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THE

PHILOSOPHICAL TRANSACTIONS

AND

COLLECTIONS,

To the End of the Year 1700.

ABRIDG'D

AND

Disposed under GENERAL HEADS.

VOL. II.

Containing all the

Physiological Papers.

By *JOHN LOWTHORP*, M. A.
and F. R. S.

LONDON:

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To His GRACE

The DUKE

OF

ORMOND,

LORD LIEUTENANT

OF

IRELAND, &c.

THESE

Physiological Papers,

ABRIDG'D

AND

Disposed under GENERAL HEADS,

Are with all Possible

Humility and Gratitude,

Dedicated, by

John Lowthorp.

V B R I D G E

L E E D S

THE Physiological Papers,

PUBLISH'D and DISPERS'D

IN THE

PHILOSOPHICAL

Transactions and Collections,

ABRIDG'D;

AND

Disposed under GENERAL HEADS.

CHAP. I.

Physiology.

Meteorology. Pneumaticks.

I. THE *Academie des Sciences* has lately received great Splendour by the Regulations, Incouragement, and Orders, M. *L'abbé Bignon* has obtained to it from the King. That *Academy* is now composed of 10 *Honorary Academicians*, which are chosen Learned and Eminent Gentlemen; of 8 *Strangers Associates*, which are distinguished by their Learning; Twenty *Pensioners* Fellows, Twenty *Eleves*, and Twelve *French Associates*, who are divided into 6 Classes, viz. Geometricians, Astronomers, Mechanicians, Anatomists, Chymists, and Botanists.

The New Regulation of the Academie des Sciences *at* Paris; *by* M. Geoffroy. n. 257. p. 144.

Out of the *Honorary Academicians*, two are Elected every Year, one for President, the other for Vice-President; only Twenty *Pensioners* have every Year 1500 French Livers; and after the Death of one *Pensioner*, the *Academy* will propose to the King 3 Persons *Associates*, or *Eleves*, or sometime others; and his Majesty will call one of the three for *Pensioner*.

The Cauſe of the preſent Languid State of Philoſophy; *by* M. Leibnitz. n. 255. p. 273.

II. 1. Neſcio quomodo remiſſius nunc tractantur Studia altiora, cum tamen nunquam, poſt tot aditus apertos, facilius potuerint tractari. Sed puto infelicia tempora interceſſiſſe, dum bella curas Hominum alio vertêre, ita pauci admodum juvenes in priſtinæ Gloriæ ſpem ſuccreſcunt. Etiam natura quampaucos nunc Obſervatores diligentes habet. Utinam, ut Gallica Scientiarum Academia nuper à Rege ſuo reſtituta eſt, etiam veſtræ Regiæ Societati novus calor infunderetur.

By Dr. J. Wallis; *ib. p.* 281.

2. Quod tu quereris, remiſſius nunc tractari altiora ſtudia; &, pauciores eſſe naturæ Obſervatores diligentes; quadantenus verum eſſe non diffiteor. Sed mirandum non eſt, (ut res alias, ſic) hominum Studia, ſuas habere viciſſitudines. Præſenti Seculo (quod jam ad finem vergit) Eruditionem, in omni rerum genere, inſignes (& quidem inſperatos) proceſſus obtinuiſſe, certum eſt; in re Phyſica, Medica, Chymica, Anatomica, Botanica, Mathematica, Geometrica, Analytica, Aſtronomica, Geographica, Nautica, Mechanica, ipſaque (quod minus lætor) Bellica. Et quidem longe majores quam per multa retro ſecula obtinuerat: Quippe quibus vix aliud ſibi propoſuiſſe videntur homines, quam ut intelligere videantur quæ ab Euclide, Ariſtotele, cæteriſque ex antiquis jam olim fuerint tradita; de Progreſſu porro faciendo haud ſoliciti; quaſi Scientiarum Metas poſuerunt illi, quas tranſcendere ſit nefas. Cum vero auſi ſint aliqui (& quidem pauci) ultra proſpicere; facti ſunt aliis animi, late patentem campum ingredi. Et res novas aggredi, novus Ardor, novus Impetus impulit; nec infeliciter. Sed, poſtquam hæc deſiit eſſe res nova; hic novus Ardor deferbuit. Mortui ſunt ex ſedulis indagatoribus non pauci, alii morituri: juveneſque non accendebat (ut antea) rerum Novitas.

Sed & ipſa materia erat magna ex parte exhauſta; ut non tam Meſſis jam ſperanda ſit, quam Spicilegium. Et quidem, jam feſſis & fatigatis permittendum videatur, ut quadantenus quieſcant: atque hinc factum (pro variabili natura hominum,) quod ſeveriora ſtudia negligantur, fierique forte poteſt, (quod tamen ominari nollem) ut præſentis ſeculi diligentiæ ſuccedat deſidia ſequentis.

Optas tu (& quidem ego pariter) ut, ſicut Gallorum Academia Scientiarum jam videatur reſtituta, ſic noſtræ Societati Regiæ novus Calor infunderetur. Atque hoc ipſum jam modo monui tuis Verbis. Sed & ipſi (quod tibi non diſplicebit) reapſe me monentem prævenerant; qui jam nuper ſibi novas Leges poſuerunt, varias hujuſmodi Inquiſitiones viritim promovendi. Sed & inter Gallorum illam Academiam, noſtramque Societatem, hoc intereſt Diſcriminis; Fruuntur illi Sumptibus Regis, ſuiſque gaudent ſingulatim Salariis. Noſtri ſuis ſumptibus agunt omnia.

A deep Cave in the Obſervatory *at* Paris; *by* M. ------ n. 74. p. 2217.

III. In the Royal Obſervatory at *Paris* there is, beſides many other rooms fit for Philoſophical Uſes and purpoſes, a very deep Cave, having 170 Steps of Deſcent; wherein many ſorts of Experiments are intended to be made, being of that Nature, that they require to be remote from the *Sun Beams* and the open Air; ſuch as are *Thermometrical* ones, and ſuch as concern *Refrigerations*, *Coagulations*, *Indurations*, and *Conſervations* of *Bodies*, &c.

Barometers, and Obſervations made with them. n. 9. p. 153.

IV. 1. The Barometer or Baroſcope was firſt made publick by that noble ſearcher of Nature, *Mr. Boyle*, and imployed by him and others, to detect

tect all the minute variations in the preſſure and weight of Air. With this Inſtrument he made divers Obſervations in the year 1659, and 1660, before any others were publick, or by him ſo much as heard of.

2. Dr. *J. Beal* is ſo much pleaſed with the diſcovery already made by the help of this Inſtrument, that he thinks it to be one of the moſt wonderful that ever was in the world. For (ſaith he) who could ever expect, that we men ſhould find an Art, to weigh all the Air that hangs over our heads, in all the changes of it, and as it were to weigh, and to diſtinguiſh by weight, the Winds and the Clouds? Or who did believe, that by palpable evidence, we ſhould be able to prove, the ſereneſt Air to be the moſt heavy, and the thickeſt Air, and when darkeſt Clouds hang neereſt to us, ready to diſſolve, or dropping, then to be lighteſt? *By Dr. J. Beal. ib. p. 154.*

1. My Wheel Barometer I could never fill ſo exactly with Mercury, as to exclude all Air; and therefore I truſt more to a Mercurial Cane, and take all my Notes from it, this Cane is but 35 Inches long, of a very ſlender Cavity, and thick Glaſs. *ib. p. 155.*

2. In all my Obſervations from *May* 28. 1664. to this preſent (*December* 9. 1665.) the Quick Silver never aſcended but very little above $30\frac{1}{4}$ Inches.

3. It aſcended very ſeldom ſo high (viz. to $30\frac{1}{4}$ Inches) chiefly in *December* 13. 1664. the weather being fickle fair, Evening.

4. I find by my Calender of *June* 22. 1664. at 5 in the Morning, in a time of long ſetled fair weather, that the Mercury had aſcended about half an Inch higher than 30: but I fear ſome miſtake, becauſe I then took no impreſſion of wonder at it; yet for 3 or 4 days, at that time it continued high, in well ſetled fair and warm weather; moſt part above 30 Inches. So that I may note the Mercury to riſe as high in the hotteſt Summer, as in the coldeſt Winter-weather.

5. Yet ſurely I have noted it aſcend a little higher for the coldneſs of the Weather; and very frequently, both in Winter and Summer, to be higher in the cold Mornings and Evenings, than in the warmer mid-day.

6. Generally in ſetled and fair Weather both of Winter and Summer, the Mercury is higher than a little before, or after, or in rainy weather.

7. Again, generally it deſcended lower after Rain, than it was before Rain.

8. Generally alſo it falls in great winds; and ſomewhat it ſeemed to ſink, when I opened a wide door to it, to let in ſtormy winds; yet I have found it to continue very high in a long ſtormy wind of three or four days.

9. Again, generally it is higher in an Eaſt and North Wind (*cæteris paribus*) than in a South and Weſt Wind.

10. I tryed ſeveral times, by ſtrong Fumes, and thick Smoaks, to alter the Air in my Cloſet; but I cannot affirm, that the Mercury yielded any more, than might be expected from ſome increaſe of heat. Such as have exact Wheel Barometers, may try whether Odors or Fumes do alleviate the Air.

11. *I* have not in all this time found the extreameſt changes of the Quick-ſilver to amount to more, than to $2\frac{3}{4}$, or to $2\frac{7}{8}$ Inches, at moſt.

12. Very often I have found great Changes in the Air, without any perceptible change in the Barometer; as in the dewy Nights, when the moiſture deſcends in a great quantity, and the thickneſs ſometimes ſeems to hide the Stars from us: In the days foregoing and following, the vapours have been drawn up ſo inviſibly, that the Air and Sky ſeemed very clear all day long. This I account a great Change between aſcending and deſcending Dews and Vapours (which import Levity and Weight) and between thick Air and clear Air: which changes do ſometimes continue, in the alternative courſe of day and night, for a week or fortnight together; and yet the Baroſcope holding the ſame.

13. Sometimes (I ſay not often) the Baroſcope yields not to other very great changes of the Air. As lately (*Dec.* 18.) an extraordinary bright and clear day; and the next following quite darkned, ſome Rain and Snow falling; but the Mercury the ſame: So on high Winds and Calms the ſame.

14. I do conceive, that ſuch as do converſe much *ſub dio*, and walk much abroad, may find many particulars much more exactly than I, who have no leiſure for it, can undertake. To inſtance in one of many, *Dec.* 16. 1665. was a clear cold day, very ſharp and ſtrong Eaſt Wind, the Mercury very near 30 Inches high, about 3 in the Afternoon I ſaw a large Black Cloud drawing near us from the Eaſt and South-Eaſt, with the Eaſt Wind. The Mercury changed not that day, nor the day following; the Stars and moſt of the Sky were very bright and clear till Nine of the Clock; and then ſuddenly all the Sky was darkned, yet no Change of Weather happened; *Dec.* 17. the Froſt held, and 'twas a clear day, till about Two of the Clock in the Afternoon; and then many thick Clouds appeared low in the Weſt; yet no Change of the Weather here; the Wind, Froſt, and Quickſilver, the ſame, *Dec.* 18. the Mercury fell almoſt $\frac{1}{4}$ of an inch, and the Sky and Air ſo clear and bright and cold with an Eaſt Wind, that I wondred what cou'd cauſe the Mercury to deſcend. I expected it ſhould have aſcended, as uſually it does in ſuch clear Skies. Caſually I ſent my Servant abroad, and he diſcovered the remote Hills, about 20 Miles off, covered with Snow. This ſeemed to manifeſt that the Air, being diſcharged of the Clouds by Snow, became lighter.

15. I have ſeldom ſeen the Change to be very great at any one time, ſo that I once wondred to ſee, that in one day it ſubſided about $\frac{3}{4}$ of an Inch.

16. *Jan.* 13. 166$\frac{5}{6}$ the Mercury ſtood (as it did alſo the day before) a quarter above 30 Inches; yet both days very dark and Cloudy, ſometimes very Thick and Miſty Air; which ſeldom falls out. For, for the moſt part I ſee it higher in cleareſt ſetled weather, than in ſuch cloudy and miſty Fogs. This thick Air and darkneſs hath laſted above a Week; lately more cold, and Eaſt and North Eaſt Wind.

n. 16. p. 163. 17. I have not yet found any ſuch infallible Prognoſtick of theſe changes of

of Weather, which do follow a long ſerenity, or ſetled Weather. And perchance in brighter Climates it may be conſtantly infallible. I have ſtore of Hygroſcopes of divers kinds; and I do remark them, and the Sweatings of Marble, and as many other famed Prognoſticks as I can hear of; but can find nothing ſo neerly indicative of the Change of Weather, as this Ballance. And the open Weather-Gläſs is known to ſignifie nothing at certainty, having a double Obedience to two Maſters, ſometimes to the weight of the Air, ſometimes to Heat, as the Service is commanded.

18. In *Jan.* 166⅝. for many days it continued very dark, ſo that all Men expected daily great rain; and though ſometimes thick Miſts aroſe, and ſome ſmall Rain fell, yet the Quickſilver held at a great height; which did indicate to me, there could then be no great change of weather, and I was not diſappointed.

19. If the Mercury aſcends to a good height after the fall of Rain (as ſometimes, but leſs often it does) then I look for a ſetled ſerenity; but if it proceeds after Rain in a deſcending Motion, then I expect a continuance of broken and ſhowry Weather.

20. That we find the Weather and our Bodies more chill, Cold, and Drooping, when the Mercury is loweſt, and the Air lighteſt, beſides other cauſes, I gueſs that as Air is to us the breath of Life, as Water is to Fiſhes; ſo when we are deprived of the uſual Meaſure of this our Food, 'tis the ſame to us as when the Water is drawn Ebb from the Fiſhes.

21. The loweſt deſcent of the Mercury in all the time ſince I have obſerved it, was *Oct.* 26. 1665. in the Evening, when it was very near at 27½ Inches. Which I find thus circumſtanced with the Weather in my Notes.

Oct. 25. Morning; Mercury at 28½ Inches, great Storms and much Rain.

Oct. 26. Morning; Mercury at 28, Winds quiet, thick dark Clouds.

Oct. 26. Evening; Mercury at 27½, That day, and ſome days following, the Weather was variable, frequent Rain, and as you ſee the Mercury lower than uſual.

22. Over the place, where this Mercurial Cane Stands, I have ſet a Wind-vane, with purpoſe of exactneſs, of a Streamer in Braſs ſo large, and pointing to a Board indented in the Margine, that I can at a ſure level upon the Vane, take every of the 32 Points of the wind, Half-points and Quarter-points, at a good diſtance. It were good to have an Index of Winds, that diſcovered as well their Aſcent and Deſcent, as their ſide Coaſtings.

23. By Change of weather and wind the Mercury ſunk ſince *Mar.* 12. more than an Inch, and this laſt Night of *Mar.* 18. by Rain and South wind 'tis ſunk half an Inch. n. 11. p. 185.

24. I found the Quick-ſilver *Dec.* 13. 1669. higher than I dare poſitively affirm that it was ever ſince I had it in my Cuſtody, *viz.* ſince *May* 28. 1664. It was compleatly and apparently above half an Inch more than 30 Inches high. It continued the 14*th*, and ſome part of the 15*th*, at about that height; ſometimes manifeſtly higher to an Eighth or Tenth part of an inch. For this Baroſcope I have two Glaſs-Canes in one Veſſel of n. 55. p. 1113.

ſtagnant

ſtagnant Quick-ſilver: and both of them agreed in this indication. The weather was at firſt diſcovery very bright and clear, a gentle Froſt, by the Sun's Heat melting. The Air was very ſilent, no wind ſtirring, and the curious Wind-vane noting, that the wind was directly in the East all the firſt day, *viz. Dec.* 13. On *Dec.* 14. the wind had a ſhort ſwing from the North-weſt, and haſtened again towards the Eaſt, yet ſo as to be North-eaſt: During this agitation, or change of Winds, the Mercury deſcended a little; and after, upon the reſetling of the wind, the Mercury aſcended a little higher, than it had been the day before.

My Houſe and Study where I keep this Baroſcope, is on the ſide of an Hill; on the higher ſide of this Country, as I gueſs near a Level with the Head of a River: which River running ſlowly, and falling into the *Severn* Sea about 20 or 30 Miles weſtward of *Briſtol*, we cannot be very much above the Level of the Sea. My Thermoſcope, ſtanding cloſe by my ſaid Barometer, was at the juſt height of ordinary diſſolving weather. In the following days it was colder. Whether the late Summer drought, or what elſe might incline this winter-air to have more than ordinary weight, or a ſtronger Spring, *I* muſt refer to the conſideration of the more Skilful.

By Dr. J. Wallis. n. 10. *p.* 169.

3. In my Baroſcope *I* never found the Quickſilver higher than 30 inches, nor lower than 28, (at leaſt ſcarce diſcernably, not $\frac{1}{16}$ of an inch higher than that, or lower than this:) which *I* mention, not only to ſhew the Limits, within which *I* have obſerved mine to keep, *viz.* full 2 inches, but likewiſe as an Eſtimate of the Clearneſs of the Quickſilver from Air. For though my Quickſilver were with good care cleanſed from the Air, yet *I* find that which Mr. *Boyle* uſeth, much better: For, comparing his with mine at the ſame times, and both in *Oxford*, at no great diſtance; *I* find his Quickſilver to ſtand always ſomewhat higher than mine (ſometimes near a quarter of an inch;) which *I* know not how to give a more probable account of, than that my Quickſilver is either heavier than his; or elſe that his is better cleanſed from the Air; (unleſs, poſſibly, the difference of the Bore; or other Circumſtances of the Tube, may cauſe the alteration; mine being a taller Tube, and a bigger Bore than his.) And upon like Reaſon, as his ſtands higher than mine; ſo another, leſs cleanſed from Air, may at the ſame time be conſiderably lower, and conſequently under 28 inches at the loweſt.

In thick foggy weather, *I* find my Quickſilver to riſe; which *I* aſcribe to the heavineſs of the Vapours in the Air.

In Sun ſhiny weather, it riſeth alſo (and commonly the clearer, the more;) which *I* think, may be imputed partly to the Vapours raiſed by the Sun, and making the Air heavier; and partly to the Heat, increaſing the Elaſtick or Springy Power of the Air. Which later *I* the rather add, becauſe *I* have ſometimes obſerved in Sun-ſhiny weather, when there have come Clouds for ſome conſiderable time (ſuppoſe an hour or two) the Quickſilver has fallen; and then, upon the Sun's breaking out again, it has riſen as before.

In Rainy weather, it uſeth to fall (of which the Reaſon is obvious, becauſe

cauſe the Air is lightned, by ſo much as falls:) in ſnowy weather likewiſe, but not ſo much as in Rain. And ſometimes *I* have obſerved it, upon a Hoar-froſt, falling in the Night.

For windy weather, *I* find it generally to fall; and that more univerſally, and more diſcernably, than upon Rain: (which *I* attribute to the wind's moving the Air collaterally, and thereby not ſuffering it to preſs ſo much directly downwards: the like of which we ſee in ſwimming, *&c.*) And *I* have never found it lower than in high winds.

I have divers times, upon diſcerning my Quickſilver to fall without any viſible Cauſe at home, looked abroad; and found (by the appearance of broken Clouds, or otherwiſe) that it had rained not far off, though not with us: whereupon, the Air being then lightned, our heavier Air (where it rained not) may have in part diſcharged it ſelf on that lighter.

Whereas *I* formerly obſerved, that in hot weather, the Quickſilver in the Baroſcope did uſe to riſe obſervably, eſpecially in Sunſhine and the Heat of the day; *I* now find (having kept the ſame Barometer for the ſpace of 5 Years unaltered) the Caſe, for theſe two Years laſt paſt, to be ſomewhat otherwiſe: And that in hot Sun-ſhiny weather the Quickſilver doth rather ſubſide a little; and in extream Cold and Froſty weather it riſeth. *I* judge the cauſe of theſe contrary Obſervations to be this, *viz.* That the Quickſilver, at its firſt putting into the Tube or Baroſcope, was not ſo perfectly cleanſed from Air, but that ſome ſmall quantity of it did remain undiſcerned in the Quickſilver: which latent particles of Air, though ſo ſmall as not to be at all diſcernable to the Eye by bubbles, yet by the external heat (adding new ſtrength, as it uſeth to do, to its Elaſtick or Springy Power) were ſo much expanded as to make the Quickſilver ſpecifically lighter, and conſequently to riſe ſomewhat higher, and upon the receſs of the External Heat the Spring of the Air again ſlackning, ſuffered the Quickſilver to be again contracted into its former leſſer dimenſions, and ſo to become heavier, and not to riſe ſo high as before, when it was hotter. But now, the Quickſilver having continued in the Tube for five Years and upwards, hath by its own weight cleanſed it ſelf better from that little Air that was in it; and that Air, freed from its intanglement with the Quickſilver, being got up into the void part of the Tube above the Quickſilver, doth act contrary-wiſe; that is, when it is by heat (upon the ſtrengthning of its ſpring) expanded, it preſſeth downward upon the Quickſilver, and doth a little depreſs it; and on the contrary, when by Froſt or very Cold weather this Air (by the abatement of its ſpring) is contracted, the Quickſilver, freed from that Preſſure, riſeth a little. But the riſing and ſinking upon this account, (as well that formerly, when this Air was in the Quickſilver, as that now, when it is gotten above it,) is not very conſiderable; hardly exceeding the 12*th* part of an inch.

n. 55. p. 1116.

I ſhall add another Accident which I lately took notice of. *I* obſerved in the late hard Froſt, that a little drop of water, (which was at firſt made uſe of for the cleanſing of the Quickſilver from the Air, and which hath ever ſince remained on the top of the Quickſilver within the Tube, was frozen faſt to the Glaſs.

Where-

Whereupon *I* did a little ſhake the Tube by moving it up and down, ſo as to make the Quickſilver undulate and ſtrike againſt it. The noiſe upon theſe ſtrokes, was not ſuch a dull noiſe, as Quickſilver or other Liquids uſe to make in the open Air, by daſhing againſt Glaſs or Ice, or other ſuch hard Bodies; but ſuch a hard ſmart noiſe, as hard Metals uſe to make by knocking one againſt the other; or, as if this Ice had been ſo knocked by a ſolid piece of Iron or other Metal of ſuch a bigneſs. Which difference of noiſe from what would have been in the open Air (where the intermediate Air muſt firſt have been beat away, before the Quickſilver could ſtrike the Ice, and thereby the ſtroke of the liquid Body obtunded or broken,) *I* attribute to that voidneſs of Air, which was between the Ice and the diſtant Quickſilver.

Jan. 7. $16\frac{69}{70}$, the Baroſcope was at 29, but for ſome days before about $28\frac{3}{4}$, (the weather having been windy and rainy;) and ſo it was in the Froſt about *Dec.* 25. but then continued to riſe till about *Jan.* 2. to $29\frac{3}{8}$; but had been *Dec.* 13. at $30\frac{1}{8}$; which is the higheſt *I* have ever known it in my Baroſcope; $27\frac{1}{8}$ being the loweſt, that *I* have ever obſerved it in (*Oct.* 26. 1665;) the moſt uſual height being about 29, or ſomewhat higher.

By Mr. Boyle. n. 11. p. 181.

4 It will be very convenient that Obſervers give notice of the ſituation of the place, where their Barometers ſtand, not only, becauſe it will aſſiſt Men to judge, whether the Inſtruments were duly perfected, but principally becauſe, that though the Baroſcope be good (nay becauſe it is ſo) the Obſervations will much diſagree, even when the Atmoſphere is in the ſame ſtate, as to weight, if one of the Inſtruments ſtand in a conſiderably higher part of the Country, than the other.

To confirm the foregoing Admonition, *I* muſt now inform you, that having in theſe parts two Lodgings, the one at *Oxford*, which you know ſtands in a bottom by the *Thames* ſide, and the other at a place 4 Miles thence, ſeated upon a moderate Hill, *I* found by comparing two Baroſcopes, that *I* made, the one at *Oxford*, the other at *Stanton St. Johns*, that, though the former be very good, and hath been noted for ſuch, during ſome Years, and the latter was very carefully fill'd; yet by reaſon, that in the higher place, the incumbent part of the Atmoſphere muſt be lighter, than in the lower, there is almoſt always between two and three eights of an inch difference betwixt them: and having ſometimes ordered my Servants to take notice of the diſparity, and divers times carefully obſerved it my ſelf, when *I* paſſed to and fro between *Oxford* and *Stanton*, *I* generally found, that the *Oxford Barometer* and the other, did, as it were by common conſent, riſe and fall together ſo, as that in the former the Mercury was uſually $\frac{3}{8}$ higher than in the latter. Which Obſervations may teach us, that the ſubterraneous Steams which aſcend into the Air, or the other cauſes of the varying weight of the Atmoſphere, do many times, and at leaſt in ſome places, uniformly enough affect the Air to a greater height, than, till *I* had made this Tryal, I durſt conclude.

But as moſt of the Barometrical Obſervations are ſubject to Exception, ſo *I* found the formerly mentioned to be. For (to omit leſſer Variations)

riding

riding one Evening from *Oxford* to *Stanton*, and having before *I* took Horſe look'd on the Baroſcope in the former of theſe two places, *I* was ſomewhat ſurprized, to find at my coming to the latter, that in places no farther diſtant, and notwithſtanding the ſhortneſs of the time (which was but an Hour and a Half, if ſo much) the Barometer at *Stanton* was ſhort of its uſual diſtance from the other near a quarter of an Inch, though the Weather being fair and calm, there appeared nothing of manifeſt change in the Air, to which *I* could aſcribe ſo great a Variation; and tho' alſo ſince that time the Mercury in the two Inſtruments hath, for the moſt part, proceeded to riſe and fall as before.

The Quickſilver has been of late for the moſt part ſo high, as to invite me to take notice of it: And about *March* 12. 166$\frac{8}{8}$ at *Oxford* the Quickſilver was higher than for ought *I* know has been yet obſerved in *England*, *viz.* above $\frac{5}{16}$ above 30 inches; but upon the firſt conſiderable Showers, that have interrupted our long Drought, as *I* foretold divers Hours before that the Quickſilver would be very low, (a bluſtering wind concurring with the Rain) ſo *I* found it at *Stanton* to fall $\frac{3}{8}$ beneath 29 inches.

It is difficult enough to ſettle any general Rule about the riſing and falling of the Quickſilver; yet in theſe parts one of thoſe that ſeem to hold oftenеſt is, that when high winds blow the Mercury is the lower; and yet that it ſelf does ſometimes fail.

5. At my firſt Arrival *I* fixt my Weather Glaſs, and found the *Argentum Vivum* to aſcend 29 inches, and in a Tornado 29 $\frac{1}{10}$: But a ſtranger by Accident broke the Cane, ſo that *I* could make no further Tryal.

At Cabo Corſe *in* Guinea; *by Mr.* Heathcot. n. 158. p. 578.

6. When my Barometer was firſt ſet up, the Mercury ſtood one Degree below Changeable; *I* diligently obſerved it every Day, and found that in the Mornings before the Sun aroſe it would be there; and as the Heat encreaſed with the Day, it ſunk to within one Degree above Rain; there it continued ſeveral Days, and never altered above 3 Degrees, tho' ſometimes fair, ſometimes rain, and ſometimes cloudy; and one Morning leaving open my Window, and the Sun having South Declination, it ſhone in on the viſible part of the Tube, and in half an Hour it ſunk 3 Degrees; (which *I* never obſerv'd it to do with heat in *England*) *I* preſently ſhut the Window, and in one hour it aroſe again to within one Degree of Changeable; after it had kept this Courſe in ſeveral Weathers, for 6 weeks together, *I* began to doubt if it were well adjuſted, and therefore took it down, new filled the Tube, turned it 3 or 4 times up and down, to let out the Air, and put it up with great Care, and ever ſince it continues the ſame, never by one degree to Changeable, nor down by one degree to Rain; ſo that the whole Progreſs of the Mercury is but $\frac{3}{10}$ of an inch.

In Jamaica; *by Sir* Will. Beeſton. n. 220. p. 225.

7. *March* 3. 168$\frac{6}{7}$ in the Evening, we had very much Thunder, and that and the next day the Mercury in the Barometer was much lower than ever *I* obſerved it, *viz.* but $\frac{4}{10}$ above 28 inches.

The loweſt degree of the Barometer; *by* Bp. *of* Cloyne. n. 243. p. 293.

8. *I* have found by a whole Months Obſervations, Mr. *Flamſteed* was pleaſed to ſend me, the Mercury ſtill roſe and fell both at *London* and here exactly at the ſame time; *I* always found it rather more than $\frac{1}{10}$ of an inch lower

The Agreement of the Barometers at London *and* Townley; *by Mr.* Townley. n. 208. p. 56.

lower here than there, by reaſon that we are ſeated though in a ſeeming Valley, in reſpect of the Neighbouring Grounds, yet we are conſiderably higher than the other low Lands near the Sea, where the Standard differs little from that at *London*. In confirmation of what *I* have ſaid, *I* ſuppoſe you may not be diſpleaſed with two remarkable Obſervations, made both by Mr. *Flamſteed* and me at the ſame time, *viz. Nov.* 18. 1674. when finding the Mercury to deſcend both very faſt and very low, we watched it very nicely, and both of us obſerved, that at 2 in the Afternoon it was rather falling, and rather riſing at 4; at which times the height was only here 27,63 inches, and at *London* $\frac{3}{10}$ higher.

A Portable Barometer; by Mr. Will. Derham. n. 236. p. 3.

V. Provide a ſtrong Glaſs Tube. Let the Head of it be pinched at about an inch from the Top, ſo as to make a Narrow Neck, whoſe Orifice ſhall be as big almoſt as a Straw. This (which is Mr. *Quare*'s way) will much bridle the blow of the Mercury againſt the Top, as it danceth up and down, which endangers breaking off the Top of the Tube. The Bottom of the Tube I would have ground aſlant near half an inch, that the bottom of the Tube touching the bottom of the Ciſtern, the Orifice thereof may lye about the middle of the Mercury in the Ciſtern: which will prevent the Air getting into the Tube, by reaſon the Mercury is always about the Mouth of the Tube. The Ciſtern muſt be made wide, either of Glaſs, or cloſe grained Wood; round the Brim of which, on the outſide, muſt be a Notch to tye on the Leather that is to cover it. When the Tube is filled, cleared of Air, and plunged into the Ciſtern near full of Mercury, encloſe the Mercury with gentle Leather tied very faſt round the Tube near the bottom, which being ſpread over the Ciſtern, tie it round that alſo: The Tube and Ciſtern, thus conjoyned with Leather, muſt be lodged in a Caſe, made very fit to receive both, where they muſt lye very faſt. Through the Caſe let 3 or 4 Holes be bored, to let the Air in freely to the Leather that covers the Ciſtern, which lying cloſe againſt the Holes, will firmly enough keep the Mercury from running out at them.

To enlarge the Diviſions of the Barometer; by Dr. Hook. n. 185. p. 241.

VI. 1. To make the more minute Variations in the Air's Preſſure ſenſible, Dr. *Hook* invented the Wheel Barometer. But this did not anſwer fully the deſigned exactneſs, both for that the Mercury being apt to ſtick againſt the ſides of the Glaſs, would riſe and fall *per ſaltum* all at once, and becauſe it is very difficult to adjuſt the *apparatus* of this Inſtrument, as alſo that it is exceeding apt to be out of order, for which reaſons it is at preſent almoſt wholly laid aſide.

Upon this in *June* 1668. (as appears on the Journal of the *Royal Society*) he bethought himſelf of another Device to do the ſame thing, which was to encreaſe the diviſions, by putting coloured Spirit of Wine, or ſome other Liquors not capable of freezing, on the Mercury, which Liquor was made to riſe as the Mercury fell, and fall as it roſe, in a narrow Cane, ſo as to make the utmoſt Limits about two foot aſunder. But yet he was not ſatisfied, till he had found out the means of encreaſing the Diviſions of the Barometer *ad libitum*, which he produced before the *Royal Society* at their meeting on *Feb.* 3. 1685. *ſt. vet.* The contrivance whereof is this.

The

The Cylinder *A*, may be of what Diameter you pleaſe, the bigger the better, but it need not be above two inches long, the Cane *A D*, muſt be ſo long that the upper part of the Cylinder *B*, may be 29 inches ÷ ſuch a part of the height of the other Cane *B C*, as the weight or ſpecifick Gravity of the Liquor that is to fill that Cane is to the ſpecifick Gravity of Mercury, below the line *A B*, in the Cylinder *A*. The third Cylinder *C*, may be as high as you pleaſe above the Cylinder *B*, but is moſt conveniently made, ſo as the ſquare of the Diameter of the Cane *B C*, be to the ſquare of the Diameter of the Cylinders *B*, or *C*, (which muſt be exactly equal) as the riſe of the Mercury in the Cylinder *B*, is to the whole length of the Cane *B C*: for in this caſe there will be nothing ſuperfluous, but the diviſions enlarged to the utmoſt advantage. Fig. 1.

As to the method of filling this Baroſcope, though the Inventor hath not as yet declared his own contrivance for the doing it, yet it will not be unneceſſary to ſhew here how it may be done. One way, (and the beſt that occurs at preſent) is to leave a ſmall hole at the top of the Cylinder *A*, and another near the top of the Cylinder *B*: this latter being well ſtopt, pour in as much Mercury, at the other hole in *A*, as ſhall fill both Canes as high as the level of the ſaid hole; which done, ſtop, either by Hermetically ſealing it, or elſe by a drop of Seal-Wax (the Glaſs being firſt ground rough to make it ſtick) the hole in *A*; then opening the hole in *B*, draw off as much of the Mercury of the Cane *B C* till it will run no longer: which done, ſtop firmly the hole in *B* (which may be done as you pleaſe, there being no Preſſure againſt you) and you will have the Cylinder *A*, evacuated of Air for your purpoſe; and the height of the Mercury will be as is uſual in the ordinary plain and Wheel Barometers. Then pour into the Cane *B C* as much Spirit of Wine tinged with Cochineele, and Oil of Turpentine, equal parts of each, as ſhall ſtand above the ſurface of the Mercury ſo many feet as you make the enlarged ſcale of your Barometer, or as is between the middle of the Cylinders *B* and *C*, and you will find the Mercury ſink in the Cane *B C*, and riſe in the other Cane *A D*, in ſuch proportion, that each 13 foot of Oil and Spirit, will raiſe the Mercury ten inches: This done, you muſt pour on, by the Cane *B C*, ſo much Mercury as may fill up the Cylinders *A*, and *B*, to ſuch heights, conſidering the preſent weight of the Atmoſphere, that the ſurface of the Mercury in both, may at the utmoſt Limits, (which have not in *England* been found to exceed 30,6 and 28,6 inches) always fall within the bodies of the Cylinders, and never enter into the Canes.

Here note, That theſe Liquors are choſen upon two accounts; Firſt, they are exceeding near of a weight, and Spirit of Wine highly rectified is ſomewhat lighter than Oil of Turpentine, but by a very ſmall Addition of Phlegm or Water, the Spirit will preponderate and be undermoſt; ſo that you may make them as near of a weight as you pleaſe, and conſequently a Cylinder of the Oyl inſenſibly differing from an equal Cylinder of Spirit of Wine. Secondly, they are Liquors that will not mix; ſo that the Oyl of Turpentine ſwimming on the top will be divided by a line only from the tinged Spirit of Wine, which the Oyl will keep from evaporating.

The Effect of this Baroſcope will be, that when the Atmoſphere is heavy,

and the Mercury raiſed high in the Cylinder *A*, and retired out of *B*, the Spirit of Wine will deſcend into the Cylinder *B*, and the Oyl of Turpentine will fill the Cane, ſo as to make the partition of the two Liquors near the Cylinder *B*. But on the contrary, when the Air is light, the Mercury will ſink in *A*, and riſe in *B*, ſo as to drive the Spirit of Wine into the Cane, and the Oyl of Turpentine into the Cylinder *C*, ſo that the Section of the two Liquors will be near *C*, and the Variation of the height of the Mercury will be enlarged into almoſt the length of the Cane, without that the Counter-preſſure from the Liquors will be in the leaſt altered, the height and weight of the incumbent Cylinders being always the ſame.

That little alteration that may happen by the dilatation and contraction of the Spirit of Wine by heat and cold, which ought to be accounted for, may be beſt diſcovered by a Thermometer hanging by it, (containing the ſame quantity of the Spirit of Wine, and whoſe Cane is, as near as may be, of the ſame Diameter with the Cane *B C*, in the Barometer) whoſe Deſcent and Aſcent muſt be added and ſubſtracted to reduce it to a rigorous exactneſs; but it is ſtill worth while to enquire if the Mercury it ſelf do not ſhrink and ſwell with cold and heat, ſo as not to need this correction.

By——— n. 236. p. 4. *Fig.* 2.

2. *A*. The head of the Tube, with its narrow Neck, to bridle the Blow of the Mercury, as formerly directed for a portable Barometer.

B. The bottom ground aſlant.

C. The Crook.

D D. The weather Plates.

By bending the Tube more or leſs at *C*, an inch of perpendicular height may be made 2 or 3 inches.

By Mr. Derham. n. 237. p. 45. *Fig.* 3.

3. *dA*. A Ruler with teeth on one edge of it, made to ſlide up and down.

b. A little Finger, fixt to the Ruler, which muſt be raiſed or depreſſed till it point exactly to the height of the Mercury.

C C C C. The Index Wheel containing juſt as many Teeth as there are Teeth in an inch of the ſliding Ruler; ſo that by thruſting up and down this toothed Ruler, you may at every inch turn round the Index once.

D D D D. A Circle, divided into 100 parts anſwering to 100 parts of an inch on the ſliding Ruler.

e e. The Index, which being faſtned to the Arber of the Index Wheel, is driven round with it, and ſhows on the Circle, the parts of an inch which the Mercury riſeth or falleth in the Tube.

By Mr. Steph. Gray. n. 240. p. 176. *Fig.* 4.

4. *A*. A long ſquare Table. Towards one end is erected a ſquare Column, *BB*. Upon which there ſlides a ſquare Socket *C*. From one ſide whereof proceeds a crooked Arm, *DE*. At *D* there is a Screw-hole to receive the Screw, and at *E* a Ring to ſupport the Tube of the Microſcope *F*. From the other ſide the Socket comes a ſhort Arm *G*, having a Screw-hole to receive the long Screw *II*, whoſe length may be about 6 or 7 inches: Its lower end, by a ſmall hole in its Center, reſts on the end of a ſmall Screw, that comes through the Screw-hole, in the Arm *H*, which is fixed on the backſide of the Column; the upper end of the Screw is filed leſs than the Body of the Screw, and goes through the Center of the round Plate without ſhaking; and to prevent its doing

ing ſo, either upwards or downwards, there is added a ſpringing Plate *n*, which keeps the ſhoulder of the Screw cloſe to the underſide of the Plate *K*; over this Plate there goes an Index *o*, and over that an handle *L*, upon the end of the Screw which comes through the Center of the Plate, which I ſhould before have told you, is riveted to the top of the Column *BB*. The Teeth of the Screw muſt be of that ſize, as to have juſt 10 in an inch. The foreſide of the Column muſt be divided into inches and tenths, begining about the height of the Socket *H*, where the lower end of the Screw reſts, and ſo continue to the top of the Column. The Limb of the round Plate muſt be divided into an 100 parts. In the Focus of the Eye Glaſs of the Microſcope is fixed an Hair, or very fine ſilver Wire, in a Horizontal Poſition.

When you uſe this Inſtrument, take hold of the Handle, and looking through the Microſcope, turn the Screw till you have brought the Hair to touch, as it were, the ſurface of the Mercury *m*; then obſerve what diviſions are cut on the Column, by the upper or under Edge of the Socket, which are tenths of an inch. See likewiſe to what parts the Index points on the Limb of the round Plate, which are Hundreds of a Tenth, or Thouſand Parts of an inch; when you perceive the Mercury varied, raiſe or depreſs the Microſcope, till the Hair be brought to its ſurface, as before; then by ſubſtracting the leſſer from the greater of the two obſerved Numbers, you will have the Variation in Inches and thouſand Parts.

This Inſtrument becomes a Micrometer on the ſame Principles, though I was obliged to alter its ſtructure from that uſed with the Teleſcope, which was firſt invented by Mr. *Gaſcoign*, improved by Mr. *Townley*, and deſcribed by Dr. *Hook*.

Vid. Vol. I. Chap. IV. §. V. 1. 2.

The Thermometer is alſo capable of the like Improvement.

VII. 1. *May* 26. 1697. between One and Two in the Afternoon, on the top of *Snowdon* Hill I thrice repeated the *Torricellian* Experiment, and as often found the height of the Mercury 26,1 inches. And being come down to *Llanberris*, at the foot of the Hill, about 6 that Evening, I as often found it 29,4 inches. The next day about 8 in the Evening I found the Mercury by a triple Experiment, to ſtand at 29,9 inches, very near the ſurface of the Sea: when at the ſame time, at *Llanerch* in *Denbyſhire* (about 25 Miles Eaſt from *Snowdon*, and 6 from the Sea, ſeveral foot above the ſurface of it) by Mr. *Davis*'s ſtanding Barometer it was above 29, $7\frac{1}{2}$. And the Air continued both before and after in the ſame ſtate. Hence I conclude, that the difference of the Air's Preſſure on the Sea, and on the top of *Snowdon*, is rather more than 3 inches 8 tenths. I could have wiſhed for one of Mr. *Hunt*'s portable Barometers; which will certainly be accurate enough for taking the Levels for bringing of Water from diſtant Places, and certainly much leſs ſubject to error; there being a Tenth of an inch for each 30 yards, which may be divided into many parts evidently. *Snowdon* was meaſured by Mr. *Caſwell*, with *Adam*'s Inſtruments, to be 1240 yards High; which abating the height of the Mercury 3 inches 8 tenths, may ſerve for a Standard, till a better be obtained on a higher Place.

The height of the Mercury, at the top of Snowdon *Hill; by Mr.* Halley. n. 229. p. 582.

2. This

Considered; by Dr. Wallis. n. 233. p. 653.

2. This Obſervation had been more uſeful, had it been repeated at ſeveral other perpendicular heights in the Aſcent. For from ſuch Comparative Obſervations, we may make a Judgment of the height of the Atmoſphere.

At the top of the Monument; *by Mr.* Derham. n. 236. p. 2.

VIII. In *Sept.* 1696. I obſerved the Variation of the Mercury on the *Monument*, and found by one of Mr. *Quare*'s beſt portable Barometers, that it deſcended $\frac{1}{10}$ of an inch at the height of 80 feet, and $\frac{2}{10}$ at 160 Feet.

But ſince that, finding my Obſervations a little different from Mr. *Halley*'s on *Snowdon* Hill, I tryed it again more nicely, in *Nov.* 1697. after this manner; I provided a pretty large Glaſs Tube well cleaned: This I lodged in Wire, and filled it with well ſtrained Mercury; which being cleared of all Air, I then plunged the Bottom of the Tube into a broad Ciſtern of Mercury, and then fixed both the Tube and Ciſtern together, in a Wire Caſe or Frame. On the top I left an Eye in the Wire, to ſuſpend the whole Barometer on a ſtring, that it might hang pendulouſly, which is abſolutely neceſſary; becauſe if the Ciſtern be deeper on one ſide than another, or if the Tube hang more towards one ſide than the other, it will cauſe a great and erroneous Variation in the Mercury above, according as the Tube ſtands perpendicularly, or not.

My Inſtrument being thus (I think) very nicely prepared, I marked exactly the Height of the Quickſilver, upon two narrow Labels of Paper, paſted on each ſide the Tube, both at the Bottom, and in my Aſcent up the Monument. The differences of the Mercury's height I meaſured with a Decimal inch Scale of thin Braſs. The Quantity of my Aſcent, I meaſured with a *Gunter*'s Chain, becauſe a ſtring would ſtretch. By the niceſt Obſervation I could make, I found that at the height of 82 Feet, the Mercury fell, $\frac{1}{10}$ of an inch, and at about 164 Feet, $\frac{2}{10}$.

By tarrying above ſomewhat long, I perceived the Preſſure of the Atmoſphere was ſomewhat altered, ſo that the Mercury in my deſcent, was about 0,01 of an inch different from my Obſervations in aſcending. Upon which, I repeated my Experiment by aſcending and deſcending quicker. At both which times, my Obſervations agreed exactly with the firſt Tryal. From whence I conclude, that at every 82 Feet height, or thereabouts, the Mercury will deſcend $\frac{1}{10}$ of an inch. But I am inclined to think that the Mercury riſeth or falleth ſometimes more ſometimes leſs at one and the ſame height. As for inſtance, if the Mercury ſinketh 0,1 of an inch at the height of 82 Feet, when the Mercury ſtandeth at 30 inches in the Barometer, I Quære, whether it will ſink ſo much when the Barometer is at 29 inches.

n. 237. p. 46.

The heights of the Mercurial Cylinder at any Elevation above the ſurface of the Earth; by Mr. Halley. n. 181. p. 104.

IX. It has been ſhown by undoubted Experiments, that the ſpecifick Gravity of the Air, near the Earth's ſurface, to that of Water, was once as 1 to 840, again as 1 to 852, and a 3*d* time, in a very large Veſſel holding ten Gallons, as 1 to 860; all which, conſidering the difficulty of the Experiment, agree well enough, the Mercury ſtanding at all thoſe times about 29 inches $\frac{3}{4}$; but by reaſon 'twas Summer weather, and conſequently the Air rarified, when all theſe were tryed, we may without ſenſible error ſay in round Numbers, that the Barometer ſtanding at 30 inches, and in a mean ſtate of Heat and Cold, the ſpecifick Gravity of the Air to Water, is as 1 to 800. By the like Tryals the Weight of the Mercury to Water, is as $13\frac{1}{2}$ to 1, or very near it; ſo that the

the Weight of Mercury to Air is as 10800 to 1, and a Cylinder of Air of 10800 inches, or 900 Feet, is equal to an inch of Mercury, and were the Air of an equal denſity like Water, the whole Atmoſphere would be no more than 5,1 Miles high, and in the aſcent of every 900 Feet the Barometer would ſink an inch. But the Expanſion of the Air encreaſing in the ſame proportion as the incumbent weight of the Atmoſphere decreaſes, that is as the Mercury in the Barometer ſinks, the upper parts of the Air are much more rarified than the lower, and each ſpace anſwering to an inch of Quickſilver grows greater and greater, ſo that the Atmoſphere muſt be extended to a much greater height.

Theſe Expanſions of the Air being reciprocally as the heights of the Mercury, it is evident, that by the help of the Curve of the *Hyperbola* and its *Aſymptotes*, the ſaid Expanſions may be expounded to any given height of Mercury; for by the 65*th Prop. Lib.* 2. *Conic. Mydorgii*, the Rectangles *ABCE*, *AKGE*, *ALDE*, *&c.* are always equal, and conſequently the ſides *CB*, *KG*, *LD*, *&c.* are reciprocally as the ſides, *AB*, *AK*, *AL*, *&c.* If then the Lines *AB*, *AK*, *AL*, be ſuppoſed equal to the heights of the Mercury, or the preſſures of the Atmoſphere, the Lines *CB*, *KG*, *LD*, anſwering thereto, will be as the Expanſions of the Air under thoſe preſſures, or the bulks that the ſame quantity of Air will occupy; which expanſions being taken infinitely many, and infinitely little, (according to the *Method* of *Indiviſibles*) their Sum will give the ſpaces of Air between the ſeveral heights of the Barometer; that is to ſay, the Sum of all the Lines between *CB*, and *KG*, or the Area *CBKG*, will be proportioned to the diſtance or ſpace intercepted between the Levels of two places in the Air, where the Mercury would ſtand at the heights repreſented by the Lines *AB*, *AK*; ſo then the ſpaces of the Air anſwering to equal parts of Mercury in the Barometer, are as the Areas *CBKG*, *GKLD*, *DLMF*. *&c.* Theſe Areas again are, by the demonſtration of *Gregory of St. Vincent*, proportionate to the Logarithms of the Numbers expreſſing the *Rationes* of *AK* to *AB*, of *AL* to *AK*, of *AM* to *AL*, *&c.* So then by the common Table of Logarithms, the height of any place in the Atmoſphere, having any aſſigned height of the Mercury, may moſt eaſily be found: For the Line *CB* in the *Hyperbola*, whereof the Areas deſign the Tabular Logarithms, being 0,0144765; 'twill be as 0,0144765, to the difference of the Logarithms of 30 and any other leſſer Number, ſo 900 Feet, or the ſpace anſwering to an inch of Mercury, if the Air were equally preſt with 30 inches of Mercury, and every where alike to the height of the Barometer in the Air, where it will ſtand at that leſſer Number of inches: And by the converſe of this proportion may the height of the Mercury be found, having the Altitude of the place given. From theſe Rules I derived the following Tables. *Fig.* 5.

Given

Given heights of the Mercury	*Altitudes.*	*Given Altitudes.*	*Heights of the Mercury.*
Inches	Miles Feet	Feet	Inches
30	0	0	30, 00.
29	915	1000	28, 91.
28	1862	2000	27, 86.
27	2844	3000	26, 85.
26	3863	4000	25, 87.
25	4922	5000	24, 93.
20	10947	Miles 1	24, 67.
15	18715	2	20, 29.
10	29662	3	16, 68.
5	48378	4	13, 72.
1	91831	5	11, 28.
0, 5	110547	10	4, 24.
0,25	129262	15	1, 60.
0, 1	29 *or* 154000	20	0, 95.
0,01	41 *or* 216169	25	0, 23.
0, 001	53 *or* 278338	30	0, 08.
		40	0, 012.

Upon theſe Suppoſitions it appears, that at the height of 41 Miles, the Air is ſo rarified as to take up 3000 times the ſpace it occupies here, and at 53 Miles high it would be expanded above 30000 times; but 'tis probable, that the utmoſt power of its ſpring cannot exert it ſelf to ſo great an Extenſion, and that no part of the Atmoſphere reaches above 45 Miles from the Surface of the Earth.

This ſeems confirmed from the Obſervations of the *Crepuſculum*, which is obſerved commonly to begin and end when the Sun is about 18 *Deg.* below the *Horizon*; for ſuppoſing the Air to reflect light from its moſt rarified parts, and that as long as the Sun illuminates any of its Atoms, they are viſible to an Eye not intercepted by the Curvity of the Earth, it will follow that the proportion of the height of the whole Air, to the ſemidiameter of the Earth, is much about as 1 to 90, or as the exceſs of the Secant of about $8\frac{1}{2}$ *Deg.* to Radius. For if *E* be the Eye of the Obſerver, *S* a place where the Sun ſets at the end of Twilight in *E*, and the Arch *ECS*, or *TCA*, be found 18 *Deg.* the Exceſs of the Secant of half thereof *ECH*, would be the height of the Air, *viz.* *GH*: But the Beam of the Sun *ASH*, and the Viſual Ray *EH*, do each of them ſuffer a Refraction of about 32 or 33 *Min.* whereby being bent inwards from *H*, towards *G*, the height of the Air need not be ſo great as if

Fig. 6.

they

they went ſtreight; and having from the Angle *ECS*, taken the double Refraction of the *Horizontal* Ray, the half of the Remainder will be $8\frac{1}{2}$ *Deg. circiter*, whoſe Secant being 10111, it follows that as 10000 to 111, ſo the ſemidiameter of the Earth ſuppoſed 4000 Miles, to 44,4 Miles; which will be the height of the whole Air, if the places *E,S*, whoſe viſible portions of the Atmoſphere *ERZH*, and *SHKB*, juſt touch one the other, be 18 *Deg.* aſunder.

At this height the Air is expanded into above 3000 times the ſpace it occupies here, and we have ſeen the Experience of condenſing it into the 60*th* part of the ſame ſpace, ſo that it ſhould ſeem, that the Air is a ſubſtance capable of being compreſſed into the 180000*th* part of the ſpace it would naturally take up, when free from preſſure: Now what texture or compoſition of parts ſhall be capable of this great expanſion and contraction, ſeems a very hard queſtion; and which, I ſuppoſe, is ſcarce ſufficiently accounted for, by the comparing it to Wool, Cotton, and the like ſpringy Bodies.

'Tis true, the weight of the whole Atmoſphere is various, being counterpoiſed ſometimes by $28\frac{1}{2}$ inches of Mercury, and at other times by no leſs than $30\frac{1}{2}$, ſo that the under parts being preſſed by about a 15*th* part, leſs weight, the ſpecifick Gravity of the Air upon that ſcore will ſometimes be a 15*th* part lighter than another; beſides Heat and Cold does very conſiderably dilate and contract the Air, and conſequently alter its Gravity, to which add the mixture of Effluvia or ſteams riſing from almoſt all Bodies, which aſſimulating into the form of Air, are kept ſuſpended therein, as Salts diſſolved in Liquors, or Metals in corroding Menſtrua, which bodies being all of them very much heavier than Air, their particles by their admixture muſt needs encreaſe the weight of that Air they lye incorporated withal, after the ſame manner as melted Salts do augment the ſpecifick Gravity of Water. 'Tis alſo true that the Condenſations are not poſſible beyond certain degrees, for being compreſſed in an 800*th* part of the ſpace it takes up here, its conſiſtence would be equally denſe with that of Water, which yields not to any force whatſoever, as hath been found by ſeveral Experiments tried here, and at *Florence* by the *Academia del Cimento*. Nor can the Rarefaction proceed *in infinitum*; for ſuppoſing the ſpring whereby it dilates it ſelf, occaſioned by what texture of parts you pleaſe, yet muſt there be a determinate magnitude of the natural ſtate of each Particle, as we ſee it is in Wool and the like, whoſe bodies being compreſſable into a very ſmall ſpace, have yet a determinate bulk which they cannot exceed, when freed from all manner of preſſure.

Theſe Objections diſturb the Geometrical accuracy of theſe Concluſions drawn from the ſpecifick Gravity of the Air obſerved at any time; but the Method here ſhewn will compute, by a like calculation, the heights of the Quickſilver, and the Rarefactions of the Air from any aſſigned height of the Barometer at the Earth's ſurface, and any ſpecifick Gravity given. As to the Condenſation and Rarefaction by Heat and Cold, and the various mixture of Aqueous and other vapours, theſe two Objections ſeem generally to compenſate each other, for when the Air is rarified by heat the Vapours are raiſed moſt capiouſly, ſo that tho' the Air properly ſo call'd, be expanded, and conſequently lighter, yet the Interſtices thereof being crouded full of Vapours of much

much heavier Matters, bulk for bulk, the weight of the Compoſitum may continue much the ſame; at leaſt a moſt curious Experiment made by the Ingenious Mr. *John Caſwel* of *Oxford*, upon the top of *Snowdon Hill* in *Caernarvanſhire*, ſeems to prove that the firſt Inches of Mercury have their portions of Air near enough to what I now determine; for the height of the Hill being 1240 Yards, or very near it, he found the Mercury to have ſubſided to 25,6 Inches, or 4 Inches below the mean Altitude thereof at the level of the Sea, and the ſpace anſwering to 4 Inches, by my Calculation ſhould be 1288 Yards; and it agrees as well with the Obſervations in the Appendix to M. *Paſcal*'s Book, *del' Equilibre des Liquers*, made on the high Hill in *Auvergne*, call'd *le puy de Domme*. So that the Rarefaction and Vapours ſeem not to have altered conſiderably the Gravity of the under parts of the Air; and much above the height where theſe Experiments were made, do few Vapours aſcend, and the Cold is ſuch that the Snow lies continually, ſo that for the more elevated parts of the Sphere of Air there is much leſs reaſon to doubt.

The Reaſon of the Aſcent of the Quickſilver; by Dr. Liſter. n. 165. p. 790.

X. 1. It is obſerved of the Barometer, that the Quickſilver is not affected with the weather, or very rarely, let that be either Cloudy, Rainy, Windy, or Serene in St. *Helena*; or the *Barbadoes*: and therefore probably not within the *Tropicks*, unleſs in a violent Storm, or Hurricane. The firſt is affirmed by Mr. *Halley*, who kept a Glaſs near two Months in the Iſland St. *Helena*, and the other of *Barbadoes* ſtands upon the Credit of our Regiſters.

2. In *England* in a violent Storm, or when the Quickſilver is at the very loweſt, it then viſibly breaks and emits ſmall Particles, as I have more than once obſerved; which diſorder I look upon as a kind of fretting; and conſequently at all times of its deſcent, it is more or leſs upon the Fret.

In this diſorder of the Quickſilver I imagine it hath its parts contracted and cloſer put together; which ſeems probable, for that, for Example, the Quickſilver then emits, and ſqueezes out freſh particles of Air into the Tube, which encreaſing the bulk of the Air, and conſequently its Elaſticity, the Quickſilver is neceſſarily depreſſed thereby, that is by an external force or power; and alſo the Quickſilver muſt of it ſelf come cloſer together in its own internal parts, that is, deſcend for both reaſons.

And that much Air is mixed with it, appears from the Application of a heated Iron to the Tube, as is practiſed in the purging of it that way; and alſo for that poliſh'd Iron will ruſt though immerſt in it, as ſome Philoſophers have lately obſerved.

Now when the Quickſilver riſes in the Pipe (which it certainly does both in Hot and Froſty weather) it may then be ſaid to be in a natural ſtate, Free, Open, and expanded like it ſelf, which it ſeems it ever is within the *Tropicks*, and with us only in very Hot, and very Froſty weather. But when it deſcends, it is then contracted, and as it were convulſed and drawn together, as it moſtly is in our Climate of *England*, and more or leſs, as we gueſs, in all places on this ſide the *Tropicks*. Which Contraction plainly appears from the Concave Figure of both Superficies, not only in that of the Quickſilver in the Tube, but alſo (if well obſerved) in that which ſtagnates in the pot or diſh it ſelf.

The

The difficulty ſeems to lye in the reconciling the ſame Effect of the Quickſilver's Riſing in the Tube, from ſuch ſeemingly different Cauſes, as great Heat and intenſe Froſt: and thoſe who ſhall willingly aſſent to us in one particular, and grant us warmth as a probable Cauſe of its Reſtitution to its Nature, will yet be at a ſtand how to imagine, that great Froſt likewiſe ſhould bring the Quickſilver nearer its own nature too: I anſwer, that Salts Liquified will Coagulate or Cryſtalize, that is, will return to their own proper Natures, both in Cold and in Heat; and therefore though moſt men practiſe the ſetting them in a cool Cellar for that purpoſe, yet ſome (as *Zwelfer*) adviſe, as the beſt means to have them ſpeedily and fairly Cryſtallized, to keep them conſtantly *in Balneo*. Thus alſo the Lympha of the Blood doth become a Jelly, if you ſet it in a cool place, and the ſame is by warmth in like manner inſpiſſated. Again, that it is no new opinion, that Water is naturally Ice, if no diſquiet from ſome external Accident hinder. *Bornichius* the Learned *Dane* has ſaid ſomething for it: and although ſome may think that what he hath ſaid, was a meer Complement to his own Frozen Climate; yet I dare venture to add, in Confirmation of that Doctrine, that Salt is naturally Rock, that is naturally Foſſile, not Liquid; and yet this is moſt like Ice of any thing in Nature, not only becauſe of its tranſparency, but alſo for its eaſie Liquefaction, and the ſudden Impreſſions and Changes which Air makes upon it, ſo that it is ſcarce to be preſerved in its natural ſtate of Cryſtallization. Alſo Salts of all ſorts ſeem naturally to propagate themſelves in a hard ſtate, and to vegetate in a dry form. The like is to be obſerved in Quickſilver, of its being a hard Rock, and alſo from its willingneſs to embrace upon all occaſions a more fixt ſtate, as in its Amalgamizing with almoſt all ſorts of Metals.

It will not be amiſs, by way of Corollary, to add a Note or two about Healthful and Sickly Seaſons, more particularly as they may refer to this *Phænomenon* of great Cold and Froſt. If therefore Quickſilver and Liquids are neereſt their own Natures, and have leſs violence done to them, in very Cold and very Hot ſeaſons; the Humours of our Bodies, as Liquids, in all probability muſt be in ſome meaſure accordingly affected. And that therefore Cold is Healthful, I argue from the vaſt Number of Old Men and Women to be found upon the Mountains of *England*, comparatively to what are found elſewhere.

Again, the Blood it ſelf, or the Vital Liquor of Animals equivalent to it, is in moſt kinds of Animals in Nature ſenſibly Cold; for that the Species of Quadrupeds and Fowls are not to be compared for number to Fiſhes and Inſects: There being in all probability, by what I have obſerved, above a hundred Species of theſe latter Creatures, whoſe Vital Juice is Cold, to one of the former: But becauſe we moſt converſe with thoſe whoſe Vital Juice is Hot, we are apt to think the ſame of all.

Again, I have obſerved, which I offer as an Argument of the little injury intenſe Cold does to the Nature of Animals, I ſay, I have ſeen both Hexapode Worms (which I compare to the tender Embryo's of Sanguineous Animals, becauſe ſuch are in a middle ſtate) and Flies of divers ſorts hard Frozen in the Winter, and I have taken them up from the Snow, and if I caſt them againſt the

Glaſs, they would endanger the breaking of it, and make it ring like ſo much hard Ice; yet when I put the Inſects under the Glaſs, and ſet them before the Fire, they would after a ſhort time nimbly creep about, and be gone, if the Glaſs which I whelmed upon them, had not ſecured them.

It hath indeed been noted by a very wiſe Philoſopher, in contradiction to our *Engliſh* Proverb, which ſays, that *A green Chriſtmas makes a fat Churchyard*; that the laſt Plague broke out here at *London* after a long and ſevere Winter 1665. But I reply, That that was accidentally only, for that diſeaſe is never bred amongſt us, but comes to us by Trade and Infection. 'Tis properly a diſeaſe of *Aſia*, where it is Epidemical. And therefore by the Providence of God, we are very ſecure from any ſuch Calamities as the Natural Effect of our Climate. But we are not to judge or prognoſticate of the Salubrity or Sicklineſs of a Year, from Foreign diſeaſes, but the raging of ſuch as are Natural to the Men of our Climate.

By Mr. Edm. Halley. n. 181. p. 116.

2. To account for the different Heights of the Mercury at ſeveral times, 'twill not be unneceſſary to enumerate ſome of the principal Obſervations made upon the Barometer.

The firſt is, That in Calm Weather, when the Air is enclined to Rain, the Mercury is commonly Low.

2. That in Serene good Setled Weather the Mercury is generally High.

3. That upon very great Winds, tho' they be not accompanied with Rain, the Mercury ſinks Loweſt of all, with relation to the point of the Compaſs the Wind blows upon.

4. That *Cæteris paribus*, the greateſt Heights of the Mercury are found upon Eaſterly and North-eaſterly Winds.

5. That in Calm Froſty Weather the Mercury generally ſtands High.

6. That after very great Storms of Wind, when the Quickſilver has been Low, it generally riſes again very Faſt.

7. That the more Northerly places have greater Alterations of the Baroſcope than the more Southerly.

8. That within the *Tropicks*, and near them, thoſe accounts we have had from others, and my own Obſervations at St. *Helena*, make very little or no variation of the Height of the Mercury in all Weathers.

Hence I conceive, that the principal Cauſe of the Riſe and Fall of the Mercury, is from the Variable Winds, which are found in the *Temperate Zones*, and whoſe great unconſtancy here in *England* is moſt notorious.

A ſecond Cauſe is the uncertain Exhalation and Preciptation of the Vapours lodging in the Air, whereby it comes to be at one time much more crouded than at another, and conſequently Heavier; but this latter in a great meaſure depends upon the former. Now from theſe Principles, I ſhall endeavour to explicate the ſeveral *Phænomena* of the Barometer, taking them in the ſame order I laid them down. Thus,

1. The Mercury's being Low enclines it to Rain, becauſe the Air being Light the Vapours are no longer ſupported thereby, being become ſpecifically Heavier than the Medium wherein they floated; ſo that they deſcend towards the Earth, and in their fall, meeting with other Aqueous particles, they incorporate

porate together and form little drops of Rain; but the Mercury's being at one time Lower than at another is the effect of two Contrary Winds blowing from the place where the Barometer ſtands; whereby the Air of that place is carried both ways from it, and conſequently the incumbent Cylinder of Air is diminiſhed, and accordingly the Mercury Sinks; as for inſtance, if in the *German Ocean* it ſhould blow a gale of Weſterly Wind, and at the ſame time an Eaſterly Wind in the *Iriſh Sea*; or if in *France* it ſhould blow a Northerly Wind, and in *Scotland* a Southerly; it muſt be granted me that that part of the Atmoſphere impendent over *England*, would thereby be exhauſted and attenuated, and the Mercury would ſubſide, and the Vapours which before floated in thoſe parts of the Air of equal Gravity with themſelves, would ſink to the Earth.

2. The greater Height of the Barometer is occaſioned by two Contrary Winds blowing towards the place of Obſervation, whereby the Air of other places is brought thither and accumulated; ſo that the incumbent Cylinder of Air being increaſed both in height and weight, the Mercury preſſed thereby muſt needs riſe and ſtand high, as long as the Winds continue ſo to blow, and then the Air being ſpecifically heavier, the Vapours are better kept ſuſpended, ſo that they have no inclination to precipitate and fall down in drops, which is the reaſon of the Serene good Weather, which attends the greater Heights of the Mercury.

3. The Mercury ſinks the Loweſt of all by the very rapid Motion of the Air in ſtorms of Wind. For the Tract or Region of the Earth's Surface, wherein theſe Winds rage, not extending all round the Globe, that ſtagnant Air which is left behind, as likewiſe that on the ſides, cannot come in ſo faſt as to ſupply the Evacuation made by ſo ſwift a Current, ſo that the Air muſt neceſſarily be attenuated when and where the ſaid Winds continue to blow, and that more or leſs according to their Violence; add to which, that the *Horizontal* motion of the Air being ſo quick as it is, may in all probability take off ſome part of the perpendicular preſſure thereof: and the great agitation of its particles is the reaſon why the Vapours are diſſipated, and do not condenſe into drops ſo as to form Rain, otherwiſe the natural conſequence of the Air's Rarefaction.

4. The Mercury ſtands the Higheſt upon an Eaſterly or North-eaſterly Wind, becauſe in the great *Atlantick Ocean*, on this ſide the 35*th Deg.* of North Latitude, the Weſterly and South-weſterly Winds blow almoſt always Trade, ſo that whenever here the Wind comes up at Eaſt and North Eaſt 'tis ſure to be checked by a contrary gale, as ſoon as it reaches the Ocean; wherefore, according to what is made out in our ſecond Remark, the Air muſt needs be heaped over this *Iſland*, and conſequently the Mercury muſt ſtand High, as often as theſe Winds blow. This holds true in this Country, but is not a general Rule for others where the Winds are under different Circumſtances: and I have ſometimes ſeen the Mercury here as Low as 29 inches upon an Eaſterly Wind, but then it blew exceeding hard, and ſo comes to be accounted for by what was obſerved upon the third Remark.

5. In Calm Froſty Weather the Mercury generally ſtands High, becauſe (as I conceive) it ſeldom Freezes but when the Winds come out of the Northern and North-eaſtern Quarters, or at leaſt unleſs thoſe Winds blow at no great diſtance off;

off; for the Northern parts of *Germany*, *Denmark*, *Sweden*, *Norway*, and all that Tract from whence North-eastern Winds come, are subject to almost continual Frost all the Winter; and thereby the lower Air is very much condensed, and in that state is brought hitherwards by those Winds, and being accumulated by the Opposition of the Westerly Wind blowing in the *Ocean*, the Mercury must needs be prest to a more than ordinary Height; and as a concurring Cause, the Shrinking of the lower parts of the Air into lesser Room by Cold, must needs cause a descent of the upper parts of the Atmosphere to reduce the Cavity made by this contraction to an *Æquilibrium*.

6. After great Storms of Wind, when the Mercury has been very Low, it generally Rises again very Fast; I once observed it to rise $1\frac{1}{2}$ inch in less than 6 Hours after a long continu'd Storm of South-west Wind. The reason is, because the Air being very much rarified, by the great Evacuations which such continued Storms make thereof, the Neighbouring Air runs in the more swiftly to bring it to an *Æquilibrium*; as we see Water runs the faster for having a great declivity.

Equi libre des Liquers.

7. The Variations are greater in the more Northerly places, as at *Stockholm* greater than at *Paris* (compared by M *Pascall*), because the more Northerly parts have usually greater storms of Wind than the more Southerly, whereby the Mercury should sink lower in that extream; and then the Northerly Winds bringing the Condensed and Ponderous Air from the Neighbourhood of the *Pole*, and that again being checked by a Southerly Wind at no great distance, and so heaped, must of Necessity make the Mercury in such case stand higher in the other extream.

8. Lastly, This Remark, That there is little or no Variation near the *Equinoctial*, does above all others confirm the *Hypothesis* of the variable Winds being the Cause of these Variations of the Height of the Mercury, for in the places above named there is always an easy gale of Wind blowing nearly upon the same point, *viz.* *E. N. E.* at *Barbadoes*, and *E. S. E.* at St. *Helena*, so that there being no contrary currents of the Air to exhaust or accumulate it, the Atmosphere continues much in the same state: However upon Hurricanes (the most violent of Storms) the Mercury has been observed very Low, but this is but once in two or three Years, and it soon recovers its setled state of about $29\frac{1}{2}$ Inches.

The Principal Objection against this Doctrine is, that I suppose the Air sometimes to move from those parts where it is already evacuated below the *Æquilibrium*, and sometimes again towards those parts where it is condensed and crouded above the mean state, which may be thought contradictory to the Laws of *Staticks*, and the Rules of the *Æquilibrium* of Fluids. But those that shall consider how when once an *Impetus* is given to a Fluid Body, it is capable of mounting above its Level, and checking others that have a contrary tendency to descend by their own Gravity, will no longer regard this as a material Obstacle; but will rather conclude, That the great Analogy there is, between the Rising and Falling of the Water upon the *Flux* and *Reflux* of the Sea, and this of accumulating and extenuating the Air, is a great Argument for the truth of this *Hypothesis*. For as the Sea, over against the Coast of *Essex*, rises and swells by the meeting of the two contrary Tides of Flood, whereof the one comes

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from the *S. W.* along the *Channel* of *England*, and the other from the North; and on the contrary ſinks below its level upon the retreat of the Water both ways, in the Tide of Ebb; ſo it is very probable, that the Air may Ebb and Flow, after the ſame manner; but by reaſon of the diverſity of Cauſes, whereby the Air may be ſet in moving, the times of theſe *Fluxes* and *Refluxes* thereof are purely caſual, and not reducible to any Rule, as are the Motions of the Sea, depending wholly upon the regular courſe of the *Moon*.

The Cauſe of the Suſpenſion of the Mercury at an Unuſual Height; by M. Hugens. n. 86. p. 5027.

XI. 1. The Experiment is briefly this; that a Tube being after the *Torricellian* way filled with Mercury, and before Inverſion perfectly purged of Air, doth when Inverted remain top full, even to the Height of 75 Inches.

M. *Hugens*, to render a probable Cauſe of this ſtrange Effect, conceiveth, That, beſides the Preſſure of the Air which keeps the Mercury ſuſpended at the Height of about 27 Inches, (and of the truth of which we are convinced by a great Number of other Effects that we ſee) there is yet another Preſſure, ſtronger than that, of a more ſubtile matter than Air, which without Difficulty penetrates Glaſs, Water, Quickſilver, and all other Bodies, which we find impenetrable to Air. This Preſſure, he ſaith, being added to that of the Air, is capable to ſuſtain the 75 Inches of Mercury, and poſſibly more, as long as it works only againſt the lower ſurface, or againſt that of the Mercury, in which ſtands the open End of the Tube: But as ſoon as it can work alſo on the other ſide, (which happens when ſtriking or hiting againſt the Tube, or intromitting into it a ſmall Bubble of Air, you give way to this matter to begin to act) the Preſſure of it becomes equal on both ſides, ſo that there is no more but the Preſſure of the Air which ſuſtains the Mercury at the ordinary Height of 29 Inches.

If you ask, why the Quickſilver in the Tube of this Experiment does not feel the Preſſure of this Matter, even whilſt that Veſſel is yet full; ſince M. *Hugens* ſuppoſeth, that it pierceth without Difficulty the Glaſs as well as the Mercury, *&c*? and why the particles of this Matter do not joyn together and begin the Preſſure, in regard that they go and come thorow the whole Extent of the Mercury, and that the Glaſs does not hinder their Communication with thoſe that are without?

To remove this Difficulty, which in M. *Hugens*'s own Opinion is very great, he anſwers, That though the parts of the Matter, by him ſuppoſed, do find paſſage between thoſe that compoſe the Glaſs, Quickſilver, *&c.* yet they there find not ſufficiently large ones for many to paſs together, nor to move there with that force which is requiſite to ſeparate the parts of the Quickſilver, that have ſome Connexion together. And this very ſame Connexion, he ſaith, is the Cauſe that though on the ſide of the inner ſurface of the Glaſs, which touches the ſuſpended Mercury, many of its parts be preſſed by the Particles of this Matter; yet there being alſo a great Number of them that feel no Preſſure, by reaſon of the Parts of the Glaſs, behind which they are placed, they retain one another, and they remain all ſuſpended, becauſe there is much leſs Preſſure on the ſurface of the Quickſilver that is contiguous to the Glaſs, than upon that below, which is all expoſed to the Action of that Matter which makes this ſecond Preſſure.

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The Ingenious and Candid Author of this Solution acknowledges himſelf, That it doth not ſo fully ſatisfie him, as not to leave ſome Scruple behind; but then he adds, That that keeps him not from being very well aſſured of that new Preſſure, which he hath ſuppoſed beſides that of the Air, by reaſon as well of the Experiment already alledged, as of two others; which he ſubjoyns to this Effect.

Firſt, When two Plates of Metal or Marble, whoſe Surfaces are perfectly plain, are put one upon another, they do ſo ſtick together, that the uppermoſt being lifted up, the undermoſt follows without quitting it: And the Cauſe hereof is juſtly aſcribed to the Preſſure of the Air againſt their two External Surfaces. He taking then two Plates, each of them but about an inch ſquare, being of that Matter of which anciently they made Looking Glaſſes, and cloſing them ſo exactly together that without putting any thing between the uppermoſt keeps not only up the other, but ſometimes alſo with it 3 Pounds of Lead faſten'd to the lowermoſt; and thus they remain together as long as you pleaſe. Having thus joyned them, and Charged them with 3 Pounds Weight, he ſuſpended them in the Recipient of his Engin, and Exhauſted it of Air ſo far as that there remained not enough to ſuſtain by its Preſſure as much as an Inch height of Water, and yet his Plates disjoined not. He adds, that he made the ſame Experiment by putting Spirit of Wine between the two Plates; and found that in the Recipient evacuated of Air they ſuſtained, without being ſevered, the ſame weight they did when it was full of Air. This he thinks ſhews clearly enough, that there remains yet in the Recipient a Preſſure great enough after that of the Air is thence taken away; and that there is no more Reaſon to doubt of it, than of the Preſſure of the Air it ſelf.

The *Second* Experiment is, That whereas the Effect of a Siphon of unequal Legs, by which you make the Water of a Veſſel to run over, is no longer aſcribed to a *Fuga Vacui*, but to the Weight of the Air which preſſing upon the Water of the Veſſel makes it Riſe in the Siphon, whilſt on the other ſide it deſcends by its Weight; M. *Hugens* found a Means to make the Water of the Siphon run after that the Recipient was exhauſted of Air, and he ſaw that with Water purged of Air it did the Effect as well as without the Recipient. The ſhorteſt of the Legs of the Siphon was 8 Inches long, and its Aperture, of two Lines. And he will not have us doubt whether the Recipient was well exhauſted of Air, for he did aſſure himſelf of that, as well by finding that there came out no more Air through the Pump, as by other more certain Marks.

And this he takes for a farther Confirmation of his Suppoſition of a preſſing Matter more ſubtile than the Air. To which he adds, That if you take the Pains of ſearching, to what Degree the Force of this Preſſure reacheth, (which he ſaith cannot be better made than by purſuing the Experiment with Tubes full of Mercury yet longer than thoſe employed by Mr. *Boyle*) it will perhaps be found, that this force is great enough to cauſe the Union of the parts of Glaſs, and of other ſorts of Bodies, which hold too well together as not to be conjoyned but by their Contiguity and Reſt, as M. *Des Cartes* would have it.

By Dr. J. Wallis. n. 91. p. 5160.

2. I have given an account of this odd *Phænomenon* in my Treatiſe *de Motu*.

III. Cap. 14. *Schol. Prop.* 13. where I hinted two Reaſons (though not perfectly ſatisfied in either:) The one of my own, concerning the Spring of the Air neceſſary to put heavy Bodies in Motion, not impelled by any other force: The other, of my L. *Brounker*, That there might be in the Air yet a greater Weight or Preſſure than is neceſſary for the Height of 29 Inches, in Caſe there be nothing but the bare Weight of Quickſilver to be ſupported. I find M. *Hugens* to fall in with that of my L. *Brounker*, ſave that what we comprehend under the Name of Air, he calls a more Subtile Matter: which alters not the Caſe at all, but only the Name.

But ſurely there muſt be ſomewhat more than this Subtile Matter, to ſolve the *Phænomenon*, notwithſtanding the two Experiments now alledged by M. *Hugens* in favour of it. For, if this Matter be ſo Subtile as to preſs through the top of the Glaſs upon the Quickſilver, (and conſequently through the upper upon the neather of the two Marbles,) as is acknowledged (and without which it is no more able to precipitate the Quickſilver while impure, and when it is in part ſubſided, than when it is pure, and the Tube top full:) I do not ſee, why it ſhould not Ballance it ſelf (above and below) in the ſame manner as Common Air would do, if the Tube were pervious to it at both Ends, and the Quickſilver, by the Preponderance of its own Weight fall preſently. And the anſwer, That though Glaſs be penetrated by it, yet not in ſo copious a manner as where no Glaſs is; doth not to me ſolve the Difficulty: Becauſe the ſame Obſtacle doth juſt in the ſame manner remain, when the Tube is in part emptied; and when the Quickſilver is unpurged: the Pores of the Glaſs not being, by either of thoſe, made more open or more pervious. And if we ſuppoſe the Subtile Matter by Percolation to be ſtrained through with ſome Difficulty, (as Air or Water would be through a Cloth,) this might poſſibly cauſe the Quickſilver, when it does ſink, to ſink gradually; but not (as we ſee it) ſuddenly to fall to the height of 29 Inches.

The Connexion or Cohæſion of the parts of Quickſilver, either each to other, or to the ſides of the Glaſs, which M. *Hugens* ſuppoſeth to require for their Separation a greater Force than is in theſe percolated Particles till they have Room made for them to Combine; ſeems to me the leſs conſiderable, becauſe it is not ſo neceſſary to ſeparate them from each other, ſince that they may unſeparated ſlide down by the ſides of the Glaſs; to which it is well known, and viſible to the Eye, the Quickſilver is not at all apt to ſtick, but doth rather decline that Contact; in like manner as we find Water not apt to joyn with Oyl or Greaſe; though Water to Glaſs, and Quickſilver to Gold, do very readily apply themſelves. So that there needs no ſuch Force to disjoyn the Quickſilver from the Glaſs, whatever there may be for disjoyning its parts one from another.

If therefore we ſhould ſuppoſe the Preſſure of the groſſer Air downwards on *AB* (the Surface of the Stagnant Quickſilver,) and conſequently by Means thereof upwards at *C*, ſufficient only to bear up that in the Tube to the height of *I*; but the ſuperadded Weight or Preſſure of the Purer Air to hold it up as high as *D*, (75 Inches or more) while it is full and the Quickſilver well cleanſed, as if ſo long it could not enter at *D*; but in Caſe it be not ſo cleanſed; *Fig.* 7.

or be already ſunk to *II*, this Purer Air would enter at *D*, and thruſt it down to *I* Counterballancing the Preſſure (at *C*) of the Purer but not of the Groſſer Air (which I take to be the Sum of the Cauſe aſſign'd by M. *Hugens*): I am yet to ſeek, why it may not as well penetrate *D* at firſt, to begin the Deſcent, as afterwards to purſue it; and why not as well begin the Deſcent when the Quickſilver is well cleanſed of Air, as when it is not ſo; and why alſo, if the Pure Air do freely enter at *D*, it does not preſently fall; or, if not freely, why, when it does fall, it falls ſuddenly and not leiſurely from *D* to *I*; eſpecially ſince ſo ſmall a Weight as *D H* of pure Air (for the Groſſer cannot enter,) is very inconſiderable; if not at all, or not freely, preſſed by that Incumbent on *D*; and the Adhæſion not conſiderably leſs, by being ſeparated only at the Top, while it yet continues to touch the Sides.

I am apt therefore, as heretofore, to adſcribe the Cauſe of this *Phænomenon* to the Spring that is in Air, and the want thereof in Quickſilver; For, that in Air there is a Spring or Elaſticity, is now undoubted; but in Water cleanſed of Air, though many Experiments have been attempted to that purpoſe, it has not yet been found that there is any: And I am apt to think the like of Quickſilver; though I do not know that this has been yet ſo rigorouſly examin'd. Now ſuppoſing, That Matter being at Reſt will ſo continue till it be put in Motion by ſome Force; this Force may be either that of Percuſſion from ſome Body already in Motion (which is the Caſe when the Quickſilver falls by ſhaking, or ſtriking the Tube;) or of Pulſion from a Contiguous Body beginning to move, as by the Expanſion of ſome adjacent Spring, (which is the Caſe when the Springy parts of the Air, either left in unpurged, or readmitted in the Quickſilver, by expanding themſelves put the Quickſilver in Motion;) or ſome Conatus or Endeavour of its own, ſuch as is that of a Spring, from whatever Cauſe it be, which I do not here enquire, but has place only in Springy Bodies, and therefore if Water and Quickſilver be not ſuch, they will not on this Account put themſelves in Motion.

Gravity or Heavineſs is reputed to be ſuch a Conatus or Pronity to move downwards, and ſo to put it ſelf in Motion: And the Wonder at preſent is why it does not ſo here. But if this which we call Gravity ſhould chance to be not a Poſitive Quality or Conatus originally of it ſelf, but only the Effect of ſome Pulſion or Percuſſion from without, (which poſſibly may be the Caſe, and principally from the Spring of the Air about us;) then while this Pulſion and Percuſſion is wanting (however Obviated,) the Bodies accounted heavy, will not of themſelves begin to fall: which ſeems to be the preſent Caſe.

And this is the more Conſiderable, becauſe we cannot (at leaſt not yet) find, what is the utmoſt Height at which the Quickſilver thus accumulated will remain ſuſpended; there having been (for ought I know) no Height yet attempted, at which, if cleanſed, it will not ſtand; and that of 75 Inches, conſidering the Weightineſs of Quickſilver, is a very great one, being more than Equivalent to 80 Foot of Water.

My Lord *Brounker* doth a little alter the Caſe, from what I take to be the *Hypotheſis* of M. *Hugens*. For he ſuppoſeth this Purer part of the Air to be of like Nature with the Groſſer part, (which I think M. *Hugens* doth not;) and, though

though Finer than the reſt, ſo as to penetrate Glaſs, which the Groſſer will not (there being in all ſorts of Grains, ſome greater than others, and which will not paſs ſo fine a ſieve) yet of a Springy nature, as the groſſer parts are: Which therefore Acts, not by its Weight only, but by its Spring; and therefore when once entered, though in a ſmall Proportion, acts as effectually at its firſt Entrance as if the whole incumbent Air had Admiſſion; its Spring being of a like Tenſure with that of the outward Air; (as I have heretofore ſhewed, *Cap.* 14. *De Motu*, *Prop.* 11, 12, 13.) but M. *Hugens*'s more Subtile Matter than Air, though he muſt allow it Weight (for elſe its Entrance would be nothing to the Purpoſe,) yet whether he allow it a Spring, I cannot tell; nor doth he Inform us. And when he ſays, this more Subtile Matter than Air doth without Difficulty Penetrate Glaſs, Water, Quickſilver, and all other Bodies, which we find Impenetrable to Air, I know not whether he mean, without any Difficulty (as the words ſeem to import,) or (as I conjecture by what follows) without great Difficulty, though with ſome.

But his *Lordſhip* (if I miſtake not) though he allow his (Springy) Subtile Matter to penetrate Glaſs, yet not without Difficulty, and till it have ſome Room made, (as *HD*) wherein it may recollect it ſelf, cannot exert its Spring; and therefore not while top full of cleanſed Quickſilver, but ſo ſoon as ſome Room is made for it: Whereas if the Quickſilver be not purged of Air, that little Air remaining doth by its Spring begin the Motion.

He thinks it alſo not improbable (and if it ſo prove, it will be a good Confirmation of this *Hypotheſis*) that a large but low Tube of Glaſs (ſhorter than 29 Inches) may ſtand top full of Quickſilver, though with a ſmall Hole in the top as at *K*; at leaſt if immerged in Water, in Caſe Air be too ſubtile for our Mechanicks.

He might alſo, ſuitably enough to his own *Hypotheſis*, have ſo explained himſelf, as to allow his more ſubtile parts of common Air to penetrate Quickſilver but not Glaſs; and therefore, in Caſe of Room for it at *HD*, it might through the Stagnant Quickſilver, and that at *C*, paſs upwards to *HD*, and there exert its Spring.

There is yet another way of explicating the ſame *Hypotheſis*, without allowing this Subtile Matter to pierce the Glaſs; which is this. Our Common Air being an Aggregate of very Heterogenious parts, we may well ſuppoſe ſome of them to be Springy, and others not to be ſo. The Springy parts we may conceive to be ſo many Conſiſtent Bodies, like ſmall Hairs or Springy Threads wrapped up in Different Forms and variouſly intangled, and ſo as to form many Vacuities capable of admitting (what the other parts of the Air may be ſuppoſed to be) ſome Fluid Matter, which may inſinuate into thoſe Vacuities (as Water in a Bundle of Buſhes,) without diſturbing the Texture of thoſe Springy parts; and which may preſs as a Weight, but not as a Spring, (of which Diſtinction ſee *Cap.* 14. *De Motu*, *Schol. Prop.* 11. *&* *Schol. Prop.* 13. p. 729, 730, 732, 733.) Now if in the *Torricellian* Tube there be a Quantity of ſuch Springy Matter, the Spring hereof will be of equal ſtrengh with that of External Air, (and therefore able to Counterballance it, though its weight be much leſs,) becauſe admitted with ſuch a Tenſure, (*ibid. Prop.* 12, 13.) But

if only an unſpringy Fluid (which preſſeth but as a Weight not as a Spring) and this defended by the Glaſs Tube from any other Preſſure, ſave that of its own Weight; it will ſtill be too weak to force its own way, till its ſingle Weight be Equivalent to that which it is to Encounter; which is, not only the Springy part of the Air, but alſo that Fluid Unſpringy part; which though (becauſe Fluid) it would give way to a Springy Body preſſing through it; yet not to this Fluid, like it ſelf, and deſtitute of ſuch a Spring; and is therefore able to keep it up to a much greater Height than it could do if Un-cleanſed of Springy Air: So long, at leaſt, as till ſome Springy Body be admitted, or ſome Concuſſion Equivalent to it, put it in Motion; but being once in Motion, it will ſo continue (as a Bullet impelled by Gun Powder, or an Arrow out of a Bow,) till ſtopped by ſome Poſitive Force Equivalent.

Vid. Inf. §. Penult.

I do not deny, but that this Explication may be ſubject to ſome Difficulties and Exceptions; but I think, fewer than that of allowing the Glaſs penetrable by this Subtile Matter. But the beſt way to ſettle this buſineſs, is by ſuitable Experiments.

A Statical Baroſcope; by Mr. Boyle. n. 14. p. 231.

XII. I cauſed to be blown at the Flame of a Lamp ſome Glaſs-bubbles, as Large, Thin, and Light, as I could then procure, and chooſing amongſt them one, that ſeemed the leaſt unfit for my turn (being of the bigneſs of a ſomewhat large Orange, and weighing about 1. *Dr.* and 10. *gr.*) I counterpoiſed it in a pair of Scales, that would looſe their *Æquilibrium* with about the 30*th* part of a grain, and were ſuſpended at a Frame. I placed both the Ballance and the Frame by a good Baroſcope, from whence I might learn the preſent weight of the Amoſphere. Then leaving theſe Inſtruments together, though the Scales, being no nicer than I have expreſſed, were not able to ſhew me all the Variations of the Air's weight that appeared in the Mercurial Baroſcope, yet they did what I expected, by ſhewing me Variations no greater than altered the height of the Quickſilver half a quarter of an inch, and perhaps much ſmaller than thoſe. I had the pleaſure to ſee the Bubble ſometimes in an *Æquilibrium* with the counterpoiſe; ſometimes when the Atmoſphere was high preponderate ſo manifeſtly, that the Scales being gently ſtirr'd, the Cock would play altogether on that ſide, at which the Bubble was hung; and at other times (when the Air was heavier) that, which was at the firſt but the Counterpoiſe, would preponderate, and upon the Motion of the Ballance make the Cock vibrate altogether on its ſide. And this would continue ſometimes many days together, if the Air ſo long retained the ſame meaſure of Gravity; and then (upon other changes) the Bubble would regain an *Æquilibrium*, or a preponderance; ſo that I had oftentimes the ſatisfaction by looking firſt upon the ſtatical Baroſcope (as for diſtinctions ſake it may be called) to foretel, whether in the Mercurial Baroſcope the Liquor were High or Low.

If the ground, on which I went in framing this Baroſcope, be demanded, the anſwer in ſhort may be; 1. That though the Glaſs Bubble, and the Braſs counterpoiſe at the time of their firſt being weighed be in the Air, wherein they both are weighed, exactly of the ſame weight; yet they are nothing near of the ſame bulk, the Bubble by reaſon of its Capacious Cavity (which contains nothing

thing but Air, or ſomething that weighs leſs than Air) being perhaps a hundred or two hundred times bigger than the Metallin counterpoiſe. 2. That according to the Hydroſtatical Laws, if two bodies of equal Gravity but unequal bulk come to be weighed in another Medium, they will be no longer equiponderant; but if the new Medium be heavier, the greater Body, as being lighter in ſpecie, will loſe more of its weight, than the leſſer and more compact; but if the new Medium be lighter than the firſt, then the bigger body will out-weigh the leſſer: and this diſparity, ariſing from the Change of Mediums, will be ſo much the greater, by how much the greater inequality of bulk there is between the Bodies formerly equiponderant. 3. That, laying theſe two together, I conſidered that 'twould be all one, as to the effect to be produced, whether the Bodies were weighed in Mediums of differing Gravity, or in the ſame Medium, in caſe its (ſpecifick) Gravity were conſiderably alter'd: And conſequently, that ſince it appeared by the Baroſcope that the weight of the Air was ſometimes heavier and ſometimes lighter, the Alterations of it, in point of Gravity, from the weight it was of at firſt counterpoiſing of the Bubble of it, would unequally affect ſo large and hollow a Body as the Bubble, and ſo ſmall and denſe an one as a Metallin weight: And when the Air by an increaſe of Gravity ſhould become a heavier Medium than before, it would buoy up the Glaſs more than the Counterpoiſe; and if it grew lighter than it was at firſt, would ſuffer the former to preponderate.

One Morning early being told of a Miſt, I ſent to ſee whether it made the Air ſo heavy as to buoy up the Bubble; but I did not learn, that that Miſt had any ſenſible operation on it.

Though a ſingle Bubble of competent bigneſs be much preferable, by reaſon that a far leſs quantity and weight of Glaſs is requiſite to compriſe an equal Capacity, when the Glaſs is blown into a ſingle Bubble, than when it is divided into two; yet I found that the employing of two inſtead of one, did not ſo ill anſwer my expectations, but that they may for a need ſerve the turn inſtead of the other; than which they are more eaſie to be procured: and if the Ballance be ſtrong enough to bear ſo much Glaſs, without being injured, by employing two or a greater number of large Bubbles the effect may be more conſpicuous, than if only a ſingle Bubble (though a very good one) were employed.

This Inſtrument may be much improved by divers accommodations. As,

1. There may be fitted to the Anſa (or Cheek of the Ballance) an Arch of a Circle divided into 15 or 20 *Deg.* (more or leſs according to the goodneſs of the Ballance) that the Cock, reſting over againſt theſe diviſions, may readily and without Calculation ſhew the Quantity of the Angle, by which when the Scales propend either way the Cock declines from the perpendicular, and the Beam from its *Horizontal* Paralleliſm.

2. Thoſe that will be ſo curious, may inſtead of the ordinary Counterpoiſe (of Braſs) employ one of Gold, or at leaſt of Lead, whereof the latter being of equal weight with Braſs is much leſs in bulk, and the former amounts not to half its bigneſs.

3. Thoſe parts of the Ballance, that may made be of Copper or Braſs, without any prejudice to the exactneſs, will by being made of one of thoſe Metals be

leſs

leſs ſubject than Steel, (which yet if well hardned and poliſhed may laſt good a great while) to ruſt with long ſtanding.

4. Inſtead of the Scales, the Bubble may be hung at one end of the Beam, and only a Counterpoiſe to it at the other, that the Beam may not be burthened with unneceſſary weight.

5. The whole Inſtrument, if placed in a ſmall Frame like a ſquare Lanthorn with Glaſs windows, and a Hole at the top for the Commerce of the internal and external Air, will be more free from duſt, and irregular agitations; to the latter of which it will otherwiſe be ſometimes incident.

6. This Inſtrument being accommodated with a light Wheel and an Index (ſuch as have been applyed by the excellent Dr. *Chr. Wren* to open Weather Glaſſes, and by the Ingenious Mr. *Hook* to Baroſcopes) may be made to ſhew much more minute Variations than otherwiſe.

7. And the length of the Beam and exquiſiteneſs of the Ballance, may eaſily without any of the foregoing helps (and much more with them) make the Inſtrument far exacter than any of thoſe I was reduced to employ. And to theſe Accommodations divers others may be ſuggeſted by a farther conſideration of the nature of the thing, and a longer practice.

Though in ſome reſpects this Statical Baroſcope be inferior to the Mercurial; yet in others it has its own advantages and conveniences above it.

And, 1. It confirms *ad Oculum* our former Doctrine, that the Falling and Riſing of the Mercury depends upon the varying Weight of the Atmoſphere; ſince in this Baroſcope it cannot be pretended, that a *Fuga Vacui*, or a *Funiculus*, is the cauſe of the Changes we obſerve. 2. It ſhews that not only the Air has weight, but a more conſiderable one, than ſome Learned Men, who will allow me to have proved it has ſome Weight, will admit; ſince even the Variation of Weight in ſo ſmall a quantity of Air, as is but equal in bulk to an Orange, is manifeſtly diſcoverable upon ſuch Ballances as are none of the niceſt. 3. This Statical Baroſcope will oftentimes be more parable than the other; for many will find it more eaſie to procure a pair of good Gold Scales and a Bubble or two, than a long Cane ſeal'd, a quantity of Quickſilver, and all the other requiſites of the Mercurial Baroſcope; eſpecially if we compriſe the trouble and skill that is requiſite to free the deſerted part of the Tube from Air. 4. And whereas the difficulty of removing the Mercurial Inſtrument has kept men from ſo much as attempting to do it even to neighbouring places; the Eſſential parts of the Scale Baroſcope (for the Frame is none of them) may very eaſily in a little Room be carried whither one will, without the hazard of being ſpoiled or injured. 5. There is not in Statical Baroſcopes, as in the other, a danger of uncertainty, as to the goodneſs of the Inſtruments, by reaſon, that in theſe the Air is in ſome more and in ſome leſs perfectly excluded; whereas in thoſe, that conſideration has no place. (And by the way, I have ſometimes upon this account, been able to diſcover by our new Baroſcope, that an eſteemed Mercurial one, to which I compared it, was not well freed from Air.) 6. It being very poſſible to diſcover Hydroſtatically, both the bigneſs of the Bubble and the Contents of the Cavity, and the weight and dimenſions of the Glaſſy ſubſtance (which together with the included Air make up the Bubble) much

may

may be discovered by this Instrument, as to the weight of the Air absolute or respective. For when the Quicksilver in the Mercurial Baroscope is either very High, or very Low, or at a Middle station between its greatest and least Height, bringing the Scale Barometer to an Exact *Æquilibrium*, (with very minute divisions of a Grain) you may by watchfully observing when the Mercury is risen or fallen just an Inch, or a fourth, or half an Inch, *&c.* And puting in the like minute divisions of a Grain to the lighter Scale, till you have again brought the Ballance to an exquisite *Æquilibrium*; you may, I say, determine what known weight in the Statical Baroscope answers such determinate Altitudes of the Ascending and Descending Quicksilver in the Mercurial. And if the Ballance be accommodated with a divided Arch, or a Wheel and Index, these Observations will assist you for the future to determine readily, by seeing the Inclination of the Cock, or the degree marked by the Index, what Pollency the Bubble hath, by the Change of the Atmosphere's weight, acquired or Lost. 7. By this Statical Instrument, we may be assisted to compare the Mercurial Baroscopes of several places (though never so distant)and to make some estimates of the Gravities of the Air therein. As if, for Instance, I have found by Observation that the Bubble I employ, weigh'd just a *Drachm*, when the Mercurial Cylinder was at the height of $29\frac{1}{2}$ inches (which in some places I have found a moderate Altitude) and that the Addition of a *16th* part of a *gr.* is requisite to keep the Bubble in an *Æquilibrium*, when the Mercury is risen an *8th*, or any determinate part of an inch above the former station: When I come to another place, where there is a Mercurial Barometer, as well freed from Air as mine (for that must be supposed) if taking out my Scale Instrument, it appear to weigh precisely a *Drachm*, and the Mercury in the Baroscope there stand at just $29\frac{1}{2}$ inches, we may conclude the Gravity of the Atmosphere not to be sensibly unequal in both those two places, though very distant. And though there be no Baroscope there, yet if there be an addition of weight, as for Instance the *16th* part of a Grain, requisite to be added to the Bubble to bring the Scales to an *Æquilibrium*, it will appear that the Air at this second place is at that time so much heavier than the Air of the former place was when the Mercury stood at $29\frac{1}{2}$ inches.

But in making such Comparisons, we must not forget to consider the situation of the several places, if we mean to make Estimates not only of the weight of the Atmosphere, but of the weight and density of the Air. For though the Scales will shew (as has been said) whether there be a difference of Weight in the Atmosphere at the two places; yet if one of them be in a Vale or Bottom, and the other on the top, or some elevated part of a Hill, it is not to be expected, that the Atmosphere, in this latter place, should gravitate as much as the Atmosphere in the former, on which a longer pillar of Air does lean or weigh.

And the mention I have made of the differing situation of places, puts me in mind of something that may prove another use of our Statical Baroscope; namely, that by exactly poysing the Bubble at the foot of a high Steeple or Hill, and carrying it in its close Frame to the top, one may, by the weight requisite to be added to the Counterpoise there to bring the Beam to its *Horizontal* position,

poſition, obſerve the difference of the weight of the Air at the bottom, and at the top; and in caſe the Hill be high enough, at ſome intermediate Stations: And perhaps when duly improv'd, it may aſſiſt men to Eſtimate the Abſolute, or Comparative Height of Mountains, and other Elevated places of the Earth.

The Uſe of Barometers; by..... n. 122. p. 539.

XIII. By Accurate Baroſcopes we may regain that Knowledge which ſtill reſides in Brutes, and we forfeited by not continuing in the Open Air, as they do for the moſt part, and by Intemperance corrupting the Craſis of our Senſes.

Thermometers and Obſervations made with them; by Dr. J. Beal. n. 55. p. 1114.

XIV. 1. *Dec.* 26. 1669. in the Morning, the Weather was colder than ever I found it, ſince I could take it by the Meaſure of a Thermometer; that is ſince theſe 5 or 6 Years. It was very cold, and Freezing quick ſome days before and after: And yet in this time the Mercury hath ſome times fallen more than an Inch, without any other change of Weather than ſome Guſts of Wind, ſome ſprinklings of Snow at ſeveral times, in all ſcarce enough to cover the Ground; and ſome abatements of Cold, more eſpecially when the Sun was up. To note this Degree of Cold more particularly, I muſt acquaint you, that in my ſtanch Thermometer on the ſaid 26. of *December* the Liquor was at $3\frac{1}{2}$ inches: whereas in ordinary briſk Froſts it is at 7 Inches. Yet here I muſt obſerve, that ſometimes the Froſt diſſolves, when it is at the *7th* Figure, and ſometimes I find it at the *8th* Figure in a ſmart Froſt. 'Tis warm *May* weather when 'tis at the *10th* Figure, and 'tis not much above the *12th* Figure in the hotteſt Weather of *June*, *July*, and *Auguſt*.

I think it remarkable, that the *7th* inch and ſometimes the *8th* in my Thermometer ſhould abide Freezing, and the Froſt increaſe till the Liquor deſcend $4\frac{1}{2}$ Inches; and yet, that it ſhould not aſcend from the *8th* Inch more, than $4\frac{1}{2}$ Inches in our hotteſt Summer, being hung in the ſame place within 18 Inches of the Glaſs Window, facing the Northweſt, and in a little Writing Room in the ſecond row of Buildings. But now I am ſtrongly perſwaded, that the Degrees of Heat and Cold are not exactly indicated by the incloſed Spirit of Wine: For when the Snow melted, and the Froſt was firſt diſſolved without Sun ſhine, the Liquor was not above the Height of $5\frac{1}{2}$ Inches; poſſibly it retains ſome part of the Cold a while after the ambient Air becomes more tepid.

By Dr. J. Wallis. n. 55. p. 1118.

2. My Thermoſcope was firſt made in *Dec.* 1664 The whole height of the ſmall Cylindrick Glaſs, whoſe Cavity was about $\frac{1}{8}$ of an Inch Diameter, was about 28 Inches; beſides a ſmall Spherical Bowl at the top, of about $\frac{1}{4}$ of an Inch Diameter, and a Bowl at the bottom, which contained the Liquor, (being Spirit of Wine tinged with Cochineal) of about 2 Inches Diameter: the ſpace above the Liquor being at the firſt compoſure of it, void of Air, ſave what it had out of the Liquor, which being warm at the firſt putting in filled the whole Cavity, while the Glaſs was Hermetically ſeal'd. I placed it ſo, as never to be expoſed to the Sun; but in a Room that has a Window only to the North; and therefore it gives an Account only of the Temperature of the Air in General, not of the immediate heat of the Sunſhine. It is ſo nice as that

n. 10. p. 169.

ib. p. 167.

my

my being or not being in my Study I find to vary it's height ſometimes almoſt $\frac{1}{4}$ of an Inch.

The loweſt mark to which the Liquor did ſubſide in *Jan.* and *Feb.* 166$\frac{4}{5}$ was at 12$\frac{1}{4}$ Inches: at 14$\frac{1}{2}$ it was Froſt certain, and ſometimes at 15, and at 15$\frac{1}{2}$ (yet this I often obſerved, that the Air by the Thermoſcope has appeared conſiderably colder, and the Liquor Lower, at ſome times when there is no Froſt, than at ſome other times when the Froſt hath been conſiderably hard:) The greateſt height in the Summer following was at 25, 26, 26$\frac{1}{2}$. n. 55. p. 1118. n. 10. p. 169. n. 55. p. 1118.

In *Dec. Jan.* and *Feb.* 1665. we had at 14$\frac{1}{2}$ Froſt certain; ſometimes at 15 or higher; and the loweſt, to which it did that Winter deſcend, was 12$\frac{3}{4}$. The height in the following Summer, 1666, was uſually about 19, 20, 21; the higheſt of all at 25.

In *Dec.* and *Jan.* 1666. it was Froſt certain at about 13$\frac{1}{2}$ (an Inch lower than the Years before, the Liquor (it ſhould ſeem) becoming leſs Spirituous) ſometimes at 14 or 14$\frac{1}{2}$, it was hard Froſty Weather at 12, 11, and once at 10$\frac{1}{2}$ the Weather being very cold. The uſual height in the Summer following, 1667. was about 19, 20, 21, and the higheſt at 24$\frac{1}{2}$.

The Winter following, 1667. it was ſcarce certain Froſt at 13; but yet ſometimes at 14, or a little higher: the loweſt, to which it did deſcend that Winter, (being very mild after *Chriſtmas*.) was at 12. And the following Summer, 1668. uſually about 18, 19, 20; the higheſt of all (the heat of that Summer being but very moderate,) at 22.

The next Winter it was Froſt certain, about 12$\frac{1}{2}$; but ſometimes, at 13, or higher: The loweſt of all at 10$\frac{1}{4}$. And in the Summer following, 1669. the higheſt of all (being but a cool Summer) not much above 20.

At *Chriſtmas*, 1669. though I found it to be Froſt certain about 12$\frac{1}{4}$, and ſometimes higher than 13; yet hath it come ſometimes lower than 8; and particularly *Dec.* 26. in the Morning to 7$\frac{3}{4}$, and did not all that day come ſo high as 8 Inches. Which being ſo much lower, than ever it had been in any of the precedent Years of my Obſervation, though it may in part be attributed to the Dis-ſpiriting of the Liquor, yet principally to the extremity of the Cold. *Jan.* 1. when the Froſt ſeem'd to relent, it was ſomewhat higher than 9; and *Jan.* 7. about 13$\frac{1}{2}$.

3. The greateſt height, the Spirit did riſe to in the Thermometer, was two Diviſions below extreme Hot, when we were near the *Æquinoctial*. *A Thermometer Obſerved at Sea; by Mr.* Ja. Cunningham. n. 264. p. 577.

XV. Since 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 increaſing very little; it may well be concluded, that no one of them does Increaſe and Diminiſh in the 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. *The Expanſion of ſeveral Fluids, in order to aſcertain the Diviſions of the Thermometer; by Mr.* Edm. Halley. n. 197. p. 650.

This will be more evident from the Experiments which I made (in the Months of *Feb.* and *Mar.* about 4 Years ſince, the Weather being reaſonably

Cold and not Freezing) with Water, Mercury, and Spirit of Wine, wherein the following particulars were very remarkable.

1. I took a large Bolt-Head, holding about $3\frac{1}{2}$ *lb.* 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 communicated it's temper to the Water included in the Bolt-Head, and I found that tho' the Water were Warm, much beyond the degree of the Summer's 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 acquired 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, having loſt nothing ſenſible by Evaporation during the Experiment, which I attribute to the length of the Neck wherein the Vapours were condenſed into Drops before they reached the top. Then I examined how much Water would raiſe that in the Neck to the Mark whereto it had been encreaſed by boiling, and found it was a 26*th* 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 uſeleſs for this purpoſe in theſe Northern Climates.

2. 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 increaſed the ſpace of 810 Grains, or a 74*th* 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 it's Expanſion more conſiderable.

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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 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 150*th* part of 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.

3. 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 increaſed, but ſlower at firſt, and faſter after it was well warm. At length being arrived 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 occaſioned 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 determined 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 arrived at the foreſaid Mark. During this Experiment, it appeared both by the dew on the Neck, and by the ſcent in the Room, that though 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 ſpirituous Liquors may poſſibly be as good a Teſt of their ſtrength and Perfection as their ſpecifick 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 encreaſed a 12*th* 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.

4. This Expanſive Power is in no Fluid 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 30*th* part; and that late Honourable Patron of Experimental Philoſophy, Mr. *Boyle*, alledges his own Tryals, proving that the Force of the ſtrongeſt Cold in *England* does not contract the Air above $\frac{1}{20}$ part. So that the ſame Air which in extream Cold occupies 12 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*.

Hiſt. of Cold. Tit. 18. §. 8. p. 475.

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

I ſhall only add, 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 Oil 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 M. *Mariotte* in the *Grottoes* under the *Obſervatory* at *Paris*) been found to have no manner of effect.

Hygroſcopes; by ..... n. 127. p. 650.

XVI. 1. The *Hygroſcope* I make uſe of, I thus contrived. I took two pieces of Deal-board (Poplar would have been better) each about two foot long, and a Foot or more in breadth, *A B*. Theſe I got well plained and ſhotten, that their edges might meet even together. Of theſe two, ſet edge by edge, I faſtned each end between two ledges of Oak *C C*, of two inches broad, and long enough to reach athwart both boards, (but one ledge, if it be thick enough, might be made to ſerve each end, by making hollow furrows or gutters in it to receive the ends of the boards) and ſo I fixed both boards in, as pannels are ſet in Wainſcot. This done, ſuppoſing $\frac{1}{4}$ of an inch to be the utmoſt diſtance

Fig. 8.

that

that theſe two boards would ſhrink aſunder in drieſt weather, (for it mattered not much, though it ſhould be ſomewhat more or leſs) I took a thin piece of Braſs *D*, of two or three inches long and $\frac{1}{4}$ inch broad, and upon one edge, towards the end, I meaſured $\frac{1}{4}$ of an inch: (which was the utmoſt diſtance *I* ſuppoſed the two boards would gape aſunder:) which ſpace *d d*, *I* divided into five equal parts, and with a ſmall File made them into ſo many fine teeth, like thoſe of a Watch wheel. This piece of Braſs *I* placed flat, acroſs the juncture of the two boards, nailing its one end by means of two ſmall holes *b b*, to the board *A* only, and leaving the other end, which is the toothed one, free and reaching to a competent diſtance over the board *B*, to which it had no coherence. Next I made a pinion, (conſiſting of as many teeth as the Braſs had) *e*, upon the end of a piece of thick Iron wire: This Axiel *F*, with its pinion *e*, *I* ſo faſtned to the other board *B*, by means of the Brachiolum *E*, and ſo adapted to the teeth of the Braſs-plate, that when the boards do ſhrink aſunder, the Braſs being drawn a little away, muſt needs turn this Axel (by means of its toothed pinion) more or leſs; and ſo if ever it happens, that the boards gape but a quarter of an inch aſunder, this Axel will have made one intire revolution: Wherefore *I* put a long Index *GG*, upon the extremity of this Axel, and made a Circle round it with the uſual graduations, numbred from what point *I* pleaſed, and the Motion of the Index back or forward, ſhews me the degrees of the drought or moiſture of the Air. Now this Axel may be made to come through a round plate of Wood or Mettle that hides the contrivance, all but the Hand and Figure, as in a Clock or Watch. 'Tis to be noted moreover, that the boards muſt be faſtned to the ledges, only at the outer edges, as at *a a a a*; that they may have the more liberty of ſwelling and ſhrinking aſunder. Though the *Hygroſcope* which *I* make uſe of be none of the beſt workmanſhip, nor exactly made after the deſcription *I* have here given you, (the boards having not liberty of gaping above $\frac{2}{10}$ of an inch) yet *I* have oftentimes the pleaſure of ſeeing the Index turn 10 or 20 degrees in an Hour or two, and when the Air is changed, will return as ſwiftly, by the ſhrinking and ſwelling of the boards.

2. *A A A A*, Is a Frame of Wood for two Pannels of Deal to play looſe in at top and bottom, to which at the two ends they are faſtned. *B B*, The two Pannels of ſlit Deal, three foot deep and three foot broad apiece, with a diſtance left in the middle for the ſcope of the Motion. *C*, The Hand, placed or faſtned by the Axletree to the plate, and alſo with Nail holes which are to faſten it to the middle of the Pannel within half an inch of the ſcope for motion; at the lower or ſhorter end of which Axletree there is, by a wire like, an *S*, faſtned a ſmall Silver Chain within a ſtraw's breadth of the Axletree; which Chain is to be carried and placed croſs the diſtance between the two pannels and faſtned to the pannel oppoſite by a Braſs nooſe, through which it is to ſlip, ſo as that it may be taken up or let down at pleaſure. *D*, The Roller with a weight annexed, which by a ſtring is faſtned to the loweſt end of the hand *C*; ſo that as the Relax gives way, the Weight will adjuſt the motion of the hand to the Index *E*. *E*, the Index of Paper, paſted upon the oppoſite pannel to the hand, and ſo as it is in this Figure, placed near the top, for the better advantage of

By Mr. Conyers. n. 129. p. 715. *Fig.* 9.

of the Hand's motion; and this Index, being but a quarter of a Circle, is divided into inches more or fewer according to the Scope which the Pannels hand requires for their motion, but when the Relax ſhall require more room for the hand, then the Chain is to be taken up one Link more, and ſo you will be ready for more play upwards and downwards: Which taking up may yet be again repeated, when there is occaſion, or the time of year requires it.

Now if the Chain be placed near the Axletree, the motion will be the nicer and larger; if farther off, then it will be leſs: For Example, the motion of two more than that of three, and 3 than that of 4, *&c.* as you may perceive by the Figures 2, 3, 4, 5, 6; which are placed in this Figure by the lower end of the hand near below the Axletree thereof.

From this contrivance it was, that I have for this 5 or 6 years paſt made theſe following Obſervations.

1. That theſe Pannels of Deal-wood will move by ſhrinking moſt in Summer, and ſwelling moſt in Winter ſeaſons; but will vary from this, according to the Change to the then more or leſs Heat or Cold, moiſture or drought, that the temper or ſeaſon of the year, ſuch as Spring and Fall do produce; it being then more apt to ſwell or ſhrink on the ſudden, but not attaining then to the higheſt ſhrinking or ſwelling, as in Summer and Winter it doth.

2. That for the moſt part, eſpecially in the Spring and Summer time this motion happens only in the day time; for then generally all night it reſts and moves very ſeldom.

3. That one kind or manner of this motion happens in dry fair Weather, but ſometimes in the forepart of the forenoon, and ſometimes not until the latter part of the forenoon, and then at that time it relaxes or ſwells the Deal for about two or three hours; more, ſeldom; leſs, often; and then all the afternoon after ſhrinks; nay, ſome times even when a ſmall rain hath newly fallen, or is then falling; and this not ſo often, but more ſeldom in Winter, or Cold moiſt Weather.

4. This Shrinking is gradual very often, or for the moſt part a little after a moiſt time *(viz.)* the firſt day after Moiſture it ſhrinks a little, the ſecond day more, and ſo yet more according to the then time of year, and as it is then inclined to moiſture or drought, and alteration of the Wind and the then Heat or Cold.

5. The Winds being in the North, North Eaſt, and Eaſt, Winter and Summer, for the moſt part at that time the Deal ſhrinks in the Night alſo as well as in the Day; but not ſo much: Which is a ſign of drying Weather, and ſometimes of Froſt or Cold in Winter; Heat or Scorching in Summer, in a clear Day. But on the contrary, the South Winds blowing, or the Weſt and Southweſt, the Deal then always relaxes that Day, or at leaſt is at a Stay, provided this happen in the Day time; for then, if in the Night, not ſo much; and ſo this will do ſome conſiderable time before Rain.

6. By a conſtant Obſervation of this Experiment of the Deal's Motion and Reſt,

Reſt, you may be able to know or gueſs at the Winds Situation without a Weather-cock, provided you have by you a common and a ſeal'd Thermometer.

7. Alſo you may know the time of the year; for in the Spring it moves quicker and more than in Winter; in Summer it is more ſhrunk than in the Spring; in Autumn leſs in motion than in the Summer.

I ſhall only add, that to find whether the Moiſture was rarified out of the ſmall Cylinder-like Ends of the Wood only, or out of the Sides alſo, I took two pieces of ſeaſon'd Deal; the Ends of the one piece I cloſed up with Diachylon Plaiſter, but the Sides of this Deal I did not ſo cloſe up; but left theſe ſides with the other piece without Diachylon. Both being expoſed to the open Air, they were found the next day both of them alike to have increaſed in proportion of Weight, which ſeems to prove that the Sides alſo do take in and let out Moiſture.

In a ſecond Contrivance, *AAAA*, is the Frame of Wood, for the Pannels of Deal to play looſe in, at the top and bottom. *BBBB*, the Croſſes of Deal or Iron faſtned to the Frame on each ſide; to which is annexed the Circular Index divided into 12; in the Center of which the Axletree *b*, for the hands, is placed. *CC*, the two Pannels of ſlit Deal, 3 foot deep, and 3 foot broad apiece, faſtned at each end of the Frame, with a diſtance left in the middle for the ſcope of the Motion. *Fig.* 19.

The inward work is thus contrived. *AA*, the two Hands. *BB*, the two Braſs Pullies or Rollers, the one bigger the other leſs; to the bigger a flat Leaden weight is faſtned with a Cat-gut ſtring; to the ſmaller is faſtned a ſmall Silver Chain, which is by the Nooſe or Loop of the Braſs *C*, to be faſtned to the Pannel under the middle of the Croſs, near the Gap or Scope for the motion; and in that nooſe the Chain to have a faſtning to be taken up or let down at pleaſure. *D*, the Roller or Pully to be placed on the other Pannel oppoſite to the Nooſe, and near the Gap or Scope, betwixt the two Pannels; over which Roller the ſmall Chain, upon its return to the Axletree, is to be placed. *E*, the Axletree, upon which the two Rollers or Pullies *Bb*, are to be faſtned, and the two hands *AA*, for the Index. *F*, the Weight annexed to the biggeſt Roller or Pully *B*, and the ſtring or Cat-gut to be moved, is to have the contrary poſture for motion to the ſmall Roller or Pully upon which the Silver Chain is faſtned: ſo that as the Shrinking of the Pannel moves the Axletree one way, the Relaxing may give way to the moving the hands or Axletree the other way by the Power of the weights drawing; which contrary poſtures, will give the niceſt account of this Motion. *Fig.* 18.

The Circumference of the ſmalleſt Pully or Roller *b*, is to be no bigger than juſt ſo much ſcope or diſtance as the two Pannels make by the extremity of their utmoſt ſwelling or ſhrinking; and ſo one full Revolution of the hand upon the Index may anſwer the fulleſt ſhrinking and ſwelling in the Year, and the diſtance between the two Rollers or Pullies, fixt upon the Axletree, muſt be the thickneſs of your Pannels; ſo that the Weight is to play or move on the one ſide of the Pannel, and the Chain on the other, without diſturbance

bance or rubbing againſt the ſides of the Pannel or the Croſs, between which, out of ſight, in the middle they are to be placed.

This way was ſo contrived 1675, ſome years after the former; and ſo with Chain and Pullies to avoid the ſhaking that would happen by applying the Work of Pinion and Teeth to move the Hands; which was then alſo propounded to Mr. *Tompion* the Watchmaker, but by him rejected, though I think that way may be uſed alſo with a Weight added to regulate the Motion.

The Deal-board ſhould be of the fineſt ſtreighteſt grain'd *Dram-deal*, laid a drying in your houſe two or three Years.

By Mr. Molyneux. n. 172. p. 1032.

Fig. 12.

3. *AB*, is a Whipcord about four foot long, tyed faſt to the end of the Hook *A*. At the end of this Whipcord there hangs the Weight *C*, about a pound or ſomething more; this weight is ſo fitted at the end as to receive and carry the Index *D*. Under theſe there is placed a Graduated Circle on the Board *EF*, Fixt by a Bragget againſt the Wall.

All things being thus adapted, the Moiſture of the Air twiſts the Rope, and gives a motion to the Index over the Diviſions in the Graduated Circle; and again, as the Air grows more Dry, the Cord untwiſts and brings back the Index by a contrary Motion. The Reaſon of this is plain; for the little particles of the Moiſture inſinuating and ſoaking into the Cord are like ſo many Wedges, which muſt needs ſhorten the Rope, as a Bladder is ſhortned by being blown up and will lift a great weight, but the eaſieſt way for the Rope *AB*, to ſhorten and lift up the weight *C*, is to do it by way of a Screw; for it ſelf is a Screw, the ſtrands thereof being twiſted (and each particular thread in it) Screw-wiſe, and conſequently muſt give a Circular Motion to the Index.

To make an Experiment of this, I wetted a Cord and hung it up with the weight at the end of it, and I perceived as it dryed it untwiſted, and that too very quick, ſo as to be perceived by the Eye; after the Cord had ſo far untwiſted, as *I* thought it had come to that degree of dryneſs, that the preſent conſtitution of the Air would permit, *I* took a Baſon of warm Water, that ſent out a Steam and Fume, and placed it under the Cord; immediately the Cord began again to twiſt very quick,and ſo continued till the Water ceaſed Fuming, or was removed, and then immediately it began to return its twiſts. *I* then tryed to breath upon it gently with my breath, and found according to my expectation, that 8 or 10 breathings would twiſt it 5 degrees of a Circle. *I* then permitted it to the Air only, and *I* find it to obey the Alterations thereof moſt nicely; there falls not the leaſt ſhower, at which it does not preſently twiſt; and when by Riſing Clouds a fair day becomes overſhadowed, the Cord is immediately ſenſible thereof, and again as ſenſible of their vaniſhing and Alteration to fair Sun-ſhine. So that *I* repute it to be the niceſt *Hygrometer* that has ever yet been uſed, and *I* am ſure is as cheap and plain as any.

One of the grand defects of moſt (indeed *I* think of all) *Hygrometers* hitherto invented, is that they grow weak with age, and do not ſo nicely obey the Alterations of the Air, when long kept as when firſt made; but whether our preſent invention be ſubject to the ſame fault *I* leave to time to determine.

The

The Alterations alſo of the Air may give this kind of *Hygroſcopes* more than one Turn; now this being inconvenient, and the Duplication of the Turn hard to be regiſtred as Mr. *Hook* propoſes, in his *Micrography*, concerning the Beard of a Wild-Oat; I have thought of a way for remedying this, for it being in our Power to increaſe the Diameter of our graduated Circle as large as we pleaſe, what need have we of more than one Turn, from the greateſt degree of Moiſture to the greateſt degree of Drought? Now ſuppoſe I find this *Hygroſcope* to have two compleat Revolutions (this is to be found by Obſervation throughout a whole Year,) I ſay then the way of rectifying it is thus. The Index *D*, has two compleat Turns, the point *A*, as being fixt, has no Turn or motion, therefore the middle point *G*, has but one Turn, and conſequently if I hang it up at the point *G*, or no longer than *G D*, half the former length, the Index *D*, will have but one Turn. What is here ſaid of two Turns and the middle point *G*, may be accommodated to any other Number of Turns and parts, and points in the Rope.

If a Candle, or Heated Iron, be applyed nigh the Rope, it makes it Twiſt very quick, contrary to Mr. *Hook*'s Oat-beard.

We may in this Experiment perceive ſomething that may help us in the conſideration of the ſtrength and motion of the Muſcles of Animals; for take a Cord able to ſuſtain an hundred pound weight, by the Weak Fume or Steam of Warm water this weight ſhall be lifted up; for if this Steam turn the weight (as moſt certainly it will do, if the Rope be of any moderate length) the weight is as certainly lifted up thereby as by a Screw, as is evident to any one that conſiders it. If therefore ſuch mighty performances can be produced by the Application of ſuch mean agents, as we all know and are converſant with, what ſhall we think is too great for thoſe parts which God has contrived and framed in the Bodies of Animals.

4. It is Obſerved, that when *Oyl* of *Vitriol* is ſatiated in the Moiſteſt Weather, it afterwards retains or loſes its acquired Weight as the Air proves more or leſs Moiſt. Thus one Grain after its full Encreaſe often vary'd its *Æquilibrium* ſo ſenſibly, that the Tongue of the Ballance of $1\frac{1}{2}$ inch long deſcribed an Arch of Variation to $\frac{1}{3}$ of an inch compaſs, (which Arch would have been $2\frac{2}{3}$ inches, had the Tongue been but one Foot in Length) even with that little Quantity of Liquor; ſo that if more Liquor expanded under a large Surface be uſed, the minuteſt Alteration of Weather muſt needs very much more affect it, and a bare pair of Scales will afford an *Hygroſcope* as nice perhaps as any yet known. *By Mr.* Will. Gould. n. 156. p. 504. Vid. inf. Cap. III.

This Ballance may be contrived two Ways, either ſuch whoſe Pin ſhould be in the middle of the Beam, with a very ſlender tapering Tongue, of a Foot or one Foot and an half long, pointing to the Diviſions on a broad Arched Plate, fixt above in the Handle; or elſe the Scale with the Liquor may be hung to a point of the Beam very near the Pin, and the other extream made ſo long as to mark a large Arch on a board plac'd conveniently for that purpoſe. The Scale in either may be a Concave Glaſs of 4 or 5 inches Diameter. Laſtly on the Diviſion of the Arches ſhould be inſcrib'd the different Temperature of the Air ſhewn by the Liquor. *Fig.* 13. *Fig.* 14.

I have Reaſon to think that *Oyl* of *Sulphur per Campanam*, as alſo *Oyl* of *Tartar per Deliquium*, and the Liquor of *Fixt Nitre*, &c. may ſucceed as well.

Another; by Mr. W. Gould. *ib.* p. 505. *Fig.* 15.

5 Another *Hygroſcope* may be made of a Viol-ſtring running upon Pullies, and ſuſpending a Bullet fixt to the ſhorter End of an Index, whoſe other Extremity is ſo long as to deſcribe a long Arch by the Falling and Riſing of the Bullet upon the Stretching and Shrinking of the String, which would be more Nice were the Index faſtned to the Center of the laſt Pully.

To Obſerve the Strength of Winds; by..... n. 24. p. 444. *Fig.* 16.

XVII. Expoſe the Inſtrument *A B C D*, to the Wind, ſo as the flat ſide *C D*, may be right againſt it; the Number of Degrees upon the Limb *A B*, to which the Wind blows up or raiſes that flat ſide, ſhews the Force or Strength of the Wind, in proportion to the Reſiſtance of the flat ſide of the Inſtrument.

Remarks concerning the Gradual Alteration of the Temperature of the Air in America *and in* Ireland; *by* ..... n. 127. p. 648.

XVIII. That in *America* (at leaſt as far as the *Engliſh* Plantations are extended) there is an extraordinary alteration, as to Temperature, ſince the *Europeans* began to Plant there firſt, is the joynt aſſertion of them all. This change of Temperature, is, and not without ſome reaſon, generally attributed to the cutting down of vaſt Woods, together with the clearing and Cultivating of the Country. But that *Ireland* ſhould alſo conſiderably Alter, without any ſuch manifeſt Cauſe, doth very much invalidate that reaſon. For if it be true, as ſome Compute, that this Kingdom was better inhabited and husbanded before the late bloody War, than at preſent, it ſhould, according to the reaſons alledged for the Change of Temperature in *America*, be rather grown more Intemperate, *viz.* for want of Cultivation: But the contrary is obſervable here, and every one almoſt begins to take notice, that this Country becomes every year more and more Temperate. Now whether there were more Inhabitants in *Ireland* before the late War than at preſent, I ſhall not here inſiſt upon, neither do *I* think it an eaſy matter to determine; yet ſure *I* am, that there hath been no ſuch increaſe of People here, within theſe 16 or 20 Years, nor ſuch improvements, as to be accountable for the great change of Temperature that is of late obſerved. Within leſs than the time newly mentioned, 'twas not unuſual to have Froſt and deep Snows of a fortnight and three Weeks continuance; and that twice or thrice, ſometimes oftener in a Winter; nay we have had great Rivers and Lakes Frozen all over; whereas of late, eſpecially theſe two or three Years laſt paſt, we have had ſcarce any Froſt or Snow at all. Neither can *I* impute this extraordinary Alteration to any fortuitous Concourſe of ordinary Circumſtances, requiſite to the Production of Fair Weather; becauſe it is manifeſt, that it hath proceeded gradually, every year becoming more Temperate than the Year preceeding. And *I* Obſerved particularly that all the Winter $167\frac{4}{5}$ was very mild, and warmer than could be well expected from ſuch a Seaſon, and but very little Rain. Having in the whole Month of *February* not Rained above twice or thrice (at leaſt in that part of the Country where *I* was then,) in ſo much that many took upon them to predict, that ſuch unſeaſonable Weather would certainly be the Cauſe of ſome Dearth or Peſtilence the enſuing Summer, or Autumn; but their Predictions proved as falſe as the following Harveſt was extraordinary both for Health and Plenty.

This

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

This Winter 167$\frac{5}{6}$. now newly ended, *I* have kept an exact Account of Wind and Weather, being well provided with a *Barometer*, Sealed *Thermometers*, *Hygroſcopes*, &c. To tranſcribe my Journal here would be too tedious; Let it ſuffice therefore to tell you, that it hath been a very Fair and Warm, or rather no Winter at all; that we have not had above 5 or 6 Froſty Mornings this Winter, and none that laſted longer than till Noon; that we had Snow but thrice, the firſt before *Chriſtmas*, the ſecond upon the 11*th*, and the third upon the 17*th*, of *January*: This laſt, which was the longeſt Snow we had this Winter, continued not 48 Hours, but Thawed. All this Winter we never had 2 days of Rain together, nor above 2 or 3 that could be well called Rainy days. *Mar.* 14. we had a ſhower of Rain and Hail together; the Wind being South-weſt and calm. The Mercury in my *Barometer* (which is very ſlender, but carefully fill'd, and conveniently placed) is for the moſt part about 29$\frac{4}{10}$ Inches high, above the Surface of the Stagnant Quickſilver; but yet doth very ſenſibly and frequently vary its height, according to the difference of the Atmoſphere's Gravity: *Jan.* 17. (which was the day it laſt Snowed here) the Mercury was ſubſided to 28$\frac{9}{10}$ Inches. The next Day it was 28$\frac{6}{10}$, being towards Night ſomewhat bluſtering, and the Snow Thawed. *Jan.* 19. being Fair but very Foggy, the Mercury was at 28$\frac{1}{2}$, which is the loweſt Station it was ever at yet with me; the Wind was Weſterly and Calm. The next Day it was up again to 29, and afterwards higher. *Feb.* 15. in the Morning, being Cloudy, the Wind Weſterly and bluſtering, the Mercury was at 29$\frac{8}{10}$; and about 11 that Night, being Fair, Clear, and Calm, it was riſen to 30$\frac{2}{10}$ inches. The next day being ſtill Fair and Calm, it was at 30$\frac{3}{10}$ inches; which is the utmoſt Height I have yet ſeen it at. Next Day it fell a little beneath 30, and kept, as before, for the moſt part about 29$\frac{3}{10}$ or $\frac{4}{10}$, to this preſent; only on the 11*th* of *March* it was at 30 again. Though it be obſerved, that Froſty and Snowy Winters make early Springs, and for as little as we have had of either this Winter, yet there hath not within the memory of any now living happened a forwarder Spring in *Ireland*; ſince this place could produce ſome ſtore of Ripe *Cherries* in the midſt of *April*. The wind keeps for the moſt part here between the North-weſt and the South, ſeldom at Eaſt, and yet ſeldomer at North or North-eaſt, in ſo much that many here don't ſcruple to affirm, that for at leaſt $\frac{1}{4}$ of the Year the Wind is Weſterly; and we have ſometimes known Paſſengers wait at *Cheſter* and *Holy-head* no leſs than 3 Months for a fair Wind, to come hither.

Obſervations of the Weather; in Ireland. 1675. *ib.* p. 649.

XIX. I fixed a Round Tunnel of 12 inches Diameter to a Leaden Pipe, which could admit of no water, but what came through the Tunnel, by reaſon of a part ſoder'd to the Tunnel it ſelf, which went over the Pipe, and ſerved alſo to fix it to it, as well as to keep out any wett that in ſtormy weather might beat againſt the under part of the Tunnel, which was ſo placed that there was no building near it that would give occaſion to ſuſpect that it did not receive its due proportion of Rain that fell through the Pipe ſome nine Yards perpendicularly, and then was bent into a window near my chamber,

To Meaſure the Quantity of falling Rain; by Mr. Townley. n. 208. p. 51.

under which convenient Veſſels were placed to receive what fell into the Tunnel; which I meaſured by a Cylindrical Glaſs, at a certain mark containing juſt a Pound or 12 Ounces *Troy*, and had marks for ſmaller parts alſo. By the Help of this Cylindrical Glaſs I thus kept my account of what Rain fell, and generally twice or thrice a Day; when i took ſeveral other Obſervations, both of the *Thermometer*, *Barometer*, Winds, *&c.* What Rain I found in the Receivers, if not more than made what was left in the Cylindrical Glaſs a full Pound, I again left in it; but if there was more than that quantity, I filled it juſt to the Pound-Mark, which I threw away, and did the like with the remaining water, as often as it would allow, ſtill keeping an account chiefly of the Pounds thrown away, and noting alſo the parts of a Pound remaining i n the Glaſs; by the help of which latter, and the parts remaining at any time before, by numbring the Pounds and ſubſtracting the parts at the end, (for example, of one Month,) from the Pounds thrown away, and the parts remaining at the end of another, I find the Quantity of Rain faln betwixt theſe two times, and that ſo as to aſſure me that I erred no more in the quantity of Rain of another Year, than by the miſtake in the differences of the parts of a Pound in the firſt and laſt Obſervation: Whereas ſhould I ſtill write down the Rain that falls between two Obſervations, I might be ſubject to make as great a miſtake in every one of them, and conſequently be much more uncertain of the Quantity of Rain faln in many of thoſe added together: Beſides, this Addition is longer in performing, and giving the Quantity ſought, than the Method I make uſe of. I have added theſe particulars to ſhew you how little trouble there is in this Task.

Obſervations of the Rain, falling Monthly for 15 Years; by Mr. Townley. *ib.* p. 53.

	1677	78	79	80	81	82	83	84	85	86	*Sum.*
Jan.	472	371	43	512	53	986	238	32	110	472	3289
Feb.	270	371	161	492	363	135	245	483	42	20	2582
March.	245	250	202	413	235	237	305	87	185	572	2731
April.	325	170	92	222	57	308	402	370	380	305	2631
May.	313	581	105	188	69	315	353	97	201	437	2659
June.	516	257	298	342	397	517	468	192	410	473	3870
July.	351	339	350	302	292	482	412	313	497	188	3526
Aug.	485	145	835	502	425	385	582	338	398	870	4965
Septem.	223	527	553	146	607	293	152	199	163	572	3435
October.	333	644	616	570	170	427	330	425	325	293	4133
Novem.	432	555	127	479	235	525	192	579	522	709	4355
Decemb.	400	57	439	269	423	456	37	299	548	132	3051
Sum.	4365	4267	3821	4428	3326	5066	3716	3414	3781	5043	41227

	1689	90	91	92	93	*Sum.*
Jan.	333	707	197	54	218	1509
Feb.	393	171	112	168	78	922
March.	875	145	476	342	298	2136
April.	468	78	386	498	539	1969
May.	182	244	300	330	93	1149
June.	302	179	412	416	181	1490
July.	120	218	285	448	112	1183
Aug.	222	402	193	198	668	1683
Septem.	442	403	215	605	641	2306
October.	740	765	165	273	514	2457
Novem.	415	717	230	148	627	2137
Decemb.	368	262	169	892	261	1952
Sum.	4860	4291	3140	4372	4230	20893

All I have yet learnt from theſe Obſervations, as to the main point, is, that here we have almoſt juſt twice the quantity of Rain that falls at *Paris.* This County, (of *Lancaſter*) and particularly that part of it (about *Townley*) where I live, being generally eſteemed to have much more Rain than other Parts, and in a greater proportion then I thought reaſonable to be allowed; however it be, yet by what I have ſent you 'twould be unjuſt, without farther Obſervations of the like nature in other parts, that all *England* ſhould be eſteemed to abound as much in Rain as theſe parts do; where, by reaſon of the very high grounds in *Yorkſhire*, and the Eaſtern parts of *Lancaſhire*, the Clouds driven hither by the *S.* and *S. W.* the general winds in this part of the World, are oftener ſtopt and broken and fall upon us, than ſuch as come by an *E.* or *S. E.* wind, which broken by the Hills, are generally ſpent there, and then little affect us; and this is the Reaſon that *Lancaſhire* has often conſiderably more Rain than *Yorkſhire.*

In the Table I have ſent you the Pounds and parts are doubled, and theſe I have rather ſent you than thoſe of the whole Pounds; ſince the ſame gives both the quantity of Half Pounds, and the Height in inches, according to the general way of eſtimating the quantity of Rain, only with this difference, that for the Half Pounds, only the laſt Figure is a Decimal Fraction, and the other the number of the Half Pounds; and for the Height, the two laſt Figures denote the Decimal Fraction of an inch, and the remainder the height in inches, ſo near the truth, that they only fall ſhort of it one inch in 200, which defect is eaſily ſupplyed. To this I need only add, that the Numbers on the right hand are the Sums of all thoſe in the ſame line, that is in the firſt part, of ſeveral Numbers for 10 Years; ſo that the laſt of them ſhews the Sum both of the Half Pounds that have fallen during that ſpace of time, and the Height the Water would have been raiſed in that time alſo. To this I ſhall only

only add one Example: The Sum of all the Rain in the 10 firſt Years is 41227, and therefore according to what hath been ſaid 4122,7 is the number of Half Pounds that fell in the compaſs of the Tunnel during thoſe 10 Years; and 412,27 the Height it would have raiſed the Water during that time. But if you deſire to be more critical, if you add 2,06, its 200*th* part, you will have 414,33 for the true Height, and 41,433 for the mean Height, by thoſe ten Years Obſervations; and 412,27 for the mean quantity of Half Pounds. By the ſame Method you will have the Means for the other five, *viz.* of Height 41,78, and 417,8 for the mean number of Half Pounds, which means do ſtrangely agree, and both conſidered do give for the Mean by all the 15 Years 41,516 inches in Height, which is about $\frac{1}{4}$ of an inch more than double to that raiſed by the water at *Paris*, which as ſet down in the *Memoirs for the Ingenious*, for *February* laſt, is ſtated about $19\frac{1}{2}$ *French* inches, which make 21 *Engliſh*.

My way of gauging by weight is grounded upon 22,7368 Cubical inches of Rain-water being equal in weight to one Pound, or 12 Ounces *Troy*; ſo that dividing any Superficies in inches of a Veſſel, for receiving the Rain-water, by the before mentioned Number, it will give you the Pounds and parts that will raiſe the Water upon that Superficies, with upright Sides, juſt an inch: And thus I found that 4,974 Pounds would fill a Cylinder equal at the bottom to my Tunnel and one inch High, which you ſee is very near 5 Pound, which you will alſo find will only raiſe the Cylinder higher by $\frac{1}{205}$*th* part.

A Hiſtory of the Weather at Oxford, 1684; *by Dr.* Plot. n. 169. p. 930. *Fig.* 17.

XX. I here give you the Obſervations of a full Year, made by order of the *Philoſophical Society* at *Oxford*, not only of the Riſe, and Fall of the Quick-ſilver, (markt by the wandring prickt Line, after Dr. *Liſter*'s Method) and the Weather; but alſo how the Wind ſtood each day. If the ſame Obſervations were made in many Forreign and Remote parts at the ſame time, we ſhould be enabled with ſome grounds to examine, not only the Coaſtings, Breadth, and Bounds of the Winds themſelves, but of the Weather they bring with them; and probably in time thereby learn to be forewarned certainly, of divers Emergencies (ſuch as Heats, Colds, Dearths, Plague, and other Epidemical Diſtempers,) which are now unaccountable to us; and by their Cauſes be inſtructed for Prevention, or Remedies. Thence too in time we may hope to be informed how far the Poſitions of the Planets, in relation to one another and to the Fixt Stars, are concerned in the alterations of the Weather, and in bringing and preventing Diſeaſes, or other Calamities; for by this means it is, doubtleſs, that the Learned Dr. *Goad* of *London* has arriv'd to that pitch of knowledge, he already has, in predicting Weather. This no Queſtion was the Opinion of the Induſtrious *Walter Merle*, Fellow of *Merton College*, who thus obſerved the Weather here at *Oxford* every day of the Month 7 years together, *viz.* from *Jan.* 1337. to *Jan.* 1344; the MS. Copy of which Obſervations are yet remaining in the *Bodleyan* Library. And doubtleſs it was ſome ſuch Conſideration as this, that moved *Eraſmus Bartholin* to make Obſervations of the Weather every day through the whole Year 1671. which are printed *inter Acta Medica Tho. Bartholini.*

Weather,

D.	*Weather.* Jan. 168¾.	D.	*Wind.*	*Weather.* Feb. 168¾.
1	Hard Froſt, and Fair.	1	N. E.	Froſt, and Fair.
2	Froſty, but Yielding a little towards night.	2	N. E.	Froſt, a little Thaw at night.
3	Rimy Froſt.	3	Due E.	Froſt, and Fair.
4	Hard Froſt, and Fair.	4	Due S.	Cloſe weather, and a little Thaw and Snow at night.
5	Hard Froſt, and Fair.			
6	Hard Froſt, and Fair.			
7	Hard Froſt, but a little Yielding at night.	5	S. W.	Thawing weather, Wind and Rain at night.
8	Rimy Froſt, morn. Fair all day, Windy night.	6	Due W.	Fair Clear weather.
		7	Due W.	Cloſe Thawing Rainy weather.
9	Froſt, but Snow at night.			
10	Cold Raw weather toward noon, Rain toward night.	8	N. b. W.	Cloſe weather.
		9	Due S.	Fair in the morning, Rain and Snow at night.
11	Moiſt Thawing weather.			
12	Cloſe Thawing weather.	10	Due S.	Cloſe Wet weather.
13	Moiſt, Cloſe weather, a ſmall Froſt at night.	11	Due S.	Fair morning, Wet at night and Windy.
14	Cloſe Froſty weather.	12	S. S. W.	Cloſe morning, Fair at night.
15	Cloſe Froſty weather.			
16	Cloſe Froſty weather, at night Windy.	13	N. b. W.	Cloſe morn. Fair at night.
		14	W. & N.	Rainy morn. Fair at night.
17	Froſt, at night Snow.	15	N. W.	Fair weather.
18	Snow, and Wind.	16	Due S.	Rainy morning, Cloſe at night.
19	Cloſe Sharp weather.			
20	Cloſe *ut ſupra*, but a little Yielding at night.	17	S. W.	Cloſe Moiſt weather.
		18	S. W.	Rainy and Wind.
21	Mild Froſt, and Fair.	19	Due W.	Moiſt morning, Fair afternoon.
22	Hard Froſt, Snow at night a little.			
23	Hard Froſt.	20	W. S. W.	Open Fair weather.
24	Hard Froſt, and Fair.	21	S. W.	Cloſe weather, windy.
25	Hard Froſt, and Snow.	22	W. S. W.	Cloſe Rainy weather.
26	Froſt, a little Snow.	23	Due W.	Wet morn. Fair afternoon.
27	Froſt, a little Thaw about noon.	24	W. b. S.	Fair morning, Cloſe evening.
28	Froſt, and Fair.			
29	Froſt, a ſmall Thaw all the afternoon.	25	S. W.	Fair morning, Cloſe evening.
30	Hard Froſt, and Fair.	26	S. W.	Wet morning, Cloſe evening.
31	Froſt, and Fair.			
		27	S. E.	Wet morn. Fair evening.
		28	N. E.	Cloſe Froſty weather.
		29	E. b. S.	Froſty Clear weather.

D.	*Wind.*	*Weather.* March $168\frac{3}{4}$.
1	S. E.	Close Frosty Cold weather.
2	N. E.	Close Cold weather.
3	N. b. W.	Close Frosty weather.
4	N. b. W.	Close Cold weather.
5	Due N.	Close morning, Snow evening.
6	N. E.	Close Cold weather.
7	N. N. E.	Frost, Fair and Windy.
8	N. N. E.	Frost, Close and Windy.
9	E. b. N.	Frost, and high Winds.
10	E. N. E.	Cose Frosty cold weather.
11	N b. W.	Frost and fair, Close at night.
12	Due N.	Frosty, Snowy, Windy weather.
13	N. b. E.	Frost morning, Fair night.
14	N. b. E.	Frost, Snow, and Wind.
15	N. N. E.	Snow and Wind.
16	N. N. E.	Snow and Rain.
17	N. b. E.	Close Moist weather.
18	W. b. N.	Close morning, Fair night.
19	N. E.	Cold changeable weather.
20	N. N. W.	Snow, and cold high Winds.
21	N. E.	Close, but Fair weather.
22	N. E.	Fair weather, but Cold.
23	E. b. N.	Cold fair weather.
24	E. b. N.	Cold fair weather.
25	E. b. N.	Cold fair weather.
26	Due E.	Cold fair weather.
27	Due E.	Cold close weather.
28	S. b. W.	Warm Moist weather.
29	S. b. W.	Wind and Rain.
30	S. b. W.	Close fair weather.
31	Due S.	Fair calm weather.

D	*Wind.*	*Weather.* April 1684.
1	N. & W.	Fair Sun-shine weather.
2	W. b. N.	Rain in the morning, Fair evening.
3	S. b. W.	Fair morning, Wind and Rain at night.
4	S. b. W.	Close moist weather.
5	S. W.	Rainy weather.
6	Due W.	Fair morning, Wet at night.
7	Due W.	Fair weather.
8	S. W.	Close weather.
9	N. W. & N.	Close weather, but Fair.
10	N. E.	Close fair weather.
11	Due E.	Rain and Wind moderate.
12	N. & W.	Close cold weather.
13	N. b. E.	Fair Sun-shine weather.
14	E. N. E.	Fair morning, Close evening.
15	N. E. b. E.	Close cold weather.
16	E b. N.	Close cold weather.
17	E. b. N.	Close cold weather.
18	S. & W.	Variable dry weather.
19	Due S.	Moist morning, Wet night.
20	S. E. & S. W.	Close warm weather.
21	S. E.	Fair Sun-shine weather.
22	S. & N. & E.	Fair morning, inclineable to Rain at night.
23	S. W.	Rainy morning, Fair evening.
24	S. W.	Fair Sun-shine weather.
25	S. W.	Fair Sun-shine weather.
26	Due S.	Close dry weather.
27	S. W.	Fair Sun-shine weather.
28	S. W.	Close dry weather.
29	S. W.	Close dry weather.
30	Due S.	Rain morning, Fair evening.

D.	*Wind.*	*Weather.* May 1684.
1	S. S. W.	Variable weather.
2	Due W.	Fair weather.
3	S. S. W.	Close Fair weather.
4	W. S. W.	Close Fair weather.
5	W. S. W.	Moist morning, Fair evening.
6	W. S. W.	Close Fair weather.
7	W. S. W.	Close morning, Rain at night.
8	S.S.E.&S.W.	Fair Warm weather.
9	N. W.	Close Fair weather.
10	Due W.	Close Fair weather.
11	Due W.	Close Fair weather.
12	Due W.	Misty morning, Fair evening.
13	S. & W.	Wet morning, Fair evening.
14	S. W.	Close weather, some Rain.
15	Due N.	Close Fair weather, some Wind.
16	N. N. E.	Windy morning, Close evening.
17	N. E.	Close Dry weather.
18	N. E.	Close Fair weather.
19	N. E.	Fair Sun-shine, weather.
20	E. b. N.	Close Fair weather, some Wind.
21	N. E.	Warm morning, Close evening.
22	N. E.	Close, Fair, and Windy.
23	N. E.	Close, Fair, and Windy.
24	N. E.	Close morning, Fair Sun-shine evening.
25	N. E.	Close Fair weather.
26	S. E:	Fair Sun-shine weather.
27	N. E.	Close Fair weather.
28	E. b. N.	Fair Sun-shine weather.
29	S. W.	Wind and Rain.
30	Due W.	Close Fair weather.
31	S. W.	Close weather, a little Rain at night.

D.	*Wind.*	*Weather.* June 1684.
1	S. W.	Close morning, Fair evening.
2	Due W.	Close morning, Rainy evening.
3	Due W.	Fair morning, Rainy evening.
4	Due W.	Close Fair weather.
5	Due W.	Close Fair weather.
6	Due W.	Close Fair weather.
7	W. & N.	Close Fair weather.
8	Due N.	Fair Sun-shine weather.
9	Due N.	Close Fair weather.
10	N. E.	Fair Sun-shine weather.
11	Due E.	Fair Sun-shine weather.
12	Due E.	Fair Sun-shine weather.
13	E. S. E.	Fair Sun-shine weather.
14	E. S. E.	Fair Sun-shine weather.
15	E. S. E.	Fair Sun-shine Dry weather.
16	E. S. E.	Fair Sun-shine Hot weather.
17	E. S. E.	Fair Sun-shine Hot weather.
18	E. b. N.	Sun-shine morning, Cloudy evening.
19	E.b.N:S.S.W.	Sun-shine Hot weather.
20	S. b. W.	A little Rain, Cloudy.
21	S. E: E. S. E.	Lowring, some Rain.
22	N. E.	Fair Hot weather.
23	N. E.	Hot, a Muddy Sky.
24	N. E.	Sun-shine Clear.
25	N. E.	Sun-shine Fair weather.
26	N. E.	Sun-shine Dry weather.
27	N. E: E.	Very Dry.
28	E: S. E.	Hot Lowring evening.
29	S: S. W.	Sun-shine Clear.
30	S. W.	Cloudy, Cool.

D.	*Wind.*	*Weather.* July 1684.
1	S.W:W.N.W.	Somewhat Cloudy.
2	W.	A little Rain, Fair.
3	S. W.	Fair, but Cloudy.
4	S. W : W.	Cloſe, ſome Rain.
5	S. W.	Sun-ſhine morning, Gloomy evening.
6	S. W.	Cloſe.
7	W. S. W.	Cool, Cloſe.
8	S. W.	Hazy, ſome Rain.
9	W: N. W.	Some Rain, Clear.
10	N. W.	Clear Sun-ſhine.
11	S. W.	Rain.
12	W.	Some Rain, Fair evening.
13	W.	A ſhower or two.
14	W : S. W.	Cool Cloſe weather.
15	W. S. W.	Rain.
16	W.	Cool Cloſe weather.
17	W.	Cool Cloſe weather.
18	N: W.	Fair Sun-ſhine weather.
19	W. S. W.	Lowring Cool weather.
20	W : N. W.	Fair Sun-ſhine weather.
21	W.	Fair Sun-ſhine weather.
22	W.	Hot Sun-ſhine weather.
23	W: S.	Hot Sun-ſhine weather.
24	S: E.	Hot Sun-ſhine weather.
25	E. b. S.	Hot Sun-ſhine weather.
26	E. b. S.	Hot, a little Rain towards night.
27	W: N.	Hot Sun-ſhine weather.
28	W.	Hot, Thunder, Rain.
29	N. N. E.	Cloudy, ſome Rain.
30	N. N. E.	Fair Sun-ſhine weather.
31	N. E.	Hot Sun-ſhine weather.

D.	*Wind.*	*Wheather.* Auguſt 1684.
1	N.	Warm Sun-ſhine weather.
2	W.	Cool Fair weather.
3	S. W.	Warm Fair weather.
4	Due S.	Hot Sun-ſhine weather.
5	S. W. b. S.	Hot Sun-ſhine weather.
6	S. W. b. S.	Warm Sun-ſhine weather.
7	Due S.	Rainy morning, Fair evening.
8	Due S.	Cloſe Fair weather.
9	Due W.	Fair Sun-ſhine weather.
10	Due N.	Fair Sun-ſhine weather.
11	S. W.	Fair morning, inclinable to Rain at night.
12	Due W.	Rainy morning. The ſame in the evening.
13	Due W.	Fair Sun-ſhine weather.
14	Due W.	Fair Sun-ſhine weather.
15	W.	Fair Sun-ſhine weather.
16	W : N.	A Shower, Sun-ſhine weather.
17	N. W.	Sun-ſhine morning, Cloudy evening.
18	N. N. W: N.	A Muddy Sky in the morning, Sun-ſhine evening.
19	N: S. W.	Fair Sun-ſhine weather.
20	S. S. W.	Hot Sun-ſhine weather.
21	S. S. W.	Hot Sun-ſhine weather.
22	S. W.	Fair Sun-ſhine weather.
23	S. W.	Hot Sun-ſhine weather.
24	S. W.	Hot Sun-ſhine weather.
25	N.	Rain all day.
26	S. W.	Rain at night.
27	N. W.	Cloſe, ſome Rain.
28	S. W.	Cloſe weather.
29	S. S. W.	Cloſe, Rain at night.
30	Due S.	Variable weather.
31	S. b. E.	Cloſe, ſome Rain.

D.	*Wind.*	*Weather.* September 1684.
1	S. b. E.	Close, some Rain.
2	Due S.	Close, some Rain.
3	S. E: W.	Close, Rain, Thunder.
4	S. E: S. W.	Close, some Rain.
5	Due E.	Close morning, Rain afternoon.
6	S. S. E.	Close, some Rain.
7	N. W.	Fair Sun-shine weather, Rain at night.
8	N. W.	Fair Close Dry weather.
9	N. W.	Sun-shine morning, Close evening.
10	N. W: N. E.	Sun-shine morning, some Rain.
11	W. b. N.	Fair morning, Close evening.
12	N. W: N.	Fair morning, some Rain at night.
13	N. N. W.	Rainy weather.
14	Due N.	Fair Sun-shine weather.
15	N. b. E.	Fair Sun-shine weather.
16	Due N.	Close Fair weather.
17	N. W.	Close, and Windy.
18	Due N.	Fair morning, some Rain, Fair again.
19	Due N.	Fair morning, Close evening.
20	Due S.	Fair Sunshine-weather.
21	S. b. E.	Fair Sun-shine weather.
22	Due S.	Fair Sun-shine weather.
23	S. b. W.	Fair morning, Close evening.
24	Due W.	Fair-Sunshine weather.
25	S. b. W.	Changeable weather.
26	Due S.	Changeable weather.
27	Due S.	Rainy weather.
28	Due S.	Close Moist weather.
29	S. W.	Close Moist weather.
30	N. W.	Close morning, Sun-shine evening.

D.	*Wind.*	*Weather.* October 1684.
1	N. W.	Moist weather, some Rain.
2	W. b. S.	Close weather, but Fair.
3	S. W.	Close morning, Fair evening.
4	S. b. W.	Close all day, Rain at night.
5	W: N. W.	Rainy morning, Fair evening.
6	Due W.	Rainy Windy weather.
7	S. b. W.	Rain all day.
8	N. N. W.	Rain morning, Fair evening.
9	N: N. N. W.	Close Fair weather.
10	N. W.	Fair weather.
11	S. W.	Windy Rainy morning, Fair evening.
12	S. S. W.	Close, and some Wind.
13	S. S. W.	Close, some Rain.
14	S. S. W.	Rain, and Wind.
15	S. b. E.	Wind and Rain.
16	S. S. W.	Fair Sun-shine weather.
17	S. W.	Fair Sun-shine weather.
18	W. b. N.	Fair weather.
19	N. W.	Close morning, Fair Sun-shine evening.
20	N. W.	Fair weather.
21	Due W.	Fair Sun-shine weather.
22	Due W.	Close Fair weather.
23	Due W.	Fair morning, Wind and Rain at night.
24	N. W.	Wind, Snow, and Rain.
25	N. W.	Close, Cold, and Windy.
26	N. W.	Fair Frosty weather.
27	N. E.	Frost, and Snow.
28	S: W: N.	Frost, and Snow.
29	N: W.	Frosty Cold weather.
30	N: W.	Snow, and Wind.
31	Due N.	Cold Thaw in the morn. Clear Frosty evening.

D.	*Wind.*	*Weather.* Nov. 1684.
1	S. b. W: N.	Thaw, Snow, Froſt.
2	N. W: W.	Froſty morning, Thaw afternoon.
3	S. b. W: W.	Thawing weather all day.
4	N. W.	Cloſe, and Windy.
5	N. W.	Cloſe, and Windy; little Froſt.
6	Due W.	Fair weather, little Froſt.
7	N: S.	Fair morning, Rain evening.
8	E. b. S.	Small Rain all day.
9	S. E.	Miſty Moiſt weather.
10	Due W.	Rainy Miſty weather.
11	N. W.	Cloudy Moiſt weather.
12	S. W.	Cloudy Moiſt weather.
13	S. W.	Cloudy, ſome Sun-ſhine.
14	S. W.	Cloſe, a Miſt at night.
15	N. W.	Froſty morning, Cloſe evening.
16	N. W.	Cloſe morning, Clear Froſty evening.
17	N. W: N.	Hard Froſt and Clear.
18	N.	Hard Froſt, Sun-ſhine.
19	S.	Cloſe, Snow, Rain.
20	S.	Much Rain.
21	W.	Warm Sun-ſhine weather.
22	S.	Froſt, Rain.
23	S. W.	Fair, ſomewhat Warm.
24	W. S. W.	Some Rain.
25	W. N. W.	Cloſe, Fair.
26	W.	Fair, Warm, Cloſe.
27	N. W.	Some Rain.
28	N.	Cold, Cloudy, Rain.
29	N. E.	Fair, but Cloudy.
30	N.	Fair.

D	*Wind.*	*Weather.* Dec. 1684.
1	N. N. E.	Froſt, Sun-ſhine.
2	N.	Froſt, Sun-ſhine.
3	W. S. W.	Snow, much ſmall Rain.
4	S.	Cloudy, ſome Rain.
5	S.	Warm Sun-ſhine weather.
6	S. E: E. N. E.	Miſty, Thick Moiſt Air.
7	E. N. E.	Froſt, Sun-ſhine weather.
8	E. N. E.	Moiſt Cloudy Air.
9	E. N. E.	Moiſt Cloudy Air.
10	E. N. E.	Thick, Moiſt Air.
11	E. N. E.	Fair but Cloudy.
12	E. N. E.	Cloſe.
13	E. N. E.	A Moiſt Cloſe Air.
14	E. S. E.	Froſt, Clear Sun-ſhine.
15	E: W. S. W.	Froſt, Cloudy.
16	N. W: N.	Froſt, Cloudy.
17	W.	Froſt Cloudy, a little Snow.
18	N.	Froſt, Sun-ſhine.
19	W.	Thaw, Cloudy.
20	N. N. W.	Rain, Hail, Snow.
21	W.	Froſt, Sun-ſhine.
22	N.	Froſt, Sun-ſhine.
23	E.	Hard Froſt, Windy.
24	N. E.	Froſt, Sun-Shine.
25	N.	Froſt, Cloudy, much Snow.
26	N.	Hard Froſt, Sun-ſhine.
27	W.	Froſt, Sun-ſhine.
28	N. W.	Rain all day.
29	N. W.	Froſt, Rain at night.
30	W. N. W.	Some Rain, Fair evening.
31	E.	Fair, Cloudy.

XXI. At *Cape Corſe* in the Latitude of 4°. 49'. N. *A.* 1686. *Nov.* 24 and 25. Clear and Hot. 26. About 2. *a. m.* a Storm of Rain with Thunder for ½ hour. 27. At the ſame hour, Rain which laſted ſomewhat longer. 28. About 5. *a. m.* ſome Rain, afterward Miſty, and about 10 extream Hot. 29. About 2. *a. m.* a great Storm of Rain, ſlacking often, but renewing again, it laſted about an Hour; the Day after Clear.

The Weather at Cape Corſe. 1686. *and* 1687. *by Mr.* J. Hillier. n. 232. p. 693.

Thence to *Dec.* 7. Clear; then Cloudy in the Morning; between 12 and 1. *p. m.* a Shower laſting about ½ hour. Thence Clear and Hot. 10. A little Miſt in the Morning, otherwiſe very Clear and Hot; ſo till 15.

15. And ſome Days after, ſomewhat Thick, eſpecially in the Morning. 19, and 20. We had a Dry North and North Eaſterly Wind, call'd an *Hermitan*, and it overcame the *Sea Brize*; found very ill for the Eyes, and moſt Men complained of a Feveriſh Temper; it was Parching, but rather Colder than ordinary. 21. It ceaſed; a Clear Air and very Hot.

23. We had the *Hermitan* again; but the morrow it ceaſed; Then and, 25. Some Clouds, but no Rain. Thence to 29. Clear and Hot; 29. The *Hermitan* returned, but did not continue. Thence Clouds ſometimes, but no Rain till *Jan.* 2.

This Month we had three Funerals, one being Sick of the Flux laid violent Hands upon Himſelf, through Impatience of the Pain, the 3*d* Day. The Second upon the 25*th* died Convulſively, not having been Sick above one Day. The Third, *Dec.* 27. Died of a Dropſy, which had ſucceeded a Tedious Flux.

A. 1687. *Jan* 2. About 5. *a. m.* Rain for ½ hour, between 7 and 9, an Hour; from ½ hour paſt 9. to 1. *p. m.* the reſt Cloudy. 5. At 2. *a. m.* about ½ hour. 8. At 1. in the Morning about an Hour, the Days between ſomewhat Cloudy. Thence to 12 extream Hot.

12. and 14. Somewhat Cloudy, otherwiſe the Heat continued. 17. At 7. *p. m.* a *Tornada* for above ½ hour, and about 12 at Night another; but the Heat very little abated.

22. Between 5 and 6. *p. m.* began a *Tornada*, which laſted above an Hour very violent, with great Claps of Thunder and Lightning. Tank fill'd 1. Foot. 23. In the Morning a great Miſt, after 8 Clear and extream Hot.

The latter End of *January*, and the Beginning of *February* commonly Miſty in the Morning; after, extream Hot.

Feb. 10. Somewhat Cloudy and Cool, till then we were troubled with Coughs, for the moſt part; aboot this time they ceaſed. So the 11*th* toward Night, Thunder afar off, and Expectation of a *Tornada*; but it fail'd. 12. Extream Hot. 13. A ſtronger Wind than ordinary from Sea-ward. 14. Something like an *Hermitan*, but not from its uſual Quarter. Clear and Hot till about 2. *p. m.* then Cloudy, but no Rain. Thence to 22. extream Hot and Clear. From 22 to *Mar.* 1. ſome flying Clouds without Rain; Sultry Hot and unwholeſome.

24. Some ſhew of a *Tornada*, but it paſt away.

This Month we had two Funerals.

The

The Beginning of *March* as the latter end of *Feb.* 5. From 6. *a. m.* for an Hour and ½ a Violent *Tornada*; the Day after Cloudy. 6. Clear. 7. At Night Lightning and Clouds afar off; but nothing followed. Thence to the 11. Clear and Hot.

11. About 5. *a. m.* a violent Rain for almoſt ½ hour. 12, and 13. Cloudy. 14. About 4. *a. m.* a gentle ſhower, but laſted not long. 15. Between 6 and 7. *a. m.* a few Drops, and likelyhood of more, but nothing followed; both Days Cloudy. 16 Extream Hot. 17. Somewhat Cloudy. Thence to 20. Extream Hot.

20. Cloudy; about 10. *a. m.* ſome few Drops. 21. Very Hot. 22. In the Morning Hot; about 12 a violent Rain for a Quarter of an Hour. 23. Clear. 24. About 2. *a. m.* Rain for about ½ hour; the Day after Clear. Thence to *April* 3. Clear and extream Hot.

No Funeral.

Apr. 3. At 3. *p. m.* a violent *Tornada*, but only ſome few Drops of Rain; at 5. *p. m.* a little more Rain. 4. Cloudy by fits, otherwiſe very Hot. 5. Hot and Clear. 6. In the Morning Hot, about 2. *p. m.* Cloudy; about 3. ſome Drops of Rain, in the Evening the Clouds diſperſed. 7. Clear and Hot. 8. Between 12 and 1. in the Morning, a violent Rain for near an hour; after 2, one ſomewhat longer; the Day after there appeared to have been much Rain; Tank fill'd 2 Foot and ſomewhat more. 9. About 7 *a. m.* Some Drops, Cloudy all Day.

10. Cloudy, about 11. *a. m.* a ſmall Miſt. 11. Preſently after Midnight it began to Rain, and laſted till 6. *a. m.* a great part of the time very violently, it began with a ſtrong *Tornada*; Tank above 3 Feet. The Day after ſome Clouds; otherwiſe extream Hot. So alſo 12, and 13. 14. About 5. *a. m.* a Shower for ½ Hour, between 6. and 7. *p. m.* another of the ſame Continuance, the Day between extream Hot. So 15. 16. A Shower for ½ hour; it began with a violent *Tornada*, the Rain not much, afterwards Cloudy. 17, and 18. Clear. 19. Clear alſo, about 7. *p. m.* a conſiderable Wind, and ſome Drops of Rain.

20. Clear but Windy. 21. Between 12 and 2. moderate Rain for near an hour. 22. About 2. *a. m.* moderate Rain almoſt an hour; at 11. *p. m.* a ſhort Shower, and gentle; the Day between extream Hot. 23. Cloudy, about 10. *a. m.* ſome Drops. 24. Extream Hot. 25. About 1. *a. m.* Rain for near an hour; the Morning after Hot; Afternoon Cloudy; moſt part of the Night, Thunder and Lightning, but no Rain. 26. At 7. *a. m.* ſtrong Rain for ½ Hour, after that a little Miſt; Afternoon from 12 to 3. it rained unequally, but the moſt part moderate. 27. Extream Hot. 28. About 12 ſomewhat Cloudy, at 3. *p. m.* it began to Rain, and laſted about an hour and ½; after, Cloudy and ſome Drops, in the Night a Shower or two. 29. Cloudy. Thence to *May* 6. ſometimes Cloudy; but for the moſt part violent Hot.

This Month we had 3. Funerals; one the 3*d* of a Feaver, another on the 19*th* of I know not what Pains in the Guts; another on the 24*th*, of the Flux.

The

The 15. and ſome Days following, there ſetled upon the Caſtle Walls, certain ſwarms of Winged Ants, a little bigger than Bees; they would bite very ſeverely, and were blown up with Powder.

May. 6. In the Morning Cloudy, a little after Noon ſome Wind, followed by gentle Rain, which laſted till 3. *p. m.* after, Cloudy. 7. Hot. 8. Cloudy, about 10. *a. m.* a gentle Shower for $\frac{3}{4}$ hour; about 8. *p. m.* a very violent Storm of Wind and Rain, but it quickly grew moderate, and laſted in all not above $\frac{1}{2}$ hour. 9. Clear. 10. About Noon a violent Shower for $\frac{1}{4}$ Hour; after 8. *p. m.* another as long, but not ſo violent; paſt 9. another ſhorter.

11. Clear. 12. Clear; paſt 9. *p. m.* a very violent *Tornada* with Rain, which laſted ſomewhat more than 2 Hours. 13. Between 12 and 1. in the Night, a ſhort Shower; about 9. *a. m.* ſome Drops; ſo alſo in the Afternoon, but nothing conſiderable; cloudy all Day. 14. Cloudy; at 9. *a. m.* a violent Rain for $\frac{1}{4}$; after, gentle for above an hour; about 3. *p. m.* ſome Drops. 15. About 3. *a. m.* Rain for $\frac{1}{2}$ hour; between 4 and 5, another; after, Foggy and Cloudy, with ſome few Drops; about 7. *p. m.* a violent *Tornada* with Rain for near an hour. 16. About 4. *a. m.* Rain for an hour; after 8. for $\frac{1}{4}$ hour; after 6. *p. m.* Rain and Wind, but both moderate, for $\frac{1}{2}$ an hour; paſt 8. about as much. 17. About 4. *a. m.* a ſhort Shower; after, Clear. 18. Clear. 19. Cloudy, about 10. *a. m.* ſome Drops.

20. Cloudy; between 8 and 10. *a. m.* a Shower; firſt violent, after more moderate, till it ended in a kind of Miſt; it laſted in all about $1\frac{1}{2}$ hour; the Day after Clear. 21 and 22. Clear. 23. In the Afternoon Cloudy; about 6. *p. m.* ſome Drops; the Night after, a Shower not conſiderable. 24. Hot, about 10. *p. m.* a little Shower. 25. Clear. 26. In the Night ſome little Rain. 27. Held up. 28. at 9. *p. m.* a ſhort Shower. 29. At 5. *a. m.* Rain till near 7; a little paſt 7 till 9. after Cloudy. 30. Cloudy; the Night after, ſome Rain. 31. About 8 *a. m.* Rain for $\frac{1}{2}$ hour; from 9 till 12. it Rained for the moſt part very violently; before 1. another Shower for $\frac{1}{2}$ hour; from a little after 2 till 5. with very great Thunder.

One Funeral on the 25*th*, after but 3 Days Sickneſs.

The Beginning of this Month, we had an extradinary Number of Toads, which after ſometime were not to be ſeen. The 14. We had winged Ants as before.

24. Was the Firſt Corn, the Seed-time having been the middle of *March.*

Jun. 1. About 4. *a. m.* Rain for an Hour; paſt 1. *p. m.* for $\frac{1}{2}$ hour; the reſt Cloudy and Miſty. 2. From 2. *a. m.* till 5. continual Rain, 'tis ſaid there was ſome before; from 9. *a. m.* till $\frac{1}{2}$ hour paſt 6. *p. m.* continual Rain, ſometimes very fierce; from $\frac{1}{2}$ hour paſt 9 at Night, Rain till paſt 10. 3. From 6. to a little paſt 7. *a. m.* a very gentle Rain, from thence till 1. *p. m.* moſt commonly very fierce; thence for a little while more moderate, but it rained hard again till 6. *p. m.* then it droped but ſlowly, and ſo continued till about 7. In the Night ſome little Rain. 4. About 8. *a. m.* ſome Drops, thence Clear

Clear. 6 and 7. Clear, except ſome few flying Clouds. 8. After 3. *a. m.* gentle Rain for near an hour; then Cloudy and ſome Drops, after 10. *p m.* a Shower. 9. At 5. *a. m.* a gentle Shower, laſted till paſt 7; thence a very violent Rain till almoſt 9; ſome Drops after that; about 3. *p. m.* it began and rained till paſt 10, ſomewhat moderately. 10. Clear and Hot.

11. Cloudy; about 8. *p. m.* a few Drops. 12. From about 2. *a. m.* till near 5, Rain, but not violent; a little before 6. a furious Storm of Rain, but little Wind; it laſted till ½ hour paſt 7. About 3. *p. m.* a moderate Rain, till a little paſt 4. And from thence to 6. ſomewhat more than a Miſt; the Night after it Rained a little. 13. Cloudy; in the Afternoon it drop'd a little. 14. About 8. *a. m.* a few Drops. 15. Somewhat Cloudy. 16. Extream Hot; toward Night Cloudy; about 5. *p. m.* a violent Shower for ½ hour; from a little before 8. till paſt 10. it rained continually. 17. From 4. *a. m.* till almoſt 6. gentle Rain; ſo from a little paſt 6 till paſt 7. thence till paſt 3. *p. m.* Cloudy, and now and then ſome Drops; then a violent Shower for ⅛ of an hour; half an hour after 4 it rained again, and continued till paſt 10. for the moſt part very furiouſly; with ſome little intermiſſion it rained all Night. 18. At 3. *a. m.* It rained very fiercely; about ½ hour after 6. it held up, but Cloudy ſtill; from 8. *a. m.* till paſt 3. *p. m.* it rained, but moderately; then it held up a little, but Rained after till paſt 6. all Day Cloudy, and at Night a great Fog. 19. About 9. *a. m.* ſome Drops; from 1. till paſt 3. *p. m.* very gentle Rain.

Thence to the firſt of *July*, Foggy, Morning and Evening, ſometimes Hot, but for the moſt Cloudy, and more Temperate than could be expected from the Climate

Two Funerals, one the *9th* of an Aſthma; The other the 21 of a Feaver.

We ſaw ſome ſorts of Inſects not uſual here, whether Monſtrous or not I cannot tell. The moſt notable, a kind of Spider about the Bigneſs of a Beetle, the Form neareſt of a Crab Fiſh, with an odd kind of Orifice Viſible in the Belly, whence the Web proceeded.

Jul. 1. Extream Hot. 2. Foggy in the Morning; about 9. *a. m.* a few Drops; after, Clear. 3. In the Morning a great Fog; about 9. *a. m.* it rained ſmall Rain for near an Hour; Toward Night more Foggy than ever before; about 6. *p. m.* ſmall Rain for a litte time; from 8 till paſt 9. ſomewhat more brisk Rain, after that it cleared up. 4. From 9. *a. m.* to 3. *p. m.* ſmall Rain, the reſt Foggy; between 10 and 11. *p. m.* ſome Rain. 5. From 2. *a. m.* till paſt 8. conſtant Rain, ſometimes very fierce, ſometimes moderate; about 10. *a. m.* ſome Rain; between 2 and 3. *p. m.* it began to Rain, but continued not long; from 8. *p. m.* to 10. Rain. 6. From about 2. *a. m.* to 6, Rain; after, fair. 7. Foggy and Cloudy; between 7 and 8. *a. m.* ſome Drops. 8. Foggy in the Morning, otherwiſe clear and Hot. 9. About 1. *a. m.* a ſmart Shower, between 3 and 5, ſome more Rain. The Day after Foggy.

Foggy. 10. Very Dull and Cloudy; from 3. *p. m.* till Night, a very great Miſt.

11. Tolerably Clear, and very Hot, yet ſomewhat Foggy Morning and Evening. 12. Cloudy; thence to 15. in the Morning and Evening Foggy; elſe very Hot. 15. Cloudy; about 10. *a. m.* ſome Drops; from ½ hour paſt 2 till 4, moderate Rain; about 7, ſome Drops. 16. Cloudy, ſeveral times it dropped a little, but nothing conſiderable. 17. A little before Day, a ſhort Shower; after, Cloudy; thence to 20. Foggy Morning and Evening, and the moſt part Cloudy.

20. Very clear all Day, and extream Hot. 21. Not Foggy at all; yet ſomewhat Cloudy, but about Midday it cleared up. 22, and 23. Very clear and extream Hot. 24. Cloudy in the Morning; after, as the Two laſt. 25. Cloudy, but not Miſty nor Foggy; Sultry Hot. 26. In the Morning Cloudy; after, extream Hot. 27. Hot and clear. 28. Thin clouds, through which the Sun ſhone very Hot. 29, and 30. Cloudy. 31. About 3. *a. m.* Two ſhort Storms of Rain, the Day after Clear and Hot.

Two Funerals; one the 17. Drowned; the other 21. of a Feaver.

Aug. 1. to 5. Clear, for the moſt part in the Mornings Cloudy; but without Fogs; ſometimes very Hot. 5. About 5. *a. m.* a Shower near an hour long, about 7 another for ½ hour; till 10, ſome ſmall Rain; thence Cloudy till 1. about 7. *p. m.* a few Drops. 6. Cloudy all Day, ſometimes it dropp'd a little. 7. About 2. *a. m.* Violent Rain with Wind for above ½ hour. The Day after, Cloudy. 8, and 9. Cloudy and Foggy. 10. More Foggy than ordinary; about 10. *a. m.* a great Miſt, or ſmall Rain for moſt part of the Day after.

11. Foggy as the former and Miſty; between 8 and 9. *a. m.* a Shower of ſmall Rain; Afternoon, Clear. 12. Small Rain in the Morning; after, as 11. 13. Clear and Hot, the *Land Brize* very ſtrong. 14. Cloudy all Day, the *Land Brize* turn'd to a kind of *Hermitan*, but not troubleſome, nor continued beyond this Day. 15. Cloudy, ſeveral times very Miſty, and ſome ſmall Rain. 16. Cloudy, but no Miſt; Afternoon, Clear. Thence to 22. Clear and Hot, but the Nights Colder than at other times.

22. At 6. *p. m.* Cloudy, a Wind *Tornada* but moderate, with ſome Drops of Rain very large. 23. Clear and Hot. 24. Cloudy and Miſty at firſt; about 10. *a. m.* Clear and Hot. 25. Clear and Hot. 26. Very Foggy, Morning and Evening; for the reſt, Hot. 27. From 5. to 10. *a. m.* it Rained ſmartly; thence Cloudy; about 2. *p. m.* it cleared up for a while; about 9. *p. m.* a ſharp Rain for ½ hour. 28. Between 12. and 3. *a. m.* it Rained about two Hours; about 7 ſome few Drops; after, Cloudy; in the middle of the Day it Cleared a little, but quickly Overcaſt again. 29. In the Night ſome Rain; at 7. *a. m.* Rain for ½ hour; till paſt 12 a very thick Miſt; about 3. *p. m.* Clear; at Night a very thick Miſt. To the End Cloudy and Miſty.

Three Funerals; 6. one of a Feaver; 7. another of a Conſumption; 29. a third of a Feaver.

Sept. 1, and 2. as the laſt. 3. Some few Drops. Thence to 8. Cloudy alſo and Miſty. 8. About 6. *p. m.* ſome ſmall Rain; between 8, and 10 *p. m.*

for an hour pretty brisk Rain. 9. In the Morning Cloudy and Misty. 10. About 10. *p. m.* a little Rain.

11. Extream Hot and Clear; in the Night considerable Rain for several Hours. 12. About 10. *a. m.* some small Rain, the Morning very Foggy, Afternoon Clear. 13. Clear and Hot. 14, and 15. In the Morning Extream Cloudy, and some Drops of Rain. 16. Clear and extream Hot. 17. Moderate, about 7. *p. m.* some Drops; at Night also some Rain, not considerable. 18. Cloudy; in the Morning about 12, some Drops; all this Week, Morning and Evening Foggy and Thick. 19, 20, 21. Extream Hot; the Foggs ceased.

22. About 1. *a. m.* some Rain, the Day after Cloudy. 23, 24, 25. In the Morning Cloudy; after, very Hot. 26. At Night also somewhat Misty, with many Flashes of Lightning, but no Thunder. The like Flashes most Nights to the End of the Month, also often Cloudy; at other times extream Hot.

Two Funerals; One 19. of a Feaver; the Other 26. whose disease I do not know.

Octob. 1. About 3. *a. m.* a very fierce Rain for near an Hour, milder towards the End; the Day after some Flying Clouds. 2. About 4. *a. m.* a little Rain, the Day after as before; from 8. *p. m.* till 10. moderate Rain. 3. Cloudy; about 10. *a. m.* Rain for somewhat more than an hour. 4. Cloudy between 8. and 10. *p. m.* a very smart Rain for above an Hour. 5. About 9. *a. m.* a little Shower. 6. About 5. *a. m.* a little Shower; another past 6. The Day after, and 7. extream Hot. 8. Hot in the Morning; after Noon a Shew of a *Tornada*, with Thunder, and a considerable Wind, but no Rain.

Thence to 16. some flying Clouds, but generally Hot. 16. About 4. *p. m.* a little Rain, the Sun shining then, and the whole Day very Hot; about 8. *p. m.* a very strong *Tornada*, Wind and Rain for about ½ hour, afterward the Rain continued, but more moderate, for near two hours. 17. Clear and Hot. 18. So too, except that about 3. *p. m.* there was a very short Shower. 19. and 20. somewhat Cloudy.

21. About 7. *a. m.* a few Drops; after, Clear and extream Hot, but quickly Cloudy again; at 11. *a. m.* a violent *Tornada*, with very strong Rain and Thunder for near an hour; thence all the time till Night, thick and Misty; till 2. *p. m.* Rain. 22. Cloudy. 23. Clear and Hot. 24. Somewhat Cloudy; at 7. *p. m.* a little Rain. 25. Cloudy; about 11. *a. m.* Expectation of a *Tornada*, with some Thunder, but it ended in a few Drops of Rain about 1. *p. m.* 26. About 2. *a. m.* a very violent *Tornada*; and after the Wind, Rain not very fierce, which lasted till 8. *a. m.* the Day after Cloudy. 27. About 10. *p. m.* a violent Wind with Rain, but it lasted not long. 28. About 3. *a. m.* a strong Rain for near an hour; the Day after, extream Hot. 29, and 30. Hot yet with some Clouds. 30. Half an Hour after 11. *p. m.* began a very furious *Tornada*, the Wind was quickly over, but the Rain lasted with extream Violence about 2. hours. 31. In the Morning very Hot; about 2. *p. m.* a violent *Tornada*, with Rain and Thunder very near; it

ceased

ceaſed ſometimes, but beginning again, laſted till near 4. *p. m.* afterward Cloudy.

Three Funerals, all upon the 6. Day; Two of Feavers, the Other I know not.

Nov. Clear and extream Hot till the 6*th*. 6. About ½ hour paſt 1. in the Morning, a very violent Rain for more than an hour.

Thence to 14. except that the 11*th* at Night there were ſome few Drops, very Hot.

14. Extream Hot, about 9 *p. m.* a little Shower; the ſame Night about 1. a ſmart Rain for an Hour and Half. 15. Hot; toward Night Cloudy and Foggy. Thence to 19. very Hot. 19. Some likelyhood of a *Tornada*; but nothing followed.

20. About 1. *p. m.* a ſhort Shower, about a quarter paſt 2. another not much longer; till Night Cloudy. Thence to 26, no Rain, but Cloudy and ſomewhat Cooler; yet ſome days extream Hot. 26. About 10. *p. m.* a ſhort Shower. 27. About 2. another; the reſt Clear. 30. About 2. *a. m.* fierce Rain for about ½ hour.

This laſt Year has been the Wetteſt and moſt Cloudy of any that can be here Remember'd, yet the Air has been Clearer than it uſes to be in *England* one Day with another. *ib. p. 691.*

A *Tornada* is a Violent Storm of Wind, followed commonly by Rain, but not always; the Wind ceaſes not preſently upon the Rain; but after, ſometimes it does: In this Place it comes (as does an *Hermitan*) moſt frequently from the North, taking in the next Points, whether to the Eaſt or Weſt, but chiefly the Eaſt, though I have ſeen both that and an *Hermitan* from other Points; ſo the Account is not without Exception. There are in it ſhort uncertain Blaſts from all Quarters, which I believe reach not many Yards, but the General Wind (for ought that I ſee) is not ſo unconſtant; Veſſels that go to Windward are helped by them, when they are not over ſtrong, for they are Oppoſite to the *Sea Brize*, and they can Steer by them a Regular Courſe; which ſure they could not do, if they were very Irregular. They never fail to give Warning beforehand, though ſometimes after that Warning they do not follow; there is a very black Cloud appears afar, in which if there be a kind of white Spot, the Wind will be moſt, if not the Rain; this the Sailors ſay. Sometimes there is that Mark, ſometimes not, though I doubt the Prediction from it is not very certain; as neither are any perhaps of that kind. *ib. p. 692.*

XXII.

The Rain at Greſham Col. London. 1695, *and* 1696. n. 223. p. 357.

M.	*D.*	℔	℥	*gr.*
Aug.	19	2	6	216
	26	4	6	246
Sept.	2	0	4	96
	9	3	10	397
	16	0	1	204
	23	0	6	336
	30	4	1	444
Oct.	7	2	3	96
	14	0	2	60
	21	0	1	234
	28	0	0	458
Nov.	4	0	0	207
	11	1	11	65
	18	1	1	309
	25	0	9	285
Decem.	2	0	8	126
	9	3	7	324
	16	1	3	435
	23	0	1	60
	30	5	8	93

M.	*D*	℔	℥	*gr.*
Jan.	6	4	10	105
	13	0	1	12
	20	1	10	450
	27	1	5	82
Feb.	3	6	11	372
	10	4	9	242
	17	0	6	291
	24	0	2	180
Mar.	2	0	9	12
	9	0	2	459
	16	0	0	396
	23	4	4	263
	30	1	5	285
Apr.	6	2	4	375
	13	1	0	294
	20	2	2	000
	27	0	7	390

M.	*D*	℔	℥	*gr.*
May	4	4	10	45
	11	7	6	0
	18	5	2	105
	25	1	7	60
Jun.	1	0	0	99
	8	5	6	150
	15	0	2	120
	22	7	5	285
	29	1	5	84
Jul.	6	0	1	120
	13	16	1	0
	20	1	7	240
	27	5	1	256
Aug.	3	1	10	120
	10	1	11	90
	12	0	0	0

This Account of the Quantities of Rain fallen in one Year in *Greſham College, Lond. per* Month, begun *Aug.* 12. 1695 and the Rain was weigh'd every *Monday* morning till *Aug.* 12. 1696. by Pounds, Ounces, and Grains, *Troy* Weight: The Diameter of the Veſſel which receives the Rain being 11,4 Inches, whoſe Area is a little more than 102,1 Inches.

℔ ℥ *gr.*

The Sum amounted to 131. 7. 113. which is equal to 29,11 Inches in a Cylinder of the aforeſaid Diameter, *viz.* 11,4 Inches.

Fig. 18. *A B C D*, is a Frame to ſupport the Glaſſes. E, is a large bolt Head, with a Neck of 20 Inches long, and capable of holding above two Gallons. F, is a Funnel, whoſe Diameter is 11 Inches, and $\frac{4}{10}$, from *G*, to *H*. I, K, Are two Stays, or Pack Threads, which are ſtrained by two Pins, L, M, to hold the Tunnel ſteddy againſt the High Winds. *N*, The Pipe of the Tunnel, at *N* being no wider than $\frac{1}{2}$ of an Inch, through which the Evaporation can be but little.

JAN.

JANUARY. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	8	Froſt	W. S. W.	30 07	
1.	12			30 07	
	9	Fair		30 04	
	8			30 05	
2.	12	Miſling	S.	30 06	
	9			30 05	
	8	Fog	S. b. W.	30 07	
3.	12	Cloudy	S.	30 11	
	9			30 15	
	8			30 18	0 50
4.	12	Miſling	S.	30 18	
	9			30 18	
	8	Calm	W. b. S.	30 22	
5.	12	and	S. W.	30 23	
	9	Cloudy		30 26	
	8	Fog		30 22	
6.	12	Warm	W.	30 00	0 30
	9	Miſling		30 14	
	8		W. b. N.	30 05	
7.	12	Cloudy	N. W.	30 05	
	9				
	8		N. W.	29 94	
8.	12	Cloudy	N. W.	29 90	
	9			29 82	
	8	Sun-ſhine		29 51	
9.	12	Rain	S.	29 38	
	9	Snow		29 10	1 20
	8	Froſt	S. W.	29 02	
10.	12	Thaw	S.	29 00	
	9	Rain	S. b. E.	28 95	0 70
	8	Cloudy		29 46	
11.	12	Fair	N.	29 00	
	9			29 77	
	8		N.	29 83	
12.	12	Sleet			
	9				
	8				
13.	12	Cloudy			
	9			29 91	
	8		N. E.	29 96	
14.	12	Snow	N. E.	29 96	0 20
	9		E. N. E.	29 98	
	8	Froſt	E. N. E.	29 94	
15.	12	Cloudy	E.	29 92	
	9			29 90	
	8	Froſt	E. N. E.	29 90	
16.	12	Cloudy	N. E. b. N.	29 91	
	9			29 94	

D.	h.	Weather.	Winds.	Barom.	Rain.
	8	Froſt	N.	30 02	
17.	12	Cloudy	N. N. W.	30 02	
	9	Calm		30 04	
	8	Froſt	W.	30 09	
18.	12	Fair	S. W.	30 10	
	9			30 10	
	8				
19.	12				
	9				
	8	Fair			
20.	12	Froſt			
	9	Cloudy	S. W. b. W.	30 20	
	8				
21.	12				
	9				
	8	Cloudy	W.	29 95	
22.	12	Thaw	W. b. N.	29 90	0 08
	9	Rain		29 95	
	8	Froſt	N. W.	29 90	
23.	12	Snow	N. W.	29 80	0 30
	9	Fair	N. N. W.	29 68	
	8	Snow	N. W. b. W.	29 64	
24.	12	Storm	N.	29 67	0 20
	9	Snow.	N. E.	29 78	
			N. b. E.	29 95	
	8	Froſt	E.	29 95	
25.	12	Fair	E. b. N.	29 97	
	9		N. E.	29 98	
	8	Sharp	N. E.	29 96	
26.	12	Froſt	N. b. E.	29 96	
	9		N. N. E.	29 86	
	8			29 77	
27.	12	Froſt	N. E.	29 77	
	9			29 7	
	8	Cloudy	S.	29 65	
28.	12	Froſt	N. E.		
	9			29 60	
	8	Snow		29 47	
29.	12	Thaw	S. W.	29 31	0 08
	9			29 29	
	8	Froſt	S. W.	29 41	
30.	12	Fair	W.	29 50	
	9		W. b. S.	29 54	
	8	Froſt	W.	29 77	0 05
31.	12	Fair	N. N. W.	29 86	
	9		N. b. W.	29 93	
				Total	3 61

XXIII.

The weather 1697 *at* Upminſter, *in* Eſſex; *by Mr.* Will. Derham. n. 237. p. 47.

FEBRUARY. 1697.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	7						
1.	12	Froſt					
	9			30	06		
	7	Cloudy		30	05		
2.	12		N. E.				
	9	Froſt		29	95		
	7	Cloudy	N.E.b.E.	29	75		
3.	12	Froſt	E.	29	66		
	9	Calm	S.	29	50		
	7	Cloudy		29	30		
4	12	Thaw	E. b. S.	29	26	0	02
	9	Sleet		29	20		
	7	Snow		29	20		
5.	12	Fair	E.	29	20	0	03
	9	Froſt		29	19		
	7	Froſt	N. b. E.	29	05		
6.	12	Cloudy		29	02	0	03
	9	Snow	N.	28	90		
	7	Snow	N.	28	86		
7.	12	Cloudy	W. b. S.	28	83	0	01
	9		S. b. W.	28	83		
	7	Fairer		28	82		
8.	12	Sleet	S. W.	28	84	0	01
	9			28	97		
	7	Thaw		29	10		
9.	12	Froſt	S. W.	29	18		
	9			29	25		
	7	Froſt	S. W.	29	43		
10.	12	Fair	S.W.b.W.	29	52		
	9			29	61		
	7	Snow	S. b. E.	29	65		
11.	12	Rain	S. E.	29	76	0	27
	9	Fair	E.	29	94		
	7	Cloudy	E. b. S.	30	08		
12	12	Froſt					
	9			30	08		
	7	Thaw		30	00		
13.	12	Warm	S.	30	00		
	9	Cloudy		29	95		
	7	Calm	S.	29	88		
14.	12	Rain	S. b. W.	29	87	0	40
	9		S.	29	80		
	7	Miſt	N.	29	85		
15.	12	Warm	N. W.	29	86	0	30
	9	Rain	E.	29	80		
	7	Cloudy	S. b. E.	29	54		
16.	12		W. S. W.	29	62	0	28
	9	Fair		29	60		
	7	Rain		29	50		
17.	12	Fair	S.	29	52	0	20
	9	Rain		29	52		
	7	Cloudy	S. b. E.	29	30		
18.	12	Bluſtering	S.	29	26		
	9	Fair		29	42		
	7	Rain	E. b. S.	29	30		
19.	12		S.	29	33	0	05
	9	Fair		29	39		
	7		S. E.	29	46		
20.	12	Froſt	E. b. S.	29	46		
	9		E.	29	40		
	7			29	36		
21.	12	Fair	E.	29	37		
	9			29	45		
	7	Rain		29	47		
22.	12		E.	29	48	0	03
	9	Fair		29	52		
	7	Hoar-Froſt	E.	29	52		
23.	12	Fair	S.	29	54		
	9	Rain	S.	29	60		
	7			29	68		
24.	12	Fair	S. b. W.	29	75	0	04
	9	Rain		29	81		
	7	Cloudy		29	84		
25.	12	Bluſter.	S.	29	85		
	9	Fair		29	88		
	7	Fair	S.	29	88		
26.	12	Cloudy				0	10
	9	Rain	S. W.	29	92		
	7	Miſling	S.	29	93		
27.	12	Fair	S. b. W.	29	97		
	9	Calm	S. S. W.	29	98		
	7	Cloudy		30	01		
28.	12	Fair	S. W.	30	01	0	03
	9	Cloudy		30	40		
				Total		1	80

MARCH. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	7	Cloudy		30 12	
1.	12		S. W.		
	9	Fair		30 20	
	7	Cloudy	W.S.W.	30 18	
2.	12	Warm	S.W.	30 19	
	9	Spring		30 14	
	7	Fog	S.	30 02	
3.	12		W.	29 95	
	9	Fair	W. b. S.	29 88	
	7	Mist		29 75	
4.	12	Rain	S. W.	29 69	0 13
	9	Fair		29 65	
	7	Fair	S. W.	29 71	
5.	12	Colder		29 70	
	9		S.	29 46	
	7	Rain	S. W.	29 20	
6.	12	Bluster.	W.	29 12	0 85
	9	Fair		29 21	
	7	Fair	W.	29 48	
7.	12	Colder	W. b. N.	29 57	
	9	Bluster.	W.	29 60	
	7	Frost	N. W.	30 01	
8.	12		N.	30 11	
	9	Fair	N. b. E.	30 15	
	7	Frost	E.	30 15	
9.	12		W.	30 14	
	9	Fair	S. W.	30 08	
	7	Mist	S. W.	29 95	
10.	12		S.W.b.S.	29 90	
	9	Fair	S. b. W.	29 76	
	7	Mist	S.	29 65	
11.	12	Frost	W. b. S.	29 64	
	9	Cloudy		29 60	
	7	Rain	N. W.	29 47	
12.	12	Fair	W.S.W.	29 35	
	9	Rain	W.b.N.	29 21	
	7		N.b.W.	29 18	
13.	12	Rain	N.	29 25	0 32
	9		N.	29 35	
	7	Frost	N.	29 59	
14.	12	Fair	W.	29 60	0 02
	9	Cloudy	W.	29 48	
	7	Fair		29 40	
15.	12	Bluster.	W.	29 48	
	9	Storms		29 28	
	7	Fair		29 04	
16.	12	Hail	W.	29 04	0 82
	9	Snow		28 93	

D.	h.	Weather.	Winds.	Barom.	Rain.
	7	Frost		29 16	
17.	12		N. W.	29 30	
	9	Fair		29 32	
	7	Frost	S.	29 10	
18.	12	Snow	N. W.	29 10	
	9		W.	29 16	
	7	Frost	W. b. S.	29 27	
19.	12	Fair	N. W.	29 41	
	9		S.W.b.S.	29 43	
	7	Frost	S.	29 42	
20.	12	Snow	S. S. E.	29 37	0 52
	9	Fair	S. E.	29 25	
	6	Bluft.	E. b. N.	29 07	
21.	12	Cloudy	E. b. N.	29 10	
	9	Hazy	N. N. E.	29 24	
	6				
22.	12				
	9				
	6				
23.	12				
	9	Frost	N. E.	29 40	
	6	Frost	N.	29 46	
24.	12		N.N.W.	29 54	
	9	Fair	N. b. E.	29 70	
	6	Frost	N.b.E.1.	29 78	
25.	12		S. 1.	30 02	
	9	Fair	S. 0.	30 11	
	6	The	E. 0.	30 11	
26.	12	same	S.E.b.E.1.	30 10	
	9			30 04	
	6			29 97	
27.	12	Same	E. 0.	29 98	
	9			30 07	
	6	Same	E. 0.	30 13	
28.	12	Hazy	E. 0.	30 15	
	9		E. 1.	30 20	
	6	Cloudy	N.E.b.N.0.	30 14	
29.	12	Cold	N. N. E. 1.	30 12	
	9			30 12	
	6	Cloudy	N. 1.	30 12	
30.	12	Warmer	N. N. E.	30 12	
	9			30 05	
	6	Cloudy	N. 1.	29 96	0 02
31.	12				
	9	Rain	N. by E.	29 88	
				Total	2 68

APRIL. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Cloudy		29 83	
1.	12	Warm	N. E. o.	29 83	
	9	Fair		29 84	
	6		N. 1.	29 88	
2.	12	Fair	N. E. 2.	29 88	
	9			29 87	
	6	Fair	N.E.b.E. 1.	29 83	
3.	12	Want of	E. 1.	29 82	
	9	Rain.		29 82	
	6	Misling	N. o.	29 75	
4.	12	Cl udy			
	9	Fair.		29 68	
	6	Cold		29 68	
5.	12	Fair	N. b. E.	29 68	
	9	Misling		29 74	
	6	Frost		29 73	
6.	12		E.	29 71	
	9	Fair		29 68	
	6	Frost		29 66	
7.	12	Dry Sea-	E.	29 67	
	9	son		29 70	
	6	Frost		29 71	
8.	12		E.	29 70	
	9	Warmer		29 71	
	6	Fog	W.	29 66	
9.	12	Fair	W.	29 64	
	9	Cloudy		29 64	
	6	Warm	E. o.	29 61	
10.	12	and	E. b. S. 1.	29 61	
	9	Fair		29 60	
	6	Fair	E. o.	29 60	
11.	12	Warm	E. 1.	29 63	
	9	Cloudy	N.b. E. 2.	29 64	
	6	Fair	N.N.E.2.	29 65	
12.	12	Cloudy	N. b. E.	29 67	
	9	Rain		29 70	
	6	Cloudy		29 72	
13.	12	Rain	N. E.		2 38
	9			29 78	o 30
	6		N.N.E.o.	29 75	
14.	12	Fair	E.b.N.o.	29 76	
	9			29 76	
	6	Fair		29 77	
15.	12	Warm	E. 1.	29 77	
	9	Spr. Day		29 73	
	6	Fair	E. o.	29 73	
16.	12			29 75	
	9	Cloudy	N. o.	29 86	

D.	h.	Weather.	Winds.	Barom.	Rain.
	6		N.b.W. 1.	29 96	
17.	12	Fair		29 96	
	9		N. 1.	29 94	
	6	Fair	N. o.	29 91	
18.	12	Hot	E. N. E.	29 93	
	9	Day		29 95	
	6			29 93	
19.	12	The	E. 1.		
	9	ſame		29 80	
	6		E. o.	29 69	
20.	12	The	S. 1.	29 60	
	9	ſame	S. o.	29 52	
	6	Cloudy	E. b. S. o.	29 35	
21.	12	Fair	E. b. S. 1.	29 21	o 43
	9	Rain	S. b. E. 1.	29 10	
	6	Cloudy	E. 1.	29 08	
22.	12	Rain	S. 1.	29 05	o 30
	9	Fair	S. E. o.	29 15	o 62
	6	Fair	E. o.	29 20	
23.	12	Rain	S. b. E. 1.	29 22	o 06
	9	Fair	S. E.	29 27	
	6	Rain	S. E. 1.	29 31	
24.	12		N.N.W.	29 32	1 24
	9	Thunder	E.	29 34	
	6	Showers	E. b. N.	29 28	
25.	12		E.	29 27	o 75
	9	Fair	E. o.	29 18	
	6	Cloudy	S.	29 14	o 65
26.	12				
	9				
	6				
27.	12				
	9				
	6				
28.	12				
	9				
	6				
29.	12				
	9				
	6				
30.	12				
	9				
					o 80
				Total	7 53

MAY. 1697.

D.	h.	Weather.	Winds.	Barom.		Rain	
	6	Cloudy					
17.	12	Miſling		29	65	3	0
	9	Bluſtr.	S. W. 2.	29	55		
	6	Rain	W. 2.	29	57		
18.	12	Fair	W. b. N. 1.	29	65	0	19
	9			29	74		
	6		W. b. S. 1.	29	79		
19.	12	Fair	E. 1.	29	85		
	9			29	92		
	6	Fair	E. b. N. o.	29	99		
20.	12		N. 2.	30	02		
	9	Cool	N. b. E. o.	30	07		
	6	Cloudy	N. o.	30	08		
21.	12	Cold	N. b. E. 1.	30	08		
	9	Fair	N. b. E. o.	30	11		
	6	The	N. b E. o.	30	07		
22.	12	ſame	N. b. E. o.	30	07		
	9		E. o.	30	02		
	6	Cloudy	E.	29	98		
23.	12	Leſs Cold	E. b. N. o.	29	93		
	9	Fair	E. b. N. o.	29	88		
	6	The	N. b. E. o.	29	85		
24.	12	ſame					
	9		E. o.	29	88		
	6	Miſt		29	88		
25.	12	Hot and	E. o.				
	9	Dry		29	85		
	6	The	E. o.	29	83		
26.	12	ſame	E. 1.	29	80		
	9		E. o.	29	73		
	6	Fair	N. o.	29	65		
27.	12	Little	N. 1.	29	65	0	01
	9	Rain		29	75		
	6	Fair	N. o.	29	82		
28.	12	Warm					
	9		S. o.	29	74		
	6	Fair	S. o.	29	79		
29.	12	Hot	E. o.	29	75		
	9		E. 1.	29	73		
	6	The	E.	29	73		
30.	12	ſame		29	76		
	9		S. o.	29	80		
	6	The		29	80		
31.	12	ſame	S. o.				
	9			29	75		
				Total		3	20

JUNE. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Fair		29 66	
1.	12	Hot	S. o		
	9	Rain		29 56	
	6	Rain	S. o	29 42	
2.	12	Shine	S. 1	29 29	0 44
	9	Rain	S. 1	29 10	
	6	Fair	S.b.W.o.	29 08	0 79
3.	12		S. 1.	29 04	
	9	Showers	S. 1.	29 02	0 37
	6		S. W. 2.	29 18	
4.	12	Cloudy		29 38	
	9		S. 1.	29 58	
	6	Cloudy		29 72	
5.	12	Sultry	S.b.W.1.	29 83	
	9	Hot		29 85	
	6	Thunder	E. b. S.	29 85	
6.	12	Rain	E. o.	29 82	1 13
	9	Thunder		29 74	
	6	Fog	S. b. W.	29 70	0 02
7.	12	Fair	S. W. 1.	29 71	
	9	Hot	S.W.b.W.	29 72	
	6	Fair	S.W.b.W.	29 70	
8.	12				
	9	Cloudy	S. o.	29 56	
	6		S.b.E.o.	29 50	
9.	12	Fair	S. 1.	29 48	
	9	Rain	S. o.	29 51	
	6		S.b.E.o.	29 60	
10.	12	Fair	S.b.W.1.	29 68	0 01
	9		S. o.	29 75	
	6		S.	29 75	
11.	12	Fair	S.		
	9		E. o.	29 65	
	6	Cloudy	N. W. 1.	29 60	
12.	12	Fair	N.W.b.W.	29 55	
	9		N. W. o.	29 49	
	6		W. o.	29 40	
13.	12	Fair	S. W. o.	29 34	
	9		S. W. o.	29 28	
	6	Fair			
14.	12				0 20
	9	Rain	E. o.	29 38	
	6	Misty	E. o.	29 45	
15.	12	Fair			
	9	Hot	N.b.W4.	29 64	
	6			29 78	
16.	12	Cloudy	N. 1.		0 01
	9			29 90	

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Cloudy	N.	29 90	
17.	12	Fair	W. 1.	29 92	
	9	Sultry	W. o.	29 94	
	6	Very	W.b.S.o.	29 98	
18.	12	Droughty	W.b.S.1.	30 00	
	9		S. W. o.	30 00	
	6	Hot	SW.b.W.2.	29 93	
19.	12		N.b.E.1.	29 91	0 22
	9	Rain	N. E. o.	29 93	
	6	Cloudy	N.b.E.o.	29 92	
20.	12			29 92	
	9	Cooler	N. 1.	29 96	
	6	Cloudy	N. o.	30 00	
21.	12	Much			
	9	Cooler	N. E. 1.	30 02	
	6		N. o.	30 01	
22.	12	Fair	E. 1.		
	9		N.E.b.N.o.	29 90	
	6	Cloudy	N. o.	29 80	
23.	12	Rain	E. 1.	29 79	
	9	Fair		29 79	
	6	Great	N.E.b.E.1.	29 77	
24.	12	Drought	E. 1.	29 78	0 10
	0			29 78	
	6	Cloudy	N.E.b.E.o	29 74	
25.	12	Dry	N. E. 1.	29 73	
			E. 1.	29 71	
	6	Sultry		29 71	
26.	12		E. o.	29 71	0 05
		Dry		29 73	
	6	Mist	E. o.	29 74	
27.	12	Rain	E. b. S.	29 73	0 29
	9	Thunder	S. o.	29 74	
	6	Mist		29 81	
28.	12	Hot and	S. 1.	29 83	
	9	Dry		29 86	
	6	Dry	E. o.	29 85	
29.	12	Burning	E. 1.	29 85	
	9	Day	S. o.	29 87	
	6	Fair	S. W. o.	29 88	0 97
30.				29 88	
	12	Rain	S. 1.	29 80	0 21
				Total	4 91

JULY. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Rain	S. S. W.	29 75	
1.	12		S. W. 1.	29 72	
	9	Fair	S. W. o.	29 70	o 24
	6		S. W. o.	29 67	
2.	12	Same			
	9		S. W. 1.	29 59	o 22
	6		W.b.N.1.	29 64	
3.	13	Fair		29 75	
	9		W. o.	29 84	
	6	Cloudy	S. o.	29 85	
4.	12	Fair	S. W. 1.	29 85	
	9	Hot	S. W.	29 85	
	6	Fair	W. o.	29 87	
5.	12	Cool			
	9	Breezes	W. 1.	29 99	
	6	Hot	W. o.	29 95	
6.	12	Dry	W.b.S.1.	29 94	
	9	Day		29 90	
	6	Fair	W.b.N.o.	29 86	
7.	12	Hot			
	9	Rain	W.b.S.o.	29 79	o 12
	6	Misling	S. W. 1.	29 68	
8.	12	Rain	S. W. 2.	29 60	
	9	Cloudy	S.S.W. 1.	29 44	o 32
	6	Rain	S. W. 1.	29 42	o 75
9.	12	Cool	S. W. 1.	29 43	
	9	Fairer	W.N.W.o.	29 47	o 77
	6	Fair and	W.b.N.o.	29 58	
10.	12	Cool	W. 1.	29 71	
	9		N.W.b.W.	29 83	
	6	Rain		29 85	
11.	12	Warmer	S. W. 1.	29 85	
	9			29 93	o 50
	6		S.W.b.W	30 00	
12.	12				
	9				
	6	Fair			
13.	12	and			
	9	Hot	S. o.	29 98	
	6	Fair	S. o.	29 90	
14.	12		S.b.W. 1.	29 88	
	9	Cloudy	S. W. 1.	29 84	
	6	Rain	N.b.W.1.	29 84	
15.	12	Cloudy	W. 1.	29 85	o 48
	9	Fair	N. W. o.	29 90	
	6	Cooler	W. 1.	29 95	
16.	12	Rain	N.W.b.W.	29 94	
	9	Thunder		29 92	o 42

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Fair	W.b.N.o.	29 91	
17.	12	and	N. o.	29 93	
	9	Cool	N.N.W.o.	29 93	
	6	Fair	N. W. 1.	29 95	
18.	12	Cloudy			
	9	Rain	N. 1.	29 98	
	6	Misling	N.	29 98	
19.	12		W.N.W.1.	30 00	o 62
	9	Cloudy			
	6				
20.	12	Showry			
	9		W.b.S. 1.	29 88	
	6	Rain	W.S.W.1.	29 75	
21.	12	Fair	W. b. N. 1.	29 71	
	9	Misling	W. 1.	29 60	
	6	Misty	S.W.b.W.	29 48	
22.	12	Rain			
	9	Fair	S.W.b.S.o.	29 50	o 43
	6	Fair	S.b.W.o.	29 50	
23.	12	Cool	S. 1.	29 48	
	9	day	S. o.	29 48	
	6	Fair Thun.	S. 1.	29 50	
24.	12	great Sh. with	W.&N.&	29 56	
	9	Hail.	S.	29 60	1 02
	6	Fair plea-	W. o.	29 65	
25.	12	sant day	N. W. 1.	29 72	
	9		W.S.W.o.	29 77	
	6	Fair		29 76	
26.	12	Cloudy	W.b.S.o.	29 76	
	9	Misling		29 69	
	6	Cloudy	S.b.W.o.	29 63	
27.	12	and	S.E.S.b.W.	29 60	
	9	Cool	E.b.N.1.	29 60	
	6		N.N.E.2.	29 58	
28.	12	The same	E.b.N.2.	29 62	
	9			29 69	
	6	Fair	N. 1.	29 70	
29.	12	Cool	N. 2.	29 76	
	9	day		29 90	
	6		N.b. W. o.	29 77	
30.	12	The same	W.b. N. 1.	30 00	
	9			30 00	
	6	Cloudy	S. b. E. 1.	29 90	o 20
31.	12	Warmer	S. S. E. 1.	29 86	
	9	Rain	S. 1.	29 79	
				Total	6 09

AUGUST. 1697.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	6		S.b.E. 1.	29	73		
1.	12	Cloudy	S.b. E. 2.	29	72		
	9	Rain	S.b.E 2.	29	65		
	6	Fair	S.b.E. o.	29	63	o	51
2.	12	Showers	W.b.S. 1.	29	65		
	9	Fair		29	68	o	40
	6	Rain	S.b. E. 2.	29	69		
3.	12	Cloudy	W. 3.	29	71		
	9	Fair		29	78	o	05
	6	Rain	S.W.b.S. 1.	29	69		
4.	12		S.b.W. 2.	29	65		
	9	Fairer	W. 1.	29	60	1	00
	6	Rain					
5.	12		S. W. 2.	29	50		
	9	Fairer	S. W. 1.	29	49	o	79
	6	The	S.b.W. o.	29	47		
6.	12	same	S. 1.	29	48		
	9			29	49	o	22
	6	Cloudy	S.b.E. o.	29	51		
7.	12	Rain	E.b.N. 1.	29	55		
	9	Fairer	E. N.E. 1.	29	58	o	07
	6		N. 2.	29	50		
8.	12	Rain	N. 1.	29	48	4	00
	9	both	N. 2.	29	35	o	91
	6		W. 2.	29	37		
9.	12	Days	W.b.S. 1.	29	42	o	50
	9			29	48	2	20
	6	Cloudy	W. 1.	29	60	o	39
10.	12	Rain	N. W. 2.	29	66		
	9	Fairer	W. 1.	29	75	o	07
	6	Fair	W. o.	29	77		
11.	12	Pleasant	W. 1.	29	80		
	9	Day	W.N.W. 1.	29	82		
	6	Cloudy	W.b.N. o.	29	82		
12.	12		W.b.N. o.	29	82		
	9	Fair	N. o.	29	85		
	6	Mist	N. o.	29	88		
13.	12	Cloudy	W.b.S. 1.	29	89		
	9	Rain	S.b.W. 1.	29	83	o	33
	6	Cloudy	S. W. 2.	29	78		
14.	12		W. 2.	29	83		
	9	Fair	W. 2.	29	88		
	6	Cloudy	S. W. 1.	29	84		
15.	12	Little	W.b.S. 2.	29	81		
	9	Rain	S.W.b.W. 1	29	75		
	6	Cloudy		29	70		
16.	12	Fair	S. 1.	29	62		
	9	Cloudy		29	53		

D.	h.	Weather.	Winds.	Barom.		Rain.	
	6		S. o.	29	48		
17.	12						
	9						
	6						
18.	12						
	9						
	6						
19.	12						
	9						
	6	Fair	S.b.W. 2.				
20.	12	gr. Storm Thunder					
	9	Rain		29	60	1	88
	6	Cloudy		29	60		
21.	12	Rain	S. 1.	29	60		
	9	Cloudy		29	61	o	13
	6	Cloudy	W.b.S. o.	29	74		
22.	12	Misling	W. 1.	29	84		
	9	Fair	W.	29	90		
	6	Fair	W.b.S. o	29	92		
23.	12		W.b.S. 2	29	88		
	9	Cloudy	S. W. 2.	29	84		
	6	Fair		29	82		
24.	12		S. W. 1.				
	9	Sultry		29	78		
	6	Cloudy	S.W.b.S. 1.	29	70		
25.	12		S.W.b.S. 2	29	67		
	9	Fair	S.b.W. 2.	29	54		
	6	Rain	S. 3.	29	29		
26.	12		W.b.S. 3.	29	31		
	9	Fair		29	54	o	53
	6		S. W. 1.	29	81		
27.	12	Fair	W.b.S. 2.	29	93		
	9			29	98		
	6		S.S.W. o.	29	94		
28.	12	Fair	S.S.W. 2.	29	94		
	9			29	90		
	6	Cloudy	S. W. o.	29	95		
29.	12	Sultry	E. o.	29	99		
	9	Very Cl.		30	03		
	6		N. E. o.	30	03		
30.	12	Fair					
	9						
	6	Fair					
31.	12	and					
	9	SharpAir		30	01		
				Total		13	98

SEPTEMBER. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Fair	E.b.N. 1.	29 98	
1.	12		N. E. 2.	30 00	
	9	Cool		29 98	
	6		N.E.b.N. 1.	29 93	
2.	12	The same	N. E. 2.	29 92	
	9			29 90	
	6	Hot Sun	E.b.N.o.	29 88	
3.	12	but	E. 1.	29 89	
	9	Cool Air	E.	29 89	
	6	Fair	E. o.	29 84	
4.	12	Warmer	E. 2.	29 84	
	9	Air		29 80	
	6	Fair	E. 1.	29 78	
5.	12		E. o.	29 80	
	9	Hot		29 83	
	6	Mist	E. o.	29 83	
6.	12	Fair	S.b.E. o.	29 86	
	9	Hot		29 87	
	6		S. o.	29 85	
7.	12	The same	E. 2.	29 83	
	9		E. o.	29 80	
	6		E. o.	29 73	
8.	12	The same			
	9			29 70	
	6	Fair	E.b.N.1.	29 68	
9.	12	Cooler	E.b.N.2.	29 66	
	9			29 56	
	6	Cloudy	E. 1.	29 43	
10.	12		S. 2.	29 39	
	9	Rain		29 40	o 10
	6		S.b.E.o.	29 38	
11.	12	Showers	W.S.W.1.	29 40	
	9			29 60	1 59
	6	Fair	S. o.	29 76	o 07
12.	12		S.b.W.2.	29 77	
	9	Cloudy		29 70	
	6	Rain	S. 2.	29 49	
13.	12		S. 3.	29 38	
	9	Fair		29 63	1 54
	6		S. o.	29 67	
14.	12	Rain	S. 2.	29 50	
	9		S. 4.	29 32	
	6	Fair	S.W. 1.	29 46	
15.	12			29 30	
	9	Rain	3.	29 30	
	6	Fair	S.W. 4.	29 28	
16.	12	Cool	W.b.S. 6.	29 32	
	9	Cloudy	2.	29 34	
	6	Fair	W. 1.	29 45	
17.	12	Cool			
	9		o.	29 75	
	6		E.b.S. o.	29 55	
18.	12	Rain	S.S.W.2.	29 34	3 10
	9		S.W. 2.	29 10	1 60
	6	Fair	W.b.N.o.	29 38	
19.	12	Cloudy	S.W. 1.	29 50	
	9	Rain	S. 1.	29 32	o 56
	6	Rain	S.W. 3.	29 05	
20.	12		W.S.W. 3.	29 02	
	9	Fair	3.	29 21	o 14
	6	Cloudy	W.S.W. 3.	29 35	
21.	12	Rain	S. 1.	29 31	
	9	Cold	S.W. 1.	28 98	
	6	Fair	S.W. 2.	29 24	
22.	12	Shower.			
	9			29 38	o 09
	6	Fair	S.W. 1.	29 51	
23.	12				
	9	Rain	W.N.W.	29 74	
	6		S.W. o.	29 87	
24.	12	Fair	N.		
	9	Rain		29 87	
	6		E. o.	29 66	o 08
25.	12	Cloudy	S. E. 2.		
	9	Misling		29 38	o 30
	6	Fair	N. E. o.	29 38	
26.	12	Rain	E. 1.	29 40	
	9	Cold		29 30	o 24
	6	Fair	E. o.	29 27	
27.	12	Cloudy	E.b.N. 1.	29 25	
	9	Rain		29 30	o 84
	6	Fair	N. E. 1.	29 38	
28.	12	Cold	N.b.E.3.		
	9	Day		29 56	
	6	Hoar-	N.b.W.1.	29 65	
29.	12	Frost	N.b.W.1.	29 70	
	9	Fair		29 78	
	6	Ice	N.b.W.o.	29 80	
30.	12	Fair		29 82	
	9	Cloudy		29 83	o 22
				Total.	10 47

OCTOBER. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	7	Cloudy	N. W. o.	29 79	
1.	12	Misty	S. 1.		
	9	Warm	S. o.	29 78	
	7	Rain.	S. o.	29 77	0 10
2.	12	Cloudy	S. b. E. o.	29 75	
	9	Warm		29 70	
	7	Cloudy	S. b. E. o.	29 51	
3.	12		S. 1.	29 40	
	9	Rain		29 31	0 72
	7	Fair	S.W.b.W.1	29 50	
4.	12	Cold	S. W. 2.	29 52	
	9	Rain		29 28	
	7		S. 4.	29 00	1 12
5.	12	Rain	S. b. W. 2.	28 98	
	9			29 13	0 57
	7	Rain	S. 1.	29 16	
6.	12	Stormy	E. & W.	28 97	
	9	Fairer	S. & 6.	29 28	1 36
	7	Rain	S. b. E. 1.	29 08	
7.	12		N. 1.	29 13	
	9	Fair	W. 1.	29 58	2 52
	7	Rain	S. 2.	29 66	
8.	12	Cloudy	S. W. 4.	29 64	0 10
	9	Stormy	5.	29 44	
	7	Stormy	S. W. 8.	29 39	
9.	12	Cloudy Fairer	W. S. W. 4	29 51	
	9	Fair	2.	29 66	
	7	Fair	S. W. b. W. o	29 88	
10.	12	and	W. b. S. o.	30 00	
	9	Pleasant		30 15	
	7	Frost	W. b. S. o.	30 20	
11.	12	and		30 21	
	9	Misty	S. W. o.	30 18	
	7	Frost	S. W. b. W. o	30 17	
12.	12				
	9	Fair			
	7				
13.	12	Fair			
	9		W. 1.	30 20	
	7	Fair	W. b. S. o.	30 18	
14.	12	and	W. N. W. o.	30 18	
	9	Warm		30 16	
	7	Cloudy	W. b. S. o.	30 12	
15.	12	Warm	N. W. o.	30 12	
	9	Misling		30 10	
	7	Cloudy	W. o.	30 06	
16.	12	Fair	N. N. W. 2.	30 08	0 14
	9	Cold	N. b. W.	30 20	
	7		N. b. W. o.	30 27	
17.	12	Same	N. b. E. 1.	30 30	
	9			30 34	
	7	Cloudy	N. b. E. o.	30 32	
18.	12	Fair		30 33	
	9	Colder	E. b. S. o.	30 27	
	7	Hoar Fr.	S. W. o.	30 22	
19.	12	Mist	N. b. E. o.	30 28	
	9	Fair		30 30	
	7	Fog. Frost	N. W.	30 28	
20.	12	Cold	S. W.	30 26	
	9			30 23	
	7	Cloudy	W. S. W. 1	30 15	
21.	12		W. b. S. 1.	30 16	
	9	Fair		30 20	
	7		W. b. S. o.	30 25	
22.	12	Fog.	S. W. o.	30 25	
	9			30 25	
	7	Cloudy	S. S. W.	30 22	
23.	12	Fair			
	9	Cloudy		30 15	
	7	Cloudy	S. W. o.	30 06	
24.	12	and			
	9	Warm		29 94	
	7		S. W. 2.	29 80	
25.	12	Same	W. S. W. 2	29 78	
	9			29 74	
	7	Cloudy	S. W. 2.	29 60	
26.	12	Warm	S. W. 6.	29 52	
	9	Rain	6.	29 27	
	7	Fair	S. W. 2.	29 37	1 52
27.	12	Rain	S. W. b. W. 5	29 34	
	9	Stormy	o.	29 88	0 21
	7	Frost	S. W. o.	30 08	
28.	12	Fair			
	9	Rain		29 89	
	7	Warm	S. W. 4.	29 78	
29.	12	Small			0 02
	9	Showers	3.	29 74	
	7	Cloudy	W. b. S. 5.	29 48	
30.	12		W. 6.	29 54	
	9	Fair		29 72	
	7	Fair	N. o.	30 04	0 01
31.	12	and	N. E. 2.	30 17	
	9	Cool		30 26	
				Total	8 39

NOVEMBER. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	8	Misling	S. 1.	30 19	
1.	12				
	9	Misty		30 15	
	8	Fair	S.S.W.o	30 11	
2.	12	Warm	W.b.S.o	30 11	
	9	Pleasant		30 07	
	8	Fair	W. o	30 04	
3.	12	Colder	W.b.S.o	30 02	
	9	Fog		29 99	
	8	Cloudy	S.W.b.S.2.	29 94	
4.	12	Cold		29 88	
	9	Day		29 80	
	8	Rain	S. W. 2.	29 73	o 50
5.	12	Fair	W.b.S.2.	29 75	
	9			29 81	
	8	Rain	W.b.N.1.	29 87	
6.	12	Fair			
	9	Cold		30 00	
	8	Cold	E. o.	29 93	
7.	12	Cloudy	E.S.E.o.	29 91	
	9	Day		29 92	
	8	Frost	E.b.S.o.	29 96	
8.	12		E.S.E.o.	29 99	
	9	Fair			
	8	Hard		30 10	
9.	12	Frost	E. o.	30 10	
	9	Fair		30 10	
	8	Cloudy	N. E. o.	30 08	
10.	12	Frost			
	9	Fair		30 04	
	8	Rain	W.b.S. 1.	29 73	
11.	12		N. 2.		
	9	Fairer		29 72	o 78
	8	Rain	N.b.W.2	29 70	o 02
12.	12	Fair	N. 1.	29 68	
	9	Frost		29 65	o 15
	8	Rain	N. 1.	29 63	
13.	12	Cloudy		29 62	o 09
	9	Frost		29 56	
	8	Snow	N. E. 2.	29 40	o 82
14.	12	Sleet all	N. 1.	29 38	
	9	Day		29 48	o 50
	8	Frost	W.b.S.o.	29 64	
15.	12				
	9				
	8	Hard			
16.	12	Frost	N.W.b.2		
	o	Fair		30 04	

D.	h.	Weather.	Winds.	Barom.	Rain.
	8		N.b.W.2	30 03	
17.	12	The same	N.b.W.3.	30 03	
	9			30 00	
	8		N.N.W. 1.	29 92	
18.	12	The same	N.N.W.o.	29 91	
	9			29 76	
	8	Snow	S.S.W.2.	29 26	
19.	12	Sleet			
	9	Rain		28 83	1 20
	8	Cloudy	N.b.W.2	28 82	
20.	12	Sleet	N.b.W.3	28 82	
	9	Cold		28 93	o 01
	8	Cloudy	N.W. 2.	28 93	
21.	12				
	9	Snow	W.b.N.1	28 90	o 18
	8	Frost	N. o.	28 95	
22.	12	Fair	N. 1.	28 98	
	9	Sleet		29 08	o 09
	8	Frost	N. W. 2.	29 11	
23.	12	Fair			o 13
	9				
	8	Snow			
24.	12	Fair			
	9			29 36	
	8	Hard	S. o.	29 36	
25.	12	Frost	S. 1.	29 37	
	9	Dripping		29 35	
	8	Rain	S.E.b.S.2.	29 21	o 01
26.	12	Fairer	S. E. 2.	29 08	
	9	Rain		29 00	o 33
	8	Fair	S.b.W.o.	29 11	o 20
27.	12	Thaw	S. 1.	29 18	
	9	Rain		29 00	
	8	Cloudy	S. o.		o 41
28.	12	Warmer			
	9	Rain		29 10	
	8	Frost	S.S.W.o.	29 15	o 18
29.	12	Fair		29 19	
	9			29 19	
	8	SmallFrost	W. 1.	29 40	
30.	12	and	W.b.N.1	29 54	
	9	Fair		29 77	o 03
				Total	5 63

DECEMBER. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	8	Hard	W.b.N.o	29 86	
1.	12	Froſt and	W.b.N.2	29 87	
	9	Fair		29 89	
	8		N. 1.	29 90	
2.	12	Same	N. o.	29 94	
	9			29 99	
	8		N. o.	30 05	
3.	12	Same	N. N. E. o.	30 08	
	9			30 06	
	8	Cloudy	N. W. 1.	29 98	
4.	12	Snow	W. N. W. 1.	29 89	
	9	Half Inch		29 96	
	8	Cloudy	N. b. E. 2.	30 00	
5.	12	Fair	N. N. E. 1	30 06	
	9			30 09	
	8	Snow	N. W. b. N. 3	29 98	
6.	12	Fair	N. W. b. N. 1	29 99	
	9	Sn. 1 Inch		30 00	
	8	Snow 6	N. W. o.	29 93	
7.	12	Snow 8	S. o.	29 71	
	9	sə Inch		29 68	
	8			29 84	
8.	12	Fair	E. o.	29 87	
	9			29 85	
	8	Snow		29 64	
9.	12	Sleet	S. b. E. 1.	29 55	
	9	Thaw		29 42	
	8	Froſt	E. N. E. o.	29 55	
10.	12	Thaw	E. o.	29 57	3 62
	9	Snow	2.	29 46	
	8	Rain	E. S. E. 2.	29 09	2 76
11.	12	Warm	S. b. W. 1	29 10	
	9	Thaw		29 24	o 90
	8	Thaw	S. b. E. 2.	29 14	
12.	12		S. 2.	29 04	
	9	Rain		29 11	o 42
	8	Fair	S. W. 3.	29 33	
13.	12	Warm	W. S. W. 3	29 50	
	9	Pleaſant	S. W. 1.	29 61	
	8	Cloudy	S. W. 1.	29 68	
14.	12	Warm	W. S. W. 1	29 67	
	9	Day	W. S. W. o	29 65	
	8	Miſty	E. 1.	29 64	
15.	12	Warm	E. b. N. o.	29 64	
	9	Day		29 65	
	8	Froſt			
16.	12		E. b. N. 1.	29 58	
	9	Fair		29 59	

D.	h.	Weather.	Winds.	Barom.	Rain.
	8	Froſt		29 57	
17.	12	Cloudy	E. o.	29 56	
	9	Fairer		29 62	
	8			29 64	
18.	12	Miſt	E. o.		
	9			29 72	
	8	Cloudy		29 70	
19.	12	Warm	E. 1.	29 68	
	9	Day		29 63	
	8	Fog	E. 2.	29 50	
20.	12	Cloudy			
	9	Colder		29 44	
	8	Rain		29 45	o 23
21.	12	Cloudy	E. 1.	29 51	
	9	Cold		29 62	o 17
	8	Rain		29 75	o 02
22.	12	Cloudy	E. 1.		
	9	Fair		29 90	
	8		S. b. E. 1.	29 83	
23.	12	Cloudy	S. 1.	29 76	
	9			29 64	
	8		S. b. W. 2.	29 52	o 46
24.	12	Rain	S. 2.	29 46	
	9	Stormy	6.	29 34	o 56
	8	Fair	W. 3.	29 25	
25.	12	and	S. W. 2.	29 40	
	9	Warm		29 61	o 03
	8	Cloudy	W. S. W. 2	29 62	
26.	12	Fair	W. b. S. 2.	29 70	
	9	Warm	3.	29 87	
	8	Cloudy	W. S. W. 2	29 90	
27.	12				
	9	Miſling		29 82	
	8	Cloudy	S. b. W. o.	29 66	
28.	12	Rain	W. b. S. 3.	29 56	
	9	Fair		29 75	o 08
	8	Fair	W. 2.	29 90	
29.	12	Cloudy	W. b. N. 2	29 97	
	9	Rain	o.	29 97	
	8	Fair	N. E. 1.	30 10	o 05
30.	12	Cloudy	N. E. 1.	30 15	
	9	Fair		30 20	
	8	Froſt	E. o.	30 18	o 01
31.	12	Cloudy	E. b. S. o.	30 15	
	9	Fair		30 08	
				Total	9 31

In

In this Table, the Quantity of Rain, which fell through a Tunnel of 12 Inches Diameter, is set down in Pounds and Centesimals: and I measured it with a Cylindrical Glass, after Mr. *Townley*'s Method.

Where only one sort of Weather is noted upon one Day, that was the Weather of all the Day; especially if the Barometer be noted 3 times. The same Observe also in the Column of Winds.

In the Column of Winds, 0, signifies a Calm; 1, 2, 3, &c. denotes the strength of the Wind; wherefore, 5, or 6, is a little Storm; 7, or 8, a great Storm.

I have noted in the Column of Weather, the Depth of the Snow upon the Ground.

The whole Quantity of Rain that fell through my Funnel last year, was 77,60 *l.* which is less than fell from the Beginning of *March* (at which time I began my Rain Observations) till the End of *December*, 1696. In which 10 Months there fell here, at *Upminster* almost 115. *l.* and at *Townley* in *Lancashire* (according to Mr. *Townley*'s Observations) above 172. *l.* and in the whole year at *Townley* 203,76. *l.*

XXIV. The Quantity of Rain which fell through my Tunnel this Year 1698. was 122,32 Pounds. I find Foggy Weather makes the Mercury rise, as well as the North Wind; as may be Observed in the following Table, in the Month of *December*, at which time the Mercury was very high, although the Wind was in the Southerly Points. I submit it, whether the Cause be not the Increase of the Weight of the Atmosphere, by an Addition of those Vapours of which the Fog consists, which are manifestly as heavy as the Air, because they swim in it without Ascending? These filling up many of the Vacuities of the Air, without extruding much the parts of Air (as I judge Clouds do) do add considerably to the Weight of the Atmosphere, and so cause the Mercury to Ascend.

The Weather 1698. *at* Upminster; *by Mr.* Wil. Derham. n. 249. p. 45.

The greatest Range I have ever Observed the Mercury to have, is no more than 2,12 Inches; it being here never higher than 30,40 nor lower than 28,28 Inches. The lowest it ever was, within my Observations, was *Jan.* 24. about 2 of the Clock in the Afternoon; about which Hour Mr. *Townley* Observed his Barometer to fall to 27,80 Inches, which, he says, was remarkably low.

JANUARY. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	8	Froſt	S. E. o.	29	95		
1.	12	Fair	S.b.E.1.	29	90		
	9	Hard Fr.	o.	29	82		
	8	Cloudy	S.b.E.1.	29	63		
2.	12	Froſt	S.b.E.2.	29	48		
	9	Snow	o.	29	26		
	8	Snow	W.b.S.o.	29	15		
3.	12	1 Inch					
	9	Rain		28	94	o	55
	8	Rain	E. o.	28	80	o	99
4.	12	Sleet	E. o.	28	88		
	9	Snow 4. Cloudy		29	18	2	98
	8	Froſt	W. o.	29	44	o	20
5.	12	Fair	W.S.W.1	29	53		
	9	Cloudy		29	64	o	33
	8	Rain	E. 1.	29	49	o	20
6	12	Fair	E.b.N.1.	29	50		
	9	Cloudy		29	78	o	23
	8	Froſt	N.b.W. 1	29	98		
7.	12	Fair	N. 1.	30	04		
	9	Snow re.		30	14		
	8	Froſt	N.b.E.1.	30	18		
8.	12	Showers	N.N.E.2	30	18		
	9	of Snow		30	16		
	8	Cloudy	N. E. 2.	30	07		
9.	12	Cold	N.E.b.N.2.	30	04		
	9	Day		30	00		
	8	Froſt	N. E. 1.	29	90		
10.	12	Cloudy		29	89		
	9	Day					
	8	Same	N. E. o.				
11.	12	but leſs		29	79		
	9	Cold		29	73		
	8	Cloudy	N. E. o.	29	61		
12.	12	Fairer	S.o: W.1	29	53		
	9	Fair		29	36		
	8	roſt	S. o.	29	21		
13.	12	Fair		29	18		
	9	Snow	W. o.	29	16		
	8	Snow. 3.	N.N.W.1.	29	23		
14.	12	Cloudy	N.N.W.1.	29	29		
	9	Fair	N. 1.	29	40		
	8	Hard	N.b.W.1	29	52		
15.	12	Froſt	N. 1.	29	65		
	9	Fair	N. o.	29	79		
	8		N.b.W.o	29	77		
16.	12	Same					
	9		N. o.	29	74		

D.	h.	Weather.	Winds.	Barom.		Rain.	
	8	Snow	N.W.o.	29	57		
17.	12	with the former, 5	E.1:N.E.2.	29	60		
	9	Inches	N.b.E.1.	29	65		
	8	Little	N. 1.	29	68		
18.	12	Snow very	N. 2.	29	69		
	9	Cold	N.b.E.2.	29	71		
	8	Snow 3	E. o.	29	62		
19.	12	Inch.more Cloudy all	E.b.S.2.	29	59		
	9	Day	2.	29	59		
	8	Cloudy	E.b.N.3.	29	65		
20.	12	very	E.b.N.3.	29	70		
	9	Cold Day	2.	29	84		
	8	Hard Fr.	E.b.N. 2.	29	92		
21.	12	& Cloudy	E.b.N. 2.	29	95		
	9	as before	1.	29	95		
	8	Fairer	E.b.S. o.	29	82		
22.	12	very	E. 1.	29	68		
	9	Cold	E. 3.	29	30		
	8	Snow 5	E.b.N. o.	29	00		
23.	12	Inches Cloudy	N. E. 1.	29	00		
	9	SnowyDay		29	07		
	8	Snow 3	E.b. S. 1.	28	73		
24.	12	Inches Sleet	S. E. 2.	28	38		
	9	Thaw	S. W. 1.	28	28		
				28	31	2	07
	8	Thaw	S. 2.	28	38	o	30
25.	12	Showers	S. 1.	28	40		
	9	of Rain		28	56	o	32
	8	Rain	S. o.	28	72	o	28
26.	12	Thaw with					
	9	Showers		28	94	o	06
	8	Fairer	S.b.w.o.	29	03	o	08
27.	12		S. b.E. 1.	29	00		
	9	Rain		28	88	o	39
	8	Froſt &	s.W.b.S.o.	28	98	o	14
28.	12	Fair	S.S. W.1.	28	88		
	9	Rain	S.E.b.S.1	28	68	o	28
	8	Same with	S. W. 2.	28	90		
29.	12	Bluſtring	S.S.E.4.	28	67		
	9	Snow	4.	28	53	o	76
	8	Froſt	W.b.S.1.	28	92	o	48
30.	12	Fair Plea-	W. 2.	29	06		
	9	ſant Day		29	51		
	8	Fair	N.W.o.	29	70	o	30
31.	12	WetAfter-	S. W. 1.	29	71		
	9	noon		29	58		
				Total		10	94

FEBRUARY. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	7	Misling	S. W. 2.	29	48		
1.	12						
	9	Warm					
	7	Fair					
2.	12						
	9	Misling	4.	29	11		
	7	Fair	W.b.S. 3.	28	97	0	34
3.	13	Cloudy	W.S.W.4	29	06		
	9	Fair	1	29	26		
	7	Froſt	S. W. 0.	29	36		
4.	12	Fair and	W. 1.	29	42		
	9	Pleaſant		29	63		
	7		N. 1.	29	86		
5.	12	Same	N. E. 1.				
	9			30	06		
	7	Froſt	E.b.N. 1.	30	08		
6.	12	and	E. 1.	30	08		
	9	Cloudy					
	7	Froſt	E.b.N. 0.	30	01		
7.	12	Fair and	W. 1.	30	01		
	9	Warm		29	96		
	7	Froſt	E.b.N. 0.	29	88		
8.	12	Fair	E. 0.	29	89		
	9	Colder	0.	29	89		
	7		E.b. N. 0	29	83		
9.	12	Same	E.N.E. 1	29	84		
	9			29	91		
	7	Cloudy	N. E. 1.	29	99		
10.	12	Cold	N. E. 2.	30	02		
	9	Fair		30	07		
	7	Froſt	N. E. 1.	30	08		
11.	12	and	E.b.N. 2.		08		
	9	Fair	N. E. 1.	30	11		
	7	Fair Clo.	E.N.E. 1	29	90		
12.	12	with	N. E. 2.	29	87		
	9	Froſt	2.	29	85		
	7	Froſt Cl.	E.N.E. 3.	29	84		
13.	12	and very	N. E. 4.	29	86		
	9	Cold	N. E. 3	29	94		
	7		N.b.W. 0	29	83		
14.	12	Snow	N.W.bN. 2	29	86		
	9		4.	29	86		
	7	Snow	N. E. 3.	29	86		
15.	12	half Inch	N.E b.N. 4	29	81		
	9	very cold	2.	29	72		
	7	Sn. 1 Inch	N.E.b.E. 2.	29	63		
16.	12	very	E.N.E. 3.	29	56		
	9	Cold		29	53		

D.	h.	Weather.	Winds.	Barom.		Rain.	
	7	Cloudy	E.b.N. 2.	29	42		
17.	12	Sleet, leſs	E.b.N. 1.	29	38		
	9	Cold		29	43		
	7	Fairer	E. 0.	29	46	0	14
18.	12	Cloudy Thaw	E.b.N. 1.	29	50		
	9	Rain		29	52	0	16
	7	Cloudy	E 2	29	51	0	15
19.	12	Rain	E.b.N. 2.	29	55		
	9	Cloudy		29	67	0	28
	7	Fairer	E.b.N. 2.	29	68		
20.	12	Colder	E.b.N. 3.	29	71		
	9	Freezing		29	75		
	7	Froſt	E.b.N. 1.	29	81		
21.	12	Fair and	E.b.N. 2.	29	84		
	9	Pleaſant	0.	29	84		
	7		N.E. 0.	29	85		
22.	12	Same	E.b.N. 1.	29	88		
	9			29	90		
	7	Froſt and	E.b.N. 0.	29	94		
23.	12	Fair	E. 1.	29	97		
	9	Cl. Warm		30	00		
	7	Cloudy	E. 0	29	96		
24.	12	Fr. Cold	E. 1	29	97		
	9	Fair		29	97		
	7	Miſt Fr.	E.b.N. 0.	29	95		
25.	12	Fair and	E. 0.	29	95		
	9	Warmer		29	93		
	7	Froſt	E. 0.	29	88		
26.	12		E. 1.	29	88		
	9	Cloudy		29	88		
	7	Froſt and	E. 0.	29	79		
27.	12	Fair Warmer	E. 1.	29	78		
	9	Cloudy	S. W.	29	76		
	7	Rain	S.W.,b.S. 1.	29	60	0	24
28.	12	Fair, and					
	9	Thaw					
				Total		1	31

MARCH. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	6	Fair					
1.	12	Warm &					
	9	Pleaſant		29	60		
	6	Fair	S.S. E. 0.	29	39		
2.	12	Warm	S.b.W.1.	29	38		
	9	Rain	N.W.2W.1	29	60	0	32
	6		N. W. 1.	29	74		
3.	12	Cloudy	N. 2.				
	9			30	00		
	6	Cloudy	N. 1.	30	05		
4.	12	Colder	N.b.E. 2.	30	10		
	9	Day		30	19		
	6	Cloudy	N. E. 1.	30	16		
5.	12	Cold	E.b.N. 2.	30	10		
	9	Winds		30	05		
	6	Froſt	N. E. 0.	29	92		
6.	12		N. E. 1.	29	90		
	9	Fair		29	83		
	6	Froſt	N. E. 2.	29	72		
7.	12	Cloudy	N.E.b.E. 3	29	74		
	9	Cold		29	74		
	6	Froſt	N. E. 0.	29	70		
8.	12	Cloudy	N.E.b.E 1	29	71		
	9	Warmer		29	80		
	6	Fr. and Fair	S.E.b. E. 0.	29	81		
9.	12	and Sharp Snow	S. 1.	29	76		
	9	Rain		29	68		
	6	Cloudy	S. 0.	29	51	1	49
10.	12	Showers	W. 2.	29	54		
	9	Fair		29	71	0	10
	6	Showers	S. 1.	29	63		
11.	12		S.S.W.2.	29	42		
	9	Fairer	S. W. 2.	29	61	0	70
	6	Rain	S.S.W. 3	29	42	0	26
12.	12	Warm	S. W. 5.	29	35		
	9	Showers	S. W. 3.	29	39	0	98
	6		S.W.b.W.2	29	63		
13.	12	Fair	S.W.b.W.2	29	69		
	9		W.S.W.2	29	78		
	6	Warm	S.W.b.W.2	29	74		
14.	12	Cloudy	S.W.b.W.4	29	74		
	9	Day		29	84		
	6		S. W. 2.	29	87		
15.	12	Same	S. W. 3.	29	89		
	9		W.b.S. 2.	29	95		
	6		W.S.W.2	30	02		
16.	12	Same					
	9			30	03		
	6		S. 1.	29	80		
17.	12	Same	S. W. 2.	29	68		
	9	Rain	S.b.W. 3.	29	+3		
	6	Fairer	W.b.S. 4.	29	24	0	23
18.	12	Hail, and	W.b.S. 7.	29	36		
	9	Cooler	1.	29	50	0	09
	6	Hoar Fr.	S. W. 0.	29	60		
19.	12	Fair	W. 2.	29	74		
	9	Rain	0	29	78		
	6	Cloudy	S.W.b.W.2	29	76	0	01
20.	12		S. W. 3.	29	78		
	9	Warmer		29	78		
	6		S.S.W. 2.	29	68		
21.	12	Same	S. W. 3.				
	9			29	58		
	6	Cloudy	S.S.W. 1.	29	59		
22.	12		W. 1.	29	73		
	9	Fair	N. W. 0.	29	98		
	6	Froſt	N.b.W.0	30	11		
23.	12	Fair and	S. 1.	30	14		
	9	Pleaſant	S. W. 0.	30	14		
	6		S. b. E. 0	30	09		
24.	12	Same	E. b. S. 1	30	08		
	9			30	00		
	6	Froſt	E.b. N. 0	29	90		
25.	12	Fair	E. 1.	29	88		
	9	Rain		29	83		
	6	Fair, very	E. 0.	29	77	0	38
26.	12	Warm	E.b. S. 1.	29	77		
	9	Lightning		29	71		
	6	Miſty	S. W. 0.	29	73		
27.	12	Fair	S. 1.	29	75		
	9	Cloudy		29	66		
	6	Rain	S. 2.	29	42	0	28
28.	12	Cloudy	S.b.W. 4	29	34		
	9	Cooler		29	46	0	05
	6	Fair	w.S.w. 1.	29	63		
29.	12		W.b.S. 2.	29	70		
	9	Showers		29	79	0	06
	6	Hoar	S. 0.	29	70		
30.	12	Froſt,	S. W. 3.	29	59		
	9	Rain		29	46	0	34
	6	Rain	E.b.N. 0.	29	36	2	52
31.	12	Rain	N. 2.	29	49	1	52
	9	Fairer		29	72	9	33
				Total		9	33

APRIL. 1698.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6		S. b. E. o.	29 68	
1.	12	Rain	S.S.W. 1.	29 48	
	9			29 26	1 47
	6	Cloudy	W.S.W 2	29 27	0 11
2.	12		W.N.W. 3.	29 40	
	9	Fair		29 57	
	6	Hoar Fr.	S. W. o.	29 62	
3.	12	Fair	W. 1.	29 71	
	9	Rain		29 83	0 26
	6		E.b. N. o.	29 90	0 03
4.	12	Fair	N. E. 1.	29 95	
	9			30 00	
	6		N.N.E. 1.	29 97	
5.	12	Same			
	9				
	6				
6.	12	Cloudy			
	9			29 88	
	6	Fair	N.N.E. o.	29 94	
7.	12		E. 2.	29 91	
	9	Cloudy		29 79	
	6		S.b.W. 2.	29 65	
8.	12	Showers	N. W. 2.	29 71	
	9			29 83	0 22
	6	Hoar Fr.	S. W. o.	29 83	
9.	12	Cloudy	S. W. 2.	29 82	
	9	Fair	S. o.	29 82	
	6		S.b.W. 2.	29 75	
10.	12	Cloudy	S.S.W. 2.	29 67	
	9			29 64	
	6	Fair with	S. W. 1.	29 66	
11.	12	Showers			
	9		W.b.S. 2.	29 56	0 11
	6	Fair	W.b.S. 1.	29 60	
12.	12	and		29 68	
	9	Cool	S. o.	29 70	
	6	Cloudy	S. 1.	29 68	
13.	12	Warm	S.S.W. 1.	29 66	
	9	Rain	W.b.S. o.	29 62	
	6		W.b.N. 1	29 68	0 14
14.	12	Fair			
	9	shower		29 80	0 06
	6	Cloudy	W.b.S. 2.	29 50	
15.	12		W.N.W. 4.	29 50	
	9	Showers	N.N.W. 3.	29 73	
	6	Snow	N. W. 3.	29 76	
16.	12		N. 5.	29 85	
	9	Cloudy	N. 2.	29 89	1 00

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Fair	N.b.W. 2	29 87	
17.	12	and	N. 2.	29 88	
	9	Cold	N.b.E. 1.	29 92	
	6		N.b.W. 1	29 90	
18.	12				
	9				
	6	Cloudy			
19.	12	Warmer	N. 1.	29 88	
	9	Rain		29 90	
	6	Cloudy	W. 1.	29 80	0 44
20.	12	Rain	W.S.W.	29 68	
	9			29 42	
	6	Fair and	W. 2.	29 28	0 37
21.	12	Cold	W.b N. 2.	29 30	
	9	Cloudy		29 26	
	6	Rain	N. 3.	29 34	0 19
22.	12	Snow	N.N.W. 3.	29 43	
	9	Fair		29 44	0 03
	6	Ice very	E.S.E. 1.	29 32	
23.	12	Cold	S. E. 2.	29 29	
	9	Rain		29 28	0 58
	6	Misling	E.b. S. o.	29 31	
24.	12	Warmer	E. 1.	29 46	
	9	Fair		29 68	
	6	Showers	S. W. 1.	29 70	
25.	12		W. 2.		
	9	Fair		29 83	0 42
	6	Fair	W. 2.	29 83	
26.	12	Hail	W. 3.	29 80	
	9	Showers		29 63	
	6	Snow	W.b.S. 2.	29 56	0 89
27.	12	Sleet	W. 3.	29 56	
	9	Fairer		29 62	0 48
	6	Showers	N.W. 1.	29 67	0 20
28.	12	of Hail	N.b.W. 2	29 71	
	9	and Rain		29 83	0 31
	6	Cold	N.W.b.N. 1	29 84	
29.	12	Showers	N. W. 2.	29 86	
	9			29 81	0 43
	6		N.N.W. 1.	29 78	0 09
30.	12	Rain	N.N.E. 2.	29 78	
	9			29 80	0 25
				Total	8 08

MAY. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain	
	6		S. 1.	29	74	0	58
1.	12	Rain	N. W. 1.	29	73		
	9			29	75	0	73
	6		N. 2.	29	72	0	46
2.	12	Fair	W.N.W.1.	29	75		
	9			29	72		
	6	Fair	N. 0.	29	75		
3.	12	Snow					
	9	Ice					
	6	Fair					
4.	12	Cold	N.b.E.2.				
	9	Cloudy		29	71	0	22
	6	Cold	W. 0.	29	72		
5.	12	and	S. W. 1.	29	71		
	9	Fair	S.b.W.2.	29	70		
	6	Rain	S. W. 1.	29	66		
6.	12	Warm					
	9	Fair	S. b. E. 1	29	78	0	76
	6	Cloudy	S.b.E.1.	29	78	0	13
7.	12		S.b.E.1.	29	80		
	9	Fair	S.S.E.0.	29	80		
	6	Fair	N.b.W.1.	29	89		
8.	12	Warm	N.N.W.2.	29	94		
	9	Day	N. 0.	30	10		
	6		N.b.W.1	30	11		
9.	12	Same	W.b.S.1.	30	11		
	9			30	00		
	6	Small	W.b.N.1	29	87		
10.	12	Showers	N. W. 2.	29	80		
	9		N.b.W.3	29	81	0	08
	6	Cloudy	N.N.W.3.	29	82	0	03
11.	12	Cooler	N.N.W.2.	29	85		
	9	Rain	N.N.E.0.	29	82		
	6		N.E. 2.	29	69	0	51
12.	12	Showers					
	9		N.N.W.2.	29	68	0	10
	6	Cloudy	N.W.b.N.2	29	70		
13.	12		N. 3.	29	70		
	9	Fair	N. 0.	29	74		
	6		N. 0.	29	75		
14.	12	Fair	E. 2.	29	82		
	9			29	87		
	6		N. E. 1.	29	92		
15.	12	Fair	N.b.E.1.	29	95		
	9		E.b.S.0.	29	94		
	6	Fair	E. 0.	29	87		
16.	12	and					
	9	Warm	E. 0.	29	73		

D.	h.	Weather.	Winds.	Barom.		Rain	
	6		E. 0.	29	66		
17.	12	Rain					
	9		E. 0.	29	63	0	54
	6	Rain	N.E.b.E.0.	29	59	0	43
18.	12	Warm	S. E. 1.	29	56		
	9	Fair	S.S.E.0.	29	53	0	05
	6	Cloudy	E. 1.	29	48		
19.	12	Hot	E.b.E.2.	29	46		
	9	Fair	S. 0.	29	49		
	6	Cloudy	S.E.b.E.1	29	49		
20.	12	Cooler	S. 4.	29	50		
	9	Fair	S.b.W.2.	29	62		
	6	Showers	S.S.W.3.	29	68		
21.	12		S.W.b.W.5	29	73		
	9	Fair		29	81	0	32
	6	Showers	S.b.E.1.	29	72	0	02
22.	12	and	E.S.E.1.	29	70		
	9	Coaler	S.W.b.S.3.	29	66	0	95
	6	Rain	S.b.E.1.	29	48	0	79
23.	12	Cloudy	S.b.W.2.	29	47		
	9	Fair	S.b.W.0.	29	46		
	6		S. 2.	29	43		
24.	12	Showers					
	9		S.W. 0.	29	46	0	49
	6						
25.	12	Fair					
	9						
	6	Rain					
26.	12						
	9	Cool	N.N.E.2.	29	53	2	73
	6	Cloudy	E.b.S.1.	29	67	0	23
27.	12	Warmer	S. 1.	29	71		
	9	Fair	E. 0.	29	78		
	6	Fair	N. 1.	29	78		
28.	12	Shower	E.b.N.1.	29	77		
	9	Rain	E. 1.	29	76	0	02
	6		N.b.E.1.	29	69	1	60
29.	12	Misling	E.b.S.0.	29	74		
	9		S. 1.	29	76	0	22
	6		S.b.W.1.	29	76		
30.	12	Fair					
	9		N.b.W.1	29	70		
	6		N.W.b.N.1	29	68	0	04
31.	12	Fair	W.N.W.1.	29	65		
	9		W.S.W.0	29	62		
				Total		12	03

JUNE. 1698.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Fair	W. 2.	29 60	
1.	12	and		29 60	
	9	Hot	S. o	29 60	
	6	Fair	S.W.b.S.2	29 57	
2.	12		W. 3.	29 52	
	9	Rain	S. 1.	29 50	o 23
	6	Cloudy	S. 1.	29 51	
3.	12	Thunder	N. W. 2.	29 55	
	9		N.b.W.o	29 72	o 46
	6	Milling	N b,W.2	29 81	
4.	12	Fair and	N. 3.	29 90	
	9	Cool	E.S.E.o.	29 99	o 02
	6	Fair	E.b.S.o.	30 01	
5.	12	Cloudy	W. 2.	30 02	
	9	Fair	S. W. o.	30 04	
	6	Fair	S. W. o	30 06	
6.	12	and	S.S.W.1.	30 07	
	9	Hotter	o.	30 08	
	6	Fair	W.b.S. 1.	30 09	
7.	12	and	S.b. E. o.	30 09	
	9	Hot		30 10	
	6	Fair	E.b.N.o.	30 08	
8.	12	Hot	E.b.N.2.	30 08	
	9	Cloudy	N.E.b.N.3	30 05	
	6	Cloudy	N.N.E.2.	30 08	
9.	12	Fair	N.N.E.3.	30 01	
	9	Cloudy	N. E. 2.	29 95	
	6	Cloudy	N. E. 2.	29 86	
10.	12	Cooler		29 81	
	9	Rain	E. 1.	29 74	2 25
	6	Cloudy	N.b.E.o.	29 68	o 17
11.	12	Close	N.b.E.1.	29 66	
	9	Day		29 62	
	6	Much	N.N.W.1.	29 57	
12.	12	Rain	N.N.W.1.	29 52	
	9		N.N.W.1.	29 47	3 92
	6		N. o.	29 42	o 91
13.	12	Milling			
	9		W.b.S. 1.	29 52	o 38
	6		W.b.S. 2.	29 62	o 10
14.	12	Cloudy	S. W. 3.	29 67	
	9		S. W. 2.	29 70	
	6		S. W. 1.	29	
15.	12				
	9				
	6				
16.	12				
	9				

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Fair			
17.	12				
	9	Cloudy	N. W. o.	30 05	
	6		N. W. o.	30 04	
18.	12	Fair	N.N.W. 1.	30 05	
	9		E. 1.	30 08	
	6		E. o.	30 08	
19.	12	Fair	E. b. S. 1.	30 08	
	9		E. o.	30 05	
	6	Fair	E.b.S.o.	30 03	
20.	12		E.b.S.o.	30 00	
	9	Hot		29 92	
	6	Fair	E.b.S.o.	29 87	
21.	12		S. W. 2.	29 86	
	9	Cloudy	W. o.	29 86	
	6	Milling	W.b.S.o.	29 86	
22.	12		N.b.W.1	29 89	
	9	Cloudy	E. 1.	29 90	
	6	Fair	E. o.	29 83	
23.	12	and			
	9	Hot	S.b.W.1.	29 73	
	6	Rain	S.b.W.2.	29 65	
24.	12	and	S. 3.	29 61	
	9	Cooler	S. 2.	29 58	o 08
	6	Fair	S.W.b.W.3	29 62	o 19
25.	12	Rain	S.b.W.3.	29 64	
	9	Fairer	S. o.	29 68	o 06
	6	Fair	W.S.W. 1.	29 76	
26.	12		W.b.S. 1.	29 78	
	9	Cloudy	W.b.S. o	29 80	
	6		S. W. 1.	29 78	
27.	12	Cloudy	W.S.W.3.	29 75	
	9		W.b.S. 2	29 69	
	6			29 69	
28.	12	Rain			
	9				
	6				
29.	12	Fair			
	9		W. 1.	29 73	
	6	Cloudy	W.b.S.2.	29 71	
30.	12	Milling	W.S.W.1	29 74	
	9	Cloudy		29 78	
				Total	8 77

JULY. 1698.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6		W.N.W.1.	29 78	
1.	12	Cloudy	W.b.S.1.	29 78	
	9		W.S.W.o.	29 75	
	6	Cool	N. 1.	29 77	
2.	12	Rain	N.N.E.2	29 83	
	9	Warmer	N. o.	29 88	o 23
	6	Fair	N. o.	29 88	
3.	12	and	S. W. 2	29 86	
	9	Hot		29 82	
	6	Cloudy	S.W.b.S.3.	29 74	
4.	12	Misling	S. W. 3.	29 67	
	9	Rain	S. W. 3.	9 61	
	6		S.b.W.2.	29 52	1 87
5.	12	Fairer	W.S.W.4.	29 50	
	9	Rain	S. W. 3.	29 56	o 05
	6	Cloudy	W.S.W.1.	29 66	o 05
6.	12	Hot	S.W.b.W.3	29 70	
	9	Fair	W.b.S.o.	29 75	
	6	Fair	S.W.b.S.1.	29 77	
7.	12	Rain		29 76	
	9	Fair	S. W. o.	29 73	
	6	Misty	S. W. o.	29 73	
8.	12	very	W.S.W.1.	29 75	
	9	Hot	S.b.E.o.	29 78	
	6	Cloudy	E.b.S.1.	29 79	
9.	12	Hot and	E. 1.	29 78	
	9	Sultry	E. o.	29 76	
	6		E. o.	29 73	
10.	12	Same	E.b.S.1.	29 72	
	9		E. o.	29 67	
	6	Thunder&	E.S.E.1.	29 59	2 83
11.	12	Rain Rain	S.S.W.1.		
	9	Fairer	S.b.W.o.	29 50	o 84
	6	Cloudy	N.N.W.1	29 48	
12.	12		W. 2.	29 47	
	9	Rain	N. W. 3.	29 47	4 98
	6	Cloudy	N.N.W.1	29 54	o 01
13.	12		N.W b.W.2	29 61	
	9	Fair	N.W.b.w.o	29 62	
	6	Cloudywith	S.W.b.W.2	29 63	
14.	12	some	S.W.b.W.1	29 63	
	9	Fair	S.b.W.2.	29 58	
	6	Cloudy	S.b.W.3.	29 48	
15.	12	Rain	S. 4.	29 43	
	9	Cloudy	S. 2.	29 38	o 36
	6	Fair	S. W. 3.	29 43	
16.	12	Cool	W.S.W.4	29 53	
	9	Rain		29 64	o 47
	6	Fair	S. W. 1.	29 74	o 06
17.	12	Fair Cloudy	S. 3.	29 77	
	9	Rain	S.b.W.2.	29 73	
	6	Misling	S.W.b.W.3	29 51	o 94
18.	12	Rain	S. W. 3.	29 56	
	9	Fairer		29 75	1 12
	6		W.S.W.1	29 83	
19.	12	Fair	W.b.N.2.	29 87	
	9			29 87	
	6		W.S.W.o	29 84	
20.	12	Hot			
	9				
	6				
21.	12				
	9				
	6				
22.	12				
	9				
	6				
23.	12				
	9				
	6				
24.	12				
	9				
	6	Thun and			
25.	12	Rain but Fair at Tun-			
	9	bridge Wells			
	6				
26.	12				
	9	Misling	S. W. 2.	29 50	4 10
	6	Fair	W.b.S.1.	29 67	
27.	12	and	W. 2.	29 78	
	9	Cooler	W.S.W.o.	29 83	
	6	Fair	S.W.b.S.o.	29 86	
28.	12	Cool and	S.b.W.3.	29 81	
	9	Cloudy	S. 2.	29 80	
	6	Rain	S.b.W.3.	29 68	o 02
29.	12				
	9	Fair	W.S.W.o	29 76	
	6	Fair	S. W. o.	29 75	
30.	12				
	9	Misling	7.	29 41	
	6	Fair	W.b.S.5.	29 41	10
31.	12	Cooler	W. 4.	29 52	
	9	Cloudy		29 57	
				Total	17 03

AUGUST. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	6	Fair	S. W. 2.	29	51		
1.	12		W.b.N.3.	29	49		
	9	Showers		29	46	0	13
	6		S.W.b.W.1	29	43		
2.	12	Showry					
	9		N.b.E.1.	29	55	0	39
	6		W.b.S. 0.	29	60		
3.	12	Fair	N. W. 2.	29	62		
	9			29	67		
	6	Misling	S.W.b.W.1	29	64		
4.	12	Fairer	W.N.W.2.	29	65		
	9	Rain		29	71		
	6	Fair	W.b.N.0.	29	75	0	14
5.	12		W.N.W.2.	29	81		
	9	Showers		29	87	0	40
	6	Cloudy	W.b.S.1.	29	88		
6.	12	Showers Fair	W.b.S.3.	29	87		
	9	Cool	N. W. 2.	29	87	0	05
	6	Fair	N.W.b.W.1.	29	84		
7.	12	Rain	N.N.W.2.	29	81		
	9	Fairer	N.N.W.0.	29	80	0	26
	6	Misty	W.b.S.1.	29	72		
8.	12	Cool	N.N.E.1.	29	72		
	9	Rain	N.N.E.0.	29	72	1	57
	6	Cloudy	S.W.b.W.1	29	63	0	01
9.	12	Dull	S. W. 2.	29	61		
	9	Day		29	58		
	6		N.W.b.N.1	29	58		
10.	12	Rain	N. 1.	29	61		
	9		N. E. 0.	29	63	1	40
	6	Cloudy	N. 1.	29	63		
11.	12	Cool	N.b.W.2.	29	65		
	9	Day	N. 0.	29	67		
	6		N.b.W.1	29	69		
12.	12	Misling	N. 3.	29	70		
	9			29	76	0	02
	6	Fair and	N.b.W.1	29	79		
13.	12	Cool	N. 2.	29	84		
	9	Cold	E.b.N.0.	29	90		
	6		N.b.E. 0.	29	98		
14.	12	Fair	E. 2.	30	01		
	9			30	00		
	6	Fair	S.E.b.E.0.	29	95		
15.	12	and	N. E. 2.	29	96		
	9	Warm		29	98		
	6		E. 0.	30	00		
16.	12	Same	E.N.E.2.	30	04		
	9			30	09		

D.	h.	Weather.	Winds.	Barom.		Rain.	
	6	Fair	N. 0.	30	10		
17.	12		N.E. 1.	30	09		
	9	Cloudy		30	05		
	6		E. 0.	29	95		
18.	12	Cloudy	E. 2.	29	94		
	9		S. 1.	29	85		
	6	Fairer	S.S.W.0.	29	82		
19.	12	Warm	W.S.W.2	29	82		
	9	Cloudy		29	80		
	6	Cloudy	S. W. 0.	29	76		
20.	12		S. W. 3.	29	73		
	9	Fair		29	67		
	6	Fair	S.W.b.S.1	29	59		
21.	12		S.S.W.2.	29	58		
	9	Cloudy		29	55		
	6	Cloudy	S.S.E.1.	29	44		
22.	12		S. 3.				
	9	Rain		29	37	0	10
	6	Rain	S. 0.	29	48	0	48
23.	12		S.E.b.E.2	29	51		
	9	Thunder		29	47		
				29	48	1	58
	6	Showers	S.b. E. 1.	29	42		
24.	12		S. 3.	29	42		
	9	Fair		29	42	0	01
	6	Cloudy	S. W. 1.	29	42		
25.	12		W.b.N.1.	29	42		
	9	Fair		29	42		
	6		E.S.E.0.	29	42		
26.	12	Fair	N. W. 2.	29	41		
	9		N. 1.	29	44		
	6	Fair and	S. W. 0.	29	50		
27.	12	goodHar.	N.W.2.	29	58		
	9	Weather		29	67		
	6		S. W. 1.	29	75		
28.	12	Fair	S. W. 3.	29	79		
	9	Rain		29	76		
	6		W. 1.	29	73		
29.	12	Fair	W.S.W.3	29	76		
	9	Rain		29	73	0	11
	6	SomeFair	S.W.0.	29	71		
30.	12	and some	S.S.W.3.	29	75		
	9	Rain		29	80	0	35
	6	Cool	N. W. 0.	29	83	0	02
31.	12	Fair with	N.W.b.N 2	29	85		
	9	Rain		29	84		
				Total		7	02

SEPTEMBER. 1698.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Cloudy	N. N. W. o	29 80	
1.	12	Cold	W. 1.	29 72	
	9	Day		29 64	
	6		S. W. 1.	29 52	
2.	12	Showers	S. W. 3.	29 54	
	9			29 56	o 14
	6		S. S. W. 1	29 48	
3.	12	Rain	S. W. 5.	29 45	
	9			29 41	1 55
	6	Fair	S. W. o.	29 40	
4.	12		S. b. W. 2.	29 37	
	9	Rain		29 16	o 20
	6	Fair	W. S. W. 2.	29 13	1 10
5.	12	Rain			
	9	Fair	S. W. 3.	29 48	o 03
	6	Rain	S. W. b. W. 2	29 50	
6.	12		S. W. 4.	29 46	
	9	Cloudy		29 47	o 09
	6		S. b. W. 4.	29 41	
7.	12				
	9				
	6	Rain			
8.	12				
	9	Fair		29 76	o 77
	6		S. o.	29 81	
9.	12	Cloudy	S. b. W. 2.	29 80	
	9		S. b. W. o.	29 80	
	6	Fog	S. W. o.	29 86	
10.	12	Fair	S. b. W. 1.	29 89	
	9	Cloudy	W. b. S. o.	29 89	
	6		S. b. E. 1.	29 81	
11.	12	Rain	S. b. E. 2.	29 70	
	9		E. b. S. o.	29 61	
				29 31	1 34
	6	Fair	N. 1.	29 86	o 01
12.	12	Warm	E. 2.	29 92	
	9	Day		29 87	
	6		E. b. S. o.	29 70	
13.	12	Cloudy	E. b. S. 1.	29 61	
	9			29 55	
	6		E. o.	29 57	
14.	12	Fairer	N. E. 2.	29 62	
	9			29 63	
	6	Fair and	E. N. E. 2.	29 60	
15.	12	Warm			
	9	Cloudy		29 51	
	6	Rain	N. E. b. E. o.	29 41	
16.	12	Warm	S. b. E. 2	29 44	
	9	Fair		29 46	o 61

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Rain	E. b. N. o.	29 39	
17.	12		E. b. S. o.	29 36	
	9	Fairer		29 34	1 46
	6	Rain	E. b. S. o.	29 31	
18.	12		S. E. 1.	29 34	
	9	Fairer		29 36	1 43
	6		E. N. E. 1.	29 25	
19.	12	Showers	S. W. 3.	29 25	
	9			29 31	o 65
	6	Rain	S. W. 1.		o 15
20.	12	Cloudy	S. W. b. W. 2	29 38	
	9	Rain		29 42	
	6	Foggy	S. W. o.	29 46	o 55
21.	12	Shower.	W. S. W. 1.	29 49	
	9	Fair		29 52	o 01
	6	Hoar Froft	S. W. b. W. o	29 47	
22.	12	Fair	S. 2.	29 41	
	9	Rain		29 37	o 20
	6	Fair	S. W. 1.	29 42	
23.	12	Warm	W. S. W. 3	29 42	
	9	Colder		29 44	
	6	Fair	S. S. W. o.	29 44	
24.	12	Cooler	S. E. b. E. 1	29 43	
	9	Cloudy		29 31	
	6	Rain	S. S. E. 2.	29 20	o 42
25.	12				
	9				
	6				
26.	12	Fair			
	9			29 45	o 01
	6	Fair and	S. S. E. 1.	29 42	
27.	12	Pleaſant	S. 3.	29 42	
	9	Rain		29 41	o 11
	6	Fair	S. o.	29 40	o 03
28.	12	Showers	S. 3.	29 36	
	9	Fair		29 26	o 01
	6	Rain	E. b. S. 1.	29 05	o 04
29.	12	Rain	S. b. E. 3.	29 06	
	9			29 06	o 76
	6	Rain	S. b. E. 2.	29 04	
30.	12	Warm	S. S. W. 4.	29 07	
	9	Fair		29 36	o 40
				Total.	12 07

OCTOBER. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	7	Misling	S. 3.	29	37		
1.	12	Warm	S.W b.S.4.	29	45		
	9	Fair		29	66		
	7	Cloudy	S. 2.	29	69	0	20
2.	12	Warm and	S. 3.	29	71		
	9	Fair		29	77		
	7	Rainy	S. 2.	29	83		
3.	12	Warm	S.S.E. 2.	29	83		
	9	Day		29	63	2	87
	7	Fair	S.W.b.W 1	29	50	1	17
4.	12	Fair		29	50		
	9	Rain	W.N.W.7.	29	50	0	36
	7	Cloudy	W.N.W.2.	29	82		
5.	12	Fair	N.b.W.3	29	88		
	9	Cooler		29	95		
	7		S.W,b.W.1.	30	00		
6.	12	Cloudy	W.b.N.2	30	03		
	9		W.b.N.0	30	07		
	7	Cloudy	W. 1.	30	07		
7.	12	Fair	W.b.N.1	30	07		
	9	Cloudy	W. 0.	30	07		
	7	Fair and	N. W. 0	30	10		
8.	12	some what	N.b.W.1	30	10		
	9	Cooler	N. W. 0.	30	11		
	7	Cloudy	N. W. 0.	30	07		
9.	12	and	W.S.W.1	30	03		
	9	Cooler	S. W. 3.	29	88		
	7	Rain	W.b.N.3	29	62	1	55
10.	12	Fair	W.N.W.3.	29	76		
	9	Rain	S.W. 3.	29	61		
	7	Cloudy	W.b.N.3	29	35	0	63
11.	12	Fair	W.b.N.3	29	36		
	9	Cloudy	W.b.N.3	29	37		
	7	Cloudy	W. 2.	29	30		
12.	12	and some	W. 3.	29	30		
	9	Rain		29	27	0	23
	7	Fair	W.b.S. 0.	29	14	0	02
13.	12	Warm	N. 2.	29	09		
	9	Cold		29	08		
	7	Fair	W.b.N.0	29	20		
14.	12	Rain	N.b.E.2.	29	30		
	9	Cloudy		29	42	0	07
	7	Hoar Fr.	N.W.b.N.0.	29	47		
15.	12	Fair and	N.W.b.N.1.	29	47		
	9	Cold		29	47		
	7	Icy Froft	N.N.W.1.	29	50		
16.	12	Fair and	N.b.W.1	29	53		
	9	Cold		29	61		

D.	h.	Weather.	Winds.	Barom.		Rain.	
	7	Ice and	N.N.W.1.	29	62		
17.	12	Fair					
	9	Rain		29	57	0	34
	7	Ice	S. 1.	29	44		
18.	12	Cloudy	S. W. 2.	29	33		
	9	Fair		29	15		
	7	Cold	E.S.E.2.	28	98		
19.	12		S. b. E. 2.	28	84		
	9	Rain		28	83	1	20
	7	Cold	S. W. 2.	29	01	0	41
20.	12	and	W.b.S.2.	29	12		
	9	Cloudy		29	24		
	7	Froft and	N. 0.	29	23		
21.	12	Fair	N. W. 2.	29	24		
	9	Cloudy		29	46		
	7	Showers	N.N.E.0	29	50		
22.	12	Hail	S. 2.	29	51		
	9	Showers		29	57	1	41
	7	Hard Froft	S.E.b.E.0.	29	65		
23.	12	and	E. S. E. 1	29	68		
	9	Fair Showers		29	70		
	7	Fair	E. 0.	29	62	0	04
24.	12	Warm					
	9	Rain		29	58	0	10
	7	Rain	S. 3.	29	40	0	11
25.	12	Mild	S. b. E. 3.	29	24		
	9	weather		29	42		
	7	Cloudy	S. S. E. 2.	29	48		
26.	12	Fair and Warm	S.E.b.S.3.	29	47		
	9	Rain		29	43		
	7	Fair	S.b.W.0.	29	52		
27.	12	Cloudy		29	52		
	9	Rain		29	42	0	80
	7	Mift	W.0.	29	41		
28.	12	Fairer	N.N.E. 2	29	24		
	9	Rain		29	46	0	05
	7	Cloudy	N.b.E.2.	29	41		
29.	12	Colder	N.b.E.1.	29	41		
	9	Rain		29	41		
	7	Snow	N.b.E.4.	29	22	1	23
30.	12	Sleet	N. 3.	29	23		
	9	Fairer		29	42	0	29
	7	Hard Fr.		29	62		
31.	12	Cloudy					
	9			26	76		
				Total		13	08

NOVEMBER. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	8	Froſt	S.W.b.S.2.	29	63		
1.	12	Sleet	S. W. 2.	29	62		
	9	Cloudy		29	65	0	12
	8	Fair	S.S.W.0	29	67	0	06
2.	12	Warmer	S.S.W.1.	29	68		
	9	Showers		29	64	0	03
	8	Fair	S. 1.	29	55		
3.	12						
	9	Cloudy	S.b.W.3.	29	49		
	8	Showers	S. 3.	29	40		
4.	12	Warm and	S. 3.	29	30		
	9	Cloudy	S. 4.	29	15	0	11
	8	Rain	W.S.W.5	28	98	0	19
5.	12	Fair and	S.W.b.W.6	29	14		
	9	Pleaſant	S.W.b.W.0	29	37		
	8	Froſt	S.W.b.W.0	29	45		
6.	12	Fair and	S.b.W.0.	29	45		
	9	Cold	S.b.W.0.	29	43		
	8	Rain	S.W.b.W.3	29	22	0	26
7.	12	Fair and	W.b.S.4	29	28		
	9	Warmer	S.W.b.S.1	29	42		
	8	Rain	S. 1.	29	24		
8.	12		W.b.S.2.	29	12		
	9	Fairer	W.S.W.2.	2	27	2	30
	8	Fair	S. W. 3.	29	33	0	23
9.	12	Cloudy	W.S.W.2.	29	2		
	9	Snow	S.S.E.1.	29	27		
	8	Cloudy	W.S.W.0	29	42	0	36
10.	12	Miſty	S.W.b.S.1.	29	48		
	9	Day		29	47		
	8	Snow and	N.b.E.1.	29	48		
11.	12	Sleet all Day	N.b.E.1.	29	47		
	9	Snow		29	43	2	66
	8	Snow, 3	N.b.W.2	29	46	2	56
12.	12	Inches,	N.b.W.1	29	54		
	9	Cloudy		29	65	0	65
	8	Hard Fr.	W.b.S.0.	29	60		
13.	12	and	W.S.W.1	29	58		
	9	Fair		29	62		
	8	Fair, Snow	W.S.W.1	29	63		
14.	12	and Hard	W.b.S.2.	29	61		
	9			29	70		
	8	Froſt	N.N.W.1.	29	90		
15.	12	Miſty &.	W.b.N.0	29	98		
	9	leſs Cold		30	01		
	8	Cloudy	S. 1.	29	92		
16.	12	Fair	S.S.E.2.	29	92		
	9	Thaw		29	81		
	8	Froſt	S. 0.	29	67		18
17.	12	and					
	9	Fair		29	37		
	8	Rain	S. E. b. S.2	29	07		
18.	12	Fair and	S.W.b.W.2	29	16		
	9	Cold		29	31	0	04
	8	Rain and	S.b.E.2.	29	28		
19.	12	Cold thaw	S.W.b.S.3.	29	14		
	9	Fair		29	20	0	10
	8	Rain	S. W. 2.	29	20	0	44
20.	12	Fair and	S. W. 4.	29	27		
	9	Warm		29	31		
	8	Rain	S. W. 4.	29	14	2	81
21.	12	Fair and	S. W. 3.	29	20		
	9	Warm		29	48		
	8	Froſt and	W.b.S.1.	29	77		
22.	12	Fair		29	83		
	9	Cloudy		29	75		
	8	Rain and					
23.	12	Warm					
	9						
	8						
24.	12	Rain					
	9	Stormy		29	75	1	15
	8	Some	S.W.b.S.8.	29	15	0	61
25.	12	Fair	S.W.b.W.8	29	30		
	9	Some Rain	3.	29	52	0	15
	8		S.W.4.	29	41		
26.	12	Rain	S.W.b.W.5	29	33		
	9			29	30	0	07
	8	Small Fr.	W.S.W.3.	29	25		
27.	12	and	W.S.W3.	29	27		
	9	Fair		29	53		
	8		W.b.S.1.	29	41		
28.	12	Same	W.b.N.1	29	44		
	9			29	37		
	8	Snow	E.b.N.1.	29	13		
29.	12		E.b.N.2.	29	09		
	9	Sleet		29	17	0	74
	8	Froſt &	N.b.W.4	29	56		
30.	12	Fair	N.N.W.2.	29	66		
	9	Rain		29	86	0	01
				Total		16	83

DECEMBER. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	8	Hard Fr.	N.b.W.o	29	85		
1.	12	Fair	E.b.S.o	29	80		
	9	Snow 3.		29	78		
	8		W.N.W.o	29	93		
2.	12	Foggy	W. b. N.	30	01		
	9			30	11		
	8	Cloudy	W.b.S.o.				
3.	12	withgentle	W.b.S.o.	30	15		
	9	Thaw	W.b.S.o.	30	16	1	32
	8		W.b.S.o.	30	09		
4.	12	Foggy	S. W. o.	30	08		
	9		S.W.b.S.o	30	06		
	8	Fog and	S.W.b.S.o	30	02		
5.	12	Misling	S.b.W.o.	30	03		
	9		S.b.E.o.	30	00	o	41
	8	Fog	E.S.E. 1.	29	97		
6.	12	Warm	E. 2.	29	94		
	9	Clearer	S.E.b.E.1	29	92		
	8	Misty	S. E. o.	29	92		
7.	12	Clearer	S. E. o.	29	91		
	9	Misty	E.b.S.o.	29	88		
	8	Mist	E.b.S.o.	29	83	o	04
8.	12	Fair	E.b.S.1.	29	86		
	9	Fog	S.W.b.S.o	29	94	o	12
	8	Rain	S.b.W.2	29	99	o	03
9.	12	Cloudy and	S.b.W.3.	29	98		
	9	Warm	S.S.W.4.	29	91		
	8	Cloudy	S. 6.	29	66		
10.	12	Rain	W.b.S.6.	29	64		
	9	Fair	W.b.S.2.	29	96	o	49
	8	Fair and	W.S.W.4	30	10		
11.	12	Cooler	S. W. 3.	30	14		
	9	Cloudy		30	00		
	8	Rain	W.N.W3.	29	79	o	72
12.	12	Fair					
	9			30	11		
	8	Frost	S.E.b S.o.	30	10		
13.	12	Fair	S.S.E.1.	30	06	o	
	9	Cloudy		29	96		
	8						
14.	12						
	9	Rain					
	8						
15.	12						
	9						
	8	Cloudy	S.b.W.2	29	60	o	01
16.	12	Rain	S. 3.	29	50		
	9	Warm	7.	29	44		

D.	h.	Weather.	Winds.	Barom.		Rain.	
	8	Rain	S.b.W.6.	29	09		
17.	12	Warm Cloudy	S.b.W.6.	29	10		
	9	Rain		29	22	o	42
	8	Cloudy	S.W.b.S.3.	29	32	o	40
18.	12	and	S.W.b.S.2.	29	30		
	9	Warm		29	34		
	8	Fair	S.b.W.o.	29	72		
19.	12	Cooler	S.b.E.1.	29	67		
	9	Rain		29	35		
	8		S. 3.	29	23	o	56
20.	12	Rain	S.b.E.5.	28	98		
	9			28	68	o	24
	8	Fair	W. 4.	29	36		
21.	12	and Colder	W. 3.	29	52		
	9	Rain		29	52		
	8		W.b.S.4.	29	49	o	17
22.	12	Fair	W.S.W.3.	29	55		
	9			29	66		
	8			29	81		
23.	12	Cloudy					
	9		6	29	65		
	8	Cloudy	S. W. 7.	29	34		
24.	12	Warm	W.b.N.8	29	56		
	9	Fair	2.	29	82		
	8		W.b.S.2.	29	94		
25.	12	Fair	W.S.W.2.	29	95		
	9			30	00		
	8	Cloudy	W.b.S.3.	29	93		
26.	12	and	W.b.S.4.	29	90		
	9	Warm		29	77		
	8	Rain	W.b.S.4.	29	50		
27.	12	Colder	S.W.b.W.4	29	43		
	9	Fairer				o	21
	8	Frost and	S. W. 3.	29	49		
28.	12	Fair					
	9	Frost		29	40		
	8	Warmer	S. W. 7.	28	88		
29.	12	Rain	S. W. 8.	28	79		
	9	Colder		28	69		
	8	Snow	W.b.S.3.	28	79	o	69
30.	12	Frost and	W.b.S.3.	28	89		
	9	Fair					
	8	Frost	W. o.	29	23		
31.	12	and	W.N.W.2.	29	36		
	9	Fair		29	67		
				Total		5	83

XXV. *The Rain 1697. and 1698. at Townley; by Mr. Townley. n. 249. p. 47.*

	1697		1698			1697		1698	
Jan.	10	26	12	94	*Jul.*	27	00	20	74
Feb.	14	34	11	76	*Aug.*	80	50	43	00
Mar.	9	86	40	32	*Sept.*	93	80	43	58
Apr.	8	24	41	90	*Oct.*	55	20	44	52
Ma.	23	76	17	90	*Nov.*	21	44	49	44
Jun.	17	84	12	90	*Dec.*	49	00	40	84
					Sum.	411,	24	379,	84

As far as I have learned, the Mercury riſes and falls much after the ſame Meaſure in moſt parts of our Iſland, and of this you may better Judge by ſome Obſervations I have here tranſcribed and ſent you, of the very low Stations, *Decemb.* 28. about 3 of the Clock Mercury 28,17; on the 29. about 2 *h.* $\frac{1}{2}$ 28,18; and *Jan.* 2. about the ſame Hour 28,05. and, this time it hardly riſe before I went to Bed; and on the *6th* ſtill about 3. *h.* 28,19; but this time before 9 at Night it was got to 29,28. What I note is, that though once I ſaw it lower many Years ago, yet never ſince I kept my Obſervations, did the Quickſilver Deſcend ſo often to thoſe Pitches; or when it was found very low, did it ever continue ſo for any conſiderable time, as it hath done this Year, during which it hath never been very high, and as I remember, generally much lower than other Years. This hath proved very unſeaſonable here, and ſo backward, that I thought I had never known the like; but examining my Obſervations, I find that of 1673 much what as late, though the Conſequence proved not ſo fatal to theſe parts of all Europe, as this.

The Weather 1698. and 1699. at Emuy in China; by Mr. Ja. Cunningham. n. 256. p. 323.

XXVI. At *Emuy* in *China* in the Latitude of 24°. 20'. N. *An.* 1698. *Octob.* From 1. to 8. the Weather was Fair and Clear; the *Mercury*'s Alt. $29\frac{14}{20}$. Digit. From the 8*th* to the 11*th*. Cloſe and Cloudy Weather; the *Mercury* falling to 29 $\frac{13}{20}$ Dig.

11. Cloſe Weather, ſomewhat Cloudy. 12. Cloſe Weather blowing freſh at *N. E.* 13, and 14. Cloſe and Cloudy Weather with much Rain, and freſh winds from *N. E.* to *N. W.*

The Tide, (which commonly flows 3 Fathoms) did flow above half a Foot higher 3 Days after the Full Moon, than it did on the Full Moon at the Æquinox.

15. Fair and Clear Weather, with ſmall Gales at *N. E.* From the 15 to the 24 fine Moderate fair Weather, with ſmall Gales at *N. E.* and to the 31*ſt* Winds and Weather variable.

Nov. 1. to the 15. variable, Cloſe and Cloudy Weather, with ſome Rain, and variable Gales round the Compaſs.

15. Fair and Clear Weather, with ſmall Gales at *N. E.* in the Morning the *Mercury*'s Alt. 29 $\frac{15}{20}$ at Noon $29\frac{14}{20}$; and at 10 of the Night being Cold, riſing

ſing to 29$\frac{16}{20}$ 16. At Sun Riſing very Cold, the *Mercury*'s Alt. 29$\frac{18}{20}$. At Noon Fair and pleaſant Weather, the *Mercury* falling to 29$\frac{17}{20}$. At Night Cold, riſing to 29$\frac{18}{20}$. The Wind at *N. E.*. 17. This Morning Cold, the *Mercury* at 29$\frac{18}{20}$, Fair and Clear Weather all Day, and at Night blowing ſomewhat Freſh at *N. E.* the *Mercury* at 29$\frac{17}{20}$. 18. This Morning Cold, the *Mercury* at 29$\frac{17}{20}$. All Day Fair and pleaſant Weather, the *Mercury* falling to 29$\frac{14}{20}$, and by Noon to 29$\frac{12}{20}$: The Weather Fair, ſomewhat Cloſe and Cloudy; the Afternoon Sun ſhining and Warm, and at Night temperate, the *Mercury* continuing at 29$\frac{12}{20}$. Small Winds at *N. E.* and almoſt Calm.

20. A Pleaſant Sun-ſhining Morning, the *Mercury* at 29$\frac{12}{20}$. At Noon overcaſt, and Cloudy, with little Wind at *N. E.* the *Mercury* falling to 29$\frac{10}{20}$ In the Afternoon ſome Drops of Rain, with Cloſe Weather, and at Night the *Mercury* continuing at 29$\frac{10}{20}$ with ſmall Weſterly Winds. Some Rain in the Night. 21. Cloſe and Cloudy Weather, with ſmall Gales, at *N. E.* the *Mercury* at 29$\frac{10}{20}$ in the Morning, and continued ſo all Day, with ſome Drops of Rain in the Afternoon, the Gale freſhning, and a Shower of Rain at 8. of the Night, the *Mercury* riſing to 29$\frac{12}{20}$. 22. Gray and Cloudy Weather all Day, with Freſh Gales between *E.* and *N. E.* The *Mercury* at 29$\frac{12}{20}$, and at Night Riſing to 29$\frac{17}{20}$. Fair Weather ſomewhat Cloudy. 23. A very cold Morning, Fair and Clear, with freſh Gales from *N. E.* to *N*; the *Mercury* at 30 Dig. Fair and clear all day, with a moderate Gale about *N. E.* Clear and very cold all Night, the *Mercury* continuing at 30 Dig. 24. A Fair Clear, and Cold Morning, the wind at *N. E.* a Moderate Gale, the *Mercury* continuing at 30. Dig. A Clear Sun-ſhining Day, Cold and Clear all Night, the *Mercury* as before. 25. A Sharp Cold Morning, Fair and Clear, with a moderate Gale at *N. W.* the *Mercury* fallen to 29. All Day fair and pleaſant, very warm and no Wind, the *Mercury* falling at Noon to 29$\frac{15}{20}$, and at Night being ſomewhat Hazy and Calm withal, to 29$\frac{14}{20}$. 26. Temperate Weather all Night, and this Morning ſomewhat Cloſe and Hazy, and no Wind, the *Mercury* at 29$\frac{14}{20}$, and and towards Noon growing Clearer, and Warmer, riſing to 29$\frac{16}{20}$. Small Brizes at *N. E.* at Night falling to 29$\frac{14}{20}$. Temperate Weather. 27. Fine Pleaſant Weather all Day with ſmall variable Brizes from the *N.* to *W.* and about to *S*, the *Mercury* in the Morning at 29$\frac{14}{20}$, and at Noon falling to 29$\frac{12}{20}$, and at Night riſing to 29$\frac{14}{20}$. Fair Weather and Calm. 28. Fine Moderate Weather, with a Gale at *N. E.* the *Mercury* at 29$\frac{14}{20}$. In the Afternoon the Gale freſhned, the Weather ſomewhat Cloudy, and at Night the *Mercury* was at 29$\frac{15}{20}$. Blowing freſh. 29. Fair and Clear Weather, ſomewhat Cold this Morning, with a Freſh Gale at *N. E*; the *Mercury* at 29$\frac{18}{20}$. Fine pleaſant Weather all Day, with ſmall Gales at *N. E.* at Noon the *Mercury* falling to 29$\frac{15}{20}$, and at Night being Clear and ſomewhat Cold, riſing to 29$\frac{17}{20}$. 30. Fair and Pleaſant weather, with ſmall Gales at *N. E.* The *Mercury* at 29$\frac{17}{20}$. At Noon a freſh Gale, the *Mercury* falling to 29$\frac{14}{20}$. At Night Temperate Weather, and little Wind, the *Mercury* riſing to 29$\frac{16}{20}$.

Dec. 1. Fine Temperate Weather, with ſmall Gales at *N. E.* the *Mercury* at 29$\frac{16}{20}$ in the Morning. Fair Weather all Day, and ſmall Brizes at *N. E.* The *Mercury* at Noon falling to 29$\frac{14}{20}$, and in the Evening to 29$\frac{12}{20}$, and at Night riſing to 29$\frac{12}{20}$, being fine Clear Weather. 2. Fair and Temperate Weather,

Weather, ſomewhat Cloudy, and overcaſt with ſmall Gales at *N. E.* The *Mercury* at $29\frac{14}{100}$ and at Night riſing to $29\frac{15}{100}$. 3. A Clear and Cold Morning, with a fine Sharp Gale at *N.* b. *E.* The *Mercury* at $29\frac{17}{100}$. A Cold Air all Day, the *Mercury* at Noon falling to $29\frac{15}{100}$, and at Night, the Gale freſhning made it Colder, the *Mercury* riſing to $29\frac{18}{100}$. 4. A Sharp Morning with a Freſh Gale at *N.* b. *E.* The *Mercury* at $29\frac{19}{100}$. Fair and Clear all Day, with a ſmall Northerly Gale, the *Mercury* by Noon falling to $29\frac{15}{100}$. A Serene Temperate Night, and almoſt Calm, the *Mercury* as before. 5. A Fine Clear Morning with a moderate Gale at *S. W.* ſomewhat Cold, the *Mercury* at $29\frac{15}{100}$. At Noon a ſmall Brize, at *E. b. S.* Pleaſant Weather, the *Mercury* at $29\frac{12}{100}$. At Night a ſmall Gale at *S. b. E.* Fair and Temperate Weather, ſomewhat Hazy, the *Mercury* at $29\frac{13}{100}$.

6. This Morning ſomewhat Cloſe and Cloudy, with a few Drops of Rain, the Weather Temperate, with ſmall Southerly Brizes, the *Mercury* at $29\frac{13}{100}$. The Afternoon Calm, and ſomewhat Hazy, the *Mercury* falling to $29\frac{10}{100}$. At Night overcaſt and Cloudy, with ſome Rain, blowing freſh at *N.* the *Mercury* riſing to $29\frac{14}{100}$. 7. A Gray Morning, Clearing up with a freſh Gale at *N. E.* the *Mercury* at $29\frac{17}{100}$. In the Afternoon the Horizon a little Hazy, the *Mercury* falling to $29\frac{15}{100}$. At Night Clearer, with a Freſher Gale, the *Mercury* riſing to $29\frac{18}{100}$. A very Cold Night. 8. A Sharp Clear Morning, with a fine Gale at *N. E.* the *Mercury* at 30. At Noon falling to $29\frac{18}{100}$, a fine Sun-ſhining Day. At Night Cold and Clear, a ſmall Gale at *N. E.* the *Mercury* riſing to 30. 9. This Morning as the laſt, all Day and Night the ſame, and the *Mercury* alſo.

10. A Cold Morning, ſomewhat Foggy, with a fine Gale at *N. E.* the *Mercury* at 30. All Day fair, Clear and Sun-ſhining. At Night Cold, the *Mercury* at $29\frac{19}{100}$. 11. A Cold Morning with a Moderate Gale at *N. W.* the *Mercury* at $29\frac{19}{100}$. All Day Fair and Clear, the *Mercury* falling to $29\frac{16}{100}$. At Night a freſh Gale at *N. E.* the *Mercury* at $29\frac{19}{100}$. 12. A Gray Cold Morning, ſomewhat Cloudy, with a Hazy Horizon, a freſh Gale at *N. E.* the *Mercury* at $29\frac{19}{100}$; towards Noon falling to $29\frac{17}{100}$ with little Wind, and fair Weather; at Night Calm and ſomewhat Cold, the *Mercury* riſing to $29\frac{18}{100}$. 13. A Fine Pleaſant Morning, with a ſmall Brize at *N. W.* the *Mercury* at $29\frac{18}{100}$. At Noon a ſmall Gale at *N. E.* and in the afternoon Calm, the *Mercury* falling to $29\frac{14}{100}$. All Day ſerene; at Night Calm; with a Clear Sky, ſomewhat Cold, the *Mercury* riſing to $29\frac{15}{100}$. 14. A fine Temperate Morning, with ſome ſmall Rain like Dew, and a moderate Gale at *S. W.* the *Mercury* at $29\frac{15}{100}$. The afternoon a little overcaſt and the Horizon ſomewhat Hazy, a ſmall Gale at *S. E.* the *Mercury* falling to $29\frac{12}{100}$. At Night Temperate and Calm, the *Mercury* riſing to $29\frac{14}{100}$. 15. A fine Temperate Calm Morning, the *Mercury* at $29\frac{15}{100}$. At Noon Fair, Pleaſant, Calm Weather, the *Mercury* fallen to $29\frac{12}{100}$. All the Afternoon, and at Night a freſh Gale at *N. E.* Fair Weather, the *Mercury* riſing to $29\frac{15}{100}$. 16. A Gray Cloudy Morning, ſomewhat Hazy, with a freſh Gale at *N. E.* the *Mercury* at $29\frac{17}{100}$. At Noon Fair and Clear, the Gale moderate, and the *Mercury* falling almoſt to $29\frac{14}{100}$. The Afternoon ſomewhat Cloudy wirh a fine Gale at *N. E.* At Night a little Wind, Serene and Sharp, the *Mercury* riſing to $29\frac{18}{100}$. 17. A Gray Morning ſomewhat Cold, with a fine Gale at *N. E.* the

Mercury

Mercury at $29\frac{17}{20}$ and at Noon falling to $29\frac{15}{20}$. At Night little Wind, the *Mercury* rising to $29\frac{16}{20}$. 18. A Fair Temperate Calm Morning, somewhat Foggy, the *Mercury*, at $29\frac{17}{20}$. All Day Fair Weather, somewhat Cloudy with small Winds at *N. E* the *Mercury* falling to $29\frac{15}{20}$. At Night blowing fresh, the *Mercury* rising to $29\frac{18}{20}$ 19. A Gray Cloudy Morning with a fresh Gale at *N. E.* the *Mercury* at $29\frac{15}{20}$. Close Thick Weather, with continual Rain all Day and Night, and a moderate Gale at *N. E.* at Night the *Mercury* rising to $29\frac{19}{20}$. 20. Close Thick Rainy Weather, in the Morning, with a moderate Gale at *N. E.* the *Mercury* falling below $29\frac{18}{20}$. And by Noon to $29\frac{16}{20}$, continual Thick Rainy Weather all Day and Night, the *Mercury* at $29\frac{16}{20}$, and the Gale as before.

21. A Gray Cloudy Morning, but fair and beginning to clear up and Calm withal, the *Mercury* at $29\frac{14}{20}$, at Noon Fair Weather, and somewhat Clear, with a small Gale at *S. W.* the *Mercury* falling to $29\frac{12}{20}$. At Night Calm and somewhat Cloudy, the *Mercury* at $29\frac{14}{20}$. 22. A Gray Cloudy Morning continuing so all Day, with a small Gale at *N. E.* the *Mercury* at $29\frac{14}{20}$, at Night rising to $29\frac{15}{20}$. 23. A Gray Cloudy Morning continuing so all Day, with small Gales at *N.E.* the *Mercury* at $29\frac{14}{20}$, at Night more Serene the *Mercury* rising to $29\frac{15}{20}$. 24. A Gray Morning and Calm Weather, the *Mercury* at $29\frac{15}{20}$, Close and Cloudy Weather all Day and no Wind, the *Mercury* falling to $29\frac{14}{20}$. At Night rising almost to $29\frac{15}{20}$. 25. A Gray Cloudy Morning (some Rain before Day-light) with small Southerly Brizes, the *Mercury* at $29\frac{14}{20}$. Towards Noon Sun shining and pleasant; little Wind variable, the *Mercury* falling to $29\frac{12}{20}$. The Afternoon and at Night overcast and Cloudy, the Wind at *S. b. E.* and the *Mercury* rising to $29\frac{13}{20}$. 27. A Fine Pleasant Morning, with a Hazy Horizon, and altogether Calm, the *Mercury* at $29\frac{13}{20}$, and by Noon at $29\frac{11}{20}$. All Day Pleasant Weather, and at Night small Gales at North East, the *Mercury* rising to $29\frac{12}{20}$. 28. A Fine Pleasant Morning with a small Brize at *E. N. E.* the Horizon somewhat Hazy, and the *Mercury* at $29\frac{11}{20}$. at Noon falling to $29\frac{10}{20}$. All Day Fair and Pleasant Weather with the foresaid Brize. At Night Calm, the *Mercury* falling almost to $29\frac{9}{20}$. 29. A Gray Morning, with a Close Horizon and a small Brize about *E. N. E.* the *Mercury* at $29\frac{9}{20}$. Calm all the Forenoon, in the Afternoon Pleasant Weather, with a small Gale at *S. E.* the *Mercury* at $29\frac{6}{20}$. At Night Calm, the *Mercury* at $29\frac{7}{20}$ 30. A Gray Cloudy Morning, and Close Weather, with a fresh Gale at *S. E.* the *Mercury* at $29\frac{10}{20}$. All Day Cloudy and Dark, the Gale freshning and Veering to *E. N. E.* the *Mercury* rising to $29\frac{12}{20}$. 31. Gray Cloudy Weather all Day, with a fresh Gale at *N. E.* in the Evening some Rain, blowing fresh all Night.

Jan. 1. 1699 Variable Weather with small Gales at *N.E.* 2. Rainy Thick Weather all Day and Night with little Wind at *N. E.* 3. Continual Thick Rainy Weather all Day and Night, the Wind at *N. E.* 4. Fair Weather somewhat Close, and Calm all Day and Night. 5. Close Weather with some Rain and Calm this Forenoon; and in the Afternoon a small Brize at *W. N. W.*

XXVII.

The Weather 1699. at Upminster; by Mr. Wil. Derham. n. 262. p. 527.

JANUARY. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	8	Frost	S.E.b.S.o		29 77		
1.	12	Fair	S.S.E.1.		29 73		
	9	Snow			29 43		
	8	Rain	S. 3.		29 21		o 63
2.	12	Warmer					
	9	& Rain	S b.E.3.		28 76		o 29
	8		S. 3.	S. b. W.	28 57		o 37
3.	12	Same					
	9		S.b.W.3		28 47		
	8	Cloudy	S.S.W3.	S.w.b. w.	28 44	110	
4.	12	Fairer	S.W. 4.		28 56	109	
	9		S.W. 4.		28 72	108	
	8	Frost	S.W. 3.		29 22	85	
5.	12	& Fair	S. 1.		29 29	94	
	9	Rain					
	8	Rain	S. o.		28 67	104	o 75
6.	12	Warm			28 61	105	
	9	Snow	S. 5				3 48
	8	small Fr.	S.W. 2.		29 00	85	
7.	12	Fair	s.w.b.w.3	S.b. W.	29 08	86	
	9	Rain	S. b.W.o.	S. W.	29 19	85	o 03
	8	Frost	S. W. o	W.S.W	29 34	85	
8.	12	and	W.b.S.1.	S. W.	29 44	88	
	9	Fair			29 70	88	
	8	HardF.			29 72		
9.	12	and					
	9	Fair			29 73		
	8		E.b.S.1.	E. S. E.	29 82	85	
10.	12	Same	S.E.b.E.2		29 82	89	
	9				29 60		
	8	Rain	S. W.2.	W.S.W	29 59	101	o 40
11.	12	Cloudy	s.w.b.w.2.	W.	29 59	99	
	9				29 71	102	
	8	Cloudy	s.w.b.S o.		29 69	103	
12.	12	Misling	S.W 2		29 66	109	
	9	Rain		W. b. S.	29 59	101	
	8	Fair	s.w.b.w.3	W.	29 48	93	o 16
13.	12	Cloudy	w.b.S.3	W.b.N.	29 42	107	
	9	Rain			29 48	93	
	8	Fairer	N.W b.W.4	N. W.	29 53	94	o 14
14.	12		N. b. W. 4	N.b.W.	29 69		
	9	Cloudy			29 97	96	
	8	Rain	N. 1.		30 12	90	o 16
15.	12	Cloudy	N.b.W.1.		30 14	94	
	9	Day			30 17	82	
	8	Frost	W.b.S.o	N.b.W.	30 10	81	
16.	12						
	9	Cloudy			30 15	93	
	8		N.W.b.W.o		30 22	94	
17.	12	Foggy	N.W.o.		30 24	100	
	9				30 27	94	
	8	Fog	W. o.		30 26		
18.	12						
	9						
	8	Fog					
19.	12						
	9				30 34	77	
	8	HardF.	S. o.		30 27	70	
20.	12	Fair	S.b. E.1.		30 24		
	9	Foggy			30 21	76	
	8	HardF.	S.b.E.o.		30 18	62	
21.	12	Fog	E.b.N.1	E.N.E.	30 18	82	
	9	Fair			30 18	81	
	8	Frost	E.b.N.1		30 16	77	
22.	12	and	E.b.N.2	E. b. N.	30 18	86	
	9	Fair			30 19	84	
	8	Cloudy	N. E. 2.		30 15	87	
23.	12	Fair					
	9	small F.			30 13	81	
	8	Frost	E.b.N.o		30 13	73	
24.	12	and	E. 2.		30 14	88	
	9	Fair			30 12	78	
	8	Frost and	E. o.		30 11	73	
25.	12	Fair, plea-	E. 1.		30 12	86	
	9	sant Day			30 09	79	
	8		E. o.		30 05	70	
26.	12	Same	E. 1.			88	
	9				29 96		
	8	Frost &	E.N.E.o	E.	29 76	76	
27.	12	Cloudy	E.b.N.1		29 72	85	
	9	Fair			29 59	76	
	8	Rain	S. E. 2.	S.E.b.S.	29 48	89	
28.	12	and	S.b.E.2.	S.	29 47	92	
	9	Thaw			29 66	93	1 51
	8	Frost	S.W.b.S o	W.b.N.	29 86	85	
29.	12	Fair	S. 1.		29 87	92	
	9	Rain			29 72	98	
	8	Cloudy	S. 2.	S.	29 56	107	o 82
30.	12	Warm	S. 3.	S. b. W.	29 49	115	
	9	Day	S.S.W.3	S.W.b.S	29 42	109	
	8	Cloudy	S.b.W.2	W.S.W.	29 49	108	o 17
31.	12		S. 3.		29 37	113	
	9	Rain	S.S.E. 2.	S. S. E.	29 47	109	
					Total		8 91

FEBRUARY. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain
	7	Fair	S.W. 1.		29 43	98	
1.	12	Pleasant	W.b.S.2	S. W.	29 53	108	
	9	Day	W.b.S.o		29 77	83	
	7	Small Fr.	w.S.W.o	w.N.w.	29 88	79	
2.	12	Hazy	S.b.w.o		29 91	95	
	9	Rain	S. 1.		29 85	100	o 05
	7	Rain	S.S.E.3.	S.b.E.	29 59	100	
3.	12		S.b.w.3	S. W.	29 51	105	
	9	Fair	S.W.b.W.1		29 64	92	1 05
	7	Small Fr.	W.S.W.1	w.N.w.	29 74	82	
4.	12	Fair Cloudy	W. 2.	N.b.W.	29 80	101	
	9	Rain	S. 1.	S. W.	29 73	89	
	7	Cloudy	S.W.b.W.3	W.S.w.	29 48	104	o 37
5.	12	Fair	W.S.W.3	W.	29 51	113	
	9	Rain	w.b.S.3	W.	29 48	91	
	7	Small Fr.	w.b N.1.		29 76	85	
6.	12	Fair					
	9	Rain			29 52	93	
	7	Violent	W. 8.	W.b.N.	28 99	103	1 52
7.	12	Storms	W.N.W.10.	N. W.	29 22	101	
	9				29 78	92	
	7	Cloudy	N.W.o.	N.w.b.N	29 98	88	
8.	12	Fair	S.b.w.1.	N. W.	30 00	101	
	9	Cloudy			29 88	99	
	7	Misling	w.S.w.3.	w.b.N.	29 79	106	
9.	12						
	9	Fair			30 07	87	o 20
	7	Hoar Fr.	S.W.2.	N.N.w	30 02	88	
10.	12	somewhat	W. 3.	N.	30 03	109	
	9	Fair			30 01	95	
	7	Cloudy	W.b.S.1.	N. W.	29 98	87	
11.	12		S. W.2.	W.b.N	29 99	107	
	9	Fairer			29 98	96	
	7	Fair	S. W.2.	N.b.W.	29 94	84	
12.	12	Hazy	S. W. 3.	N. W.	29 84	102	
	9	Cloudy Rain	5.		29 46	101	
	7		W. 4.	W.	29 34	107	o 02
13.	12						
	9						
	7						
14.	12						
	9						
	7						
15.	12						
	9						
	7	Rain					1 50
16.	12	Cloudy	E.b.N.2	N. E.	29 37	102	
	9				29 52	97	

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	7		E.b.N.o		29 76	93	
17.	12	Cloudy	E.b.N.1	W.b.S.	29 82	109	
	9	Rain			29 83	94	
	7	Fair and	w.N.w.1		29 84	91	o 09
18.	12	Pleasant	N.w.1.		29 93	110	
	9	Rain			29 80	99	
	7		w.b.S.3.		29 71	87	o 13
19.	12	Fair	W.b.N.4.		29 77	104	
	9				29 94	90	
	7	Frost	W.S.W1.		30 00	82	
20.	12	and					
	9	Fair			29 98	97	
	7	Cloudy	W.S.W.1	W.N.W.	29 94	92	
21.	12		W.b.N.2		29 92	110	
	9	Fairer			29 91	90	
	7	Cloudy	w.b.S.2.	w.N.w.	29 81	84	
22.	12	Sleet	N.W. 3.		29 72	100	
	9	Cold			29 75	79	o 09
	7	H.Frost	N.W.2.		29 83	75	
23.	12	Fair					
	9	Sleet			29 59	86	
	7	Cloudy	N.N.W.6		29 60	92	o 40
24.	12	Bluster.					
	9	Fairer			29 91	85	
	7	Fair	N.W.b W.1		29 90	83	
25.	12	Cloudy	W.b.W.1.	N. W.	29 82	102	
	9	Rain			29 75	96	
	7	Fair	W.1.	w.N.w.	29 77	86	o 08
26.	12	and	W.b.N.1.		29 83	105	
	9	Pleasan.			29 77	95	
	7	Rain	W.b.S.2.	w.b.N.	29 64	99	
27.	12		N.W.b.W.3		29 67	103	
	9	Fair			29 71	92	o 45
	7	Cloudy	S.W.3.	W.	29 58	93	
28.	12						
	9						o 10
						Total	6 05

MARCH. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6	Fair					
1.	12						
	9	Sleet	N.b.E.2		29 26	86	0 12
	6	Snow	N.b.w.3		29 40	82	
2.	12	Fair					
	9				29 64	80	0 04
	6	Hard F.	N w.b.N.o.		29 72	68	
3.	12	Fair	W. 1.		29 77	96	
	9	Cloudy	w.b.S.1.	N. W.	29 78	96	
	6	Cloudy	N.b.w.2	N.N.E.	29 82	93	
4.	12	Rain	N. 2.		29 91	98	
	9	Cloudy	N. 2.		30 02	90	0 02
	6	Froſt	N.W.o.	N.	30 11	79	
5.	12	Cloudy	N.b.E.1	N.b.W.	30 15	94	
	9	Fairer	N.b.W.o.		30 19	77	
	6	Hard Fr.	N.N.W.o		30 11	65	
6.	12	Fair	E. 1.	N.b. E.	30 07	96	
	9	Cloudy	S.b.E.o.		29 95	87	
	6		S. E. 1.	S. b. E.	29 82	82	
7.	12	Fair	S.E.b.S.2	S. E.	29 83	107	
	9	Cloudy			29 88	89	
	6		E.S.E.o	N.E.b. E.	29 97	82	
8.	12	Fair	E.b.N.2		30 05		
	9				30 11	85	
	6	Froſt	N.E. o.		30 12	80	
9.	12	and	E.N.E. 2.		30 13	98	
	9	Cloudy			30 14	87	
	6		N.*b*.E.o	E.	30 10	85	
10.	12	Cloudy	N.*b*.E.1		30 11	103	
	9				30 08	91	
	6	Small	E.b.N.o		30 00	86	
11.	12	Rain	S.b.w.2	S.	29 97	102	
	9				29 93	92	0 41
	6		S. 1.		29 84	93	0 18
12.	12	Cloudy	S.b.w. 1		29 84	106	
	9				29 78	97	
	6	Rain	S.b.w.1		29 63	93	0 01
13.	12		S.b.E.1		29 58	102	
	9	Fairer			29 69	88	1 68
	6	Froſt	W. o.		29 80	81	
14.	12	Fair					
	9	Cloudy			29 84	108	
	6		S.w.b.S.2	W.b. S.	29 87	107	
15.	12	Cloudy					
	9				30 02	116	
	6	Cloudy	S.W. 1.	W. S. W.	30 04	112	
16.	12	Fair	S.W. 2.		30 02	127	
	9	Cloudy			29 99	110	

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6	Fair	S. 2.	S. b.W.	29 84	108	
17.	12	Hail					
	9				30 12	92	0 05
	6	Small Fr.	S. W. o.		30 19	78	
18.	12	Fair and	W. 2.		30 22	112	
	9	Pleaſant			30 09	94	
	6		S.W.*b*.S.3		29 88	98	
19.	12	Cloudy	S.W. 4.		29 77	115	
	9	Rain			29 60	103	
	6	Cloudy	s.w *b*.w.3		29 47	101	0 05
20.	12	Fair	w.b.S.4.	w. S.w.	29 54	118	
	9	Cloudy			29 48	100	
	6	Fair	S.W. 3.	W.b. S.	29 38	99	
21.	12						
	9	Rain			29 49	96	0 25
	6	HoarFr.	w.S.w.1		29 50	82	
22.	12	Fair	S.W. 2.	W.	29 53	113	
	9	Cloudy			29 53	96	
	6		S. b.E.3.	S.b. W.	29 40	101	
23.	12	Rain	S. 3.		29 32	118	
	9				29 23	113	0 66
	6	Cloudy	S.b.W.2	S.S. W.	29 07	100	0 57
24.	12	Fair	S. 4.		29 06	119	
	9	Thunder			29 01	100	
	6	Rain	S. W. 3	W.	29 19	99	0 59
25.	12	Cloudy	W. 2.		29 31	117	
	9	Fair			29 38	94	
	6	HoarFr.	S. W. o.		29 39	82	
26.	12	Fair	S.b.w.2		29 41	117	
	9	Rain			29 46	102	0 25
	6	Fair	S. o.	w.S. w.	29 48	86	
27.	12	Rain and	S. o.		29 50	121	
	9	Hail			29 54	98	0 41
	6	Rain	S.S.E.o.		29 63	92	
28.	12		N.N.W.1		29 71		
	9						
	6	Fair					
29.	12	Rain					
	9	Fair			29 33	96	0 10
	6	Cloudy	w.b.S.1	W.	29 30	93	
30.	12		w.S.w. 3		29 23	112	
	9	Fair			29 20	96	
	6	Cloudy	w.N.w.4.		29 20	99	0 24
31.	12	Fair	N.N.W.6		29 29	102	
	9	Rain	N.W.2.		22 43	96	
					Total		5 63

APRIL. 1699.

D.	h.	Weather.	Winds.	Clouds	Barom.	Ther.	Rain.
	6	Rain	W.b.N.1.	N. W.	29 37	93	
1.	12	and	N. 4.		29 39	102	
	9	Hail			29 52	98	0 27
	6		N.N.W.3		29 50	92	
2.	12	Same	N. 2.		29 53	102	
	9		N.b.E.2	N. E.	29 61	95	0 14
	6		N. 2.	N.E.b.N.	29 63	88	
3.	12	Cloudy	N.E.b.N.3		29 67	108	
	9		N.b.E.3	N.E.b.N.	29 79	93	
	6	Fairer	N.b.E.3	N. E.	29 85	90	
4.	12	Day	N.E. 4.		29 90	107	
	9		N.b.E.2		29 91	86	
	6	Frost and	N.b.E.2		29 83	82	
5.	12	Fair	N.E. 2.		29 75	109	
	9	Cloudy			29 69	95	
	6		E.b.N.0	N.	29 55	92	
6.	12	Cloudy	E.S.E. 1	S.	29 46	112	
	9				29 43	95	
	6	Cloudy	S.E.b.E.1	S. E.	29 37	85	
7.	12	Cold	E. 2.		29 36		
	9	Fair			29 28	98	
	6	Cloudy	N. 2.		29 17	98	
8.	12	with some	N.b.W.1		29 21	103	
	9	Drops			29 17	98	
	6	Cloudy	S. 0.	N. W.	29 13	97	
9.	12		S. 1.	S. W.	29 15	115	
	9	Rain			29 16	97	0 52
	6	Fair	S.b.W.0	S. W.	29 23	93	
10.	12		S. 1.		29 31	124	
	9	Cloudy			29 43	104	
	6		N. 1.		29 46	99	
11.	12	Rain	N. 3.	N.N.E.	29 48		
	9				29 52	101	0 07
	6		N.E. 3.		29 59	103	0 35
12.	12	Cloudy	N.E. 4.		29 70	113	
	9				29 83	99	
	6	Cloudy			29 90		
13.	12	Fair	N. E.				
	9	Cloudy			29 86	97	
	6	Cloudy	N.E.b.E.3		29 82	104	
14.	12	Fair	E.N.E.3	E.	29 83	121	
	9	Rain			29 76	108	0 12
	6	Cloudy	N E.b.N.1	E.	29 64	105	0 05
15.	12	Rain	S.W. 1.	S. W.	29 61	118	
	9	Fairer			29 61	101	0 97
	6	Cloudy	S. b.W.1.		29 58	101	
16.	12		S. 1.		29 50	129	
	9	Fair			29 36	103	

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain
	6	Rain	w.s.w.2		29 21	103	
17.	12						
	9	Fair			29 25	99	0 21
	6	HoarFr.	S.W. 1.		29 34	85	
18.	12	Fair					
	9	Rain	S. 1.		29 34	100	
	6	Fairer	E. 2.		29 28	103	0 02
19.	12		w.b.N.1		29 42	125	
	9	Cloudy			29 65	110	
	6	HoarFr.	W. 0.		29 72	89	
20.	12	Fair					
	9				29 84	115	
	6	Cloudy	S.S.w.1	S. W.	29 87	110	
21.	12	Warm &	S.W. 2.		29 94	131	
	9	Fair			29 98	115	
	6	Cloudy	w.s.w.0	W.	29 99	97	
22.	12		w.b.S.2		30 00	130	
	9	Fairer			29 97	110	
	6	Fair	s.W.b.W.2		29 96	104	
23.	12	and	w.s.w.3	N. W.	29 97	131	
	9	Pleasant			29 88	113	
	6		S.S.w.3	W.S.w.	29 74	109	
24.	12	Fair					
	9				29 60	110	
	6	Fair	s.w.*b*.w.3	W.	29 64	102	
25.	12						
	9	Rain			29 37	105	
	6	Fair	s.w.*b*.w.4	W.	29 12	109	0 71
26.	12		W. 4.		29 15	123	
	9	Cloudy			29 14	100	
	6	Fair	S.W. 1.		29 23	91	
27.	12	Rain	w.b.S.1		29 31	124	
	9	Cloudy			29 41	105	0 01
	6	Fair	w.b.N.1	N.b.W.	29 52	89	
28.	12	drops of	N. 2.		29 64	122	
	9	Rain	E. 1.	E.b.N.	29 77	101	
	6	HoarFr.	N. E. 0.		29 81	92	
29.	12	Fair	E. 1.	N.b.E.	29 81	129	
	9	Cloudy	E. 0.		29 79	104	
	6	Cloudy	E. 0.	N.b.W.	29 78	106	
30.	12	Fair	S.b.w.1	N.W.b.W	29 79	135	
	9	Cloudy	N.E.*b*.N.0		29 81	117	
					Total		3 44

MAY. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6		w.b.S.1.	N.W.	29 84	112	
1.	12	Fair	N.W.1.			138	
	9						
	6	Fair					
2.	12	Dry					
	9	Rain	S.b.w.3		29 65	113	
	6	Cloudy	S.W.b.W.2.		29 47	120	o 34
3.	12		W. S.W.3		29 38	133	
	9	Showers	W. 3.		29 35	106	o 19
	6	Fair	S.W.1.		29 34	105	
4.	12						
	9	Rain			29 11	99	o 88
	6	Fair	w.b.S.2		29 17	90	
5.	12	Thunder	S.W.1.		29 31	118	
	9	Rain			29 40	98	o 29
	6	Hoar Fr.	S.S.W.1		29 51	92	o 08
6.	12	Fair	S.W.3.		29 58	121	
	9	Showers			29 69	107	o 01
	6		S.b.w.o		29 79	98	
7.	12	Fair	S.b.E.2.		29 81	137	
	9				29 87	108	
	6		S. 1.		29 90	102	
8.	12	Fair	S. 2.		29 93	143	
	9						
	6	Fair					
9.	12	and					
	9	Warm	E. 1.		29 93	115	
	6		N.E.1.		29 90	92	
10.	12	Same	N.b.E.1.		29 88	147	
	9				29 92	118	
	6		N.b.E.3.		30 00	117	
11.	12	Same	N. 2.		30 10	150	
	9				30 21	108	
	6	Fair	N.b.W.2		30 17	105	
12.	12	and	N. 4.		30 14	132	
	9	Dry			30 10	108	
	6		N.b.E.3.		30 10	110	
13.	12	Same	N.N.E.4.		30 08	137	
	9				30 06	109	
	6	Cloudy	N.N.E.2		30 05	110	
14.	12		N.b.E.2.		30 02	130	
	9	Fair	E. 1.	N.N.E	30 01	112	
	6		E.N.E.1.	N. E.	29 99	110	
15.	12	Same					
	9				29 92	100	
	6	Cloudy	N.E.*b.*E.2	E.N.E.	29 88	108	
16.	12	Fair	E.N.E.3.		29 87	131	
	9	Cloudy			29 83	110	

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6		E.N.E.3.		29 76	113	
17.	12	Cloudy	N.E.*b.*E.3.		29 72	137	
	9				29 71	113	
	6	Fair and	N.E b.N.2.		29 69	115	
18.	12	Hot Day					
	9				29 77	124	
	6		N. 2.	N.b.E.	29 80	113	
19.	12	Fair	N E b.E.3.		29 83	146	
	9		E.b.S.o.		29 86	115	
	6		N.E.2.		29 86	110	
20.	12	Same	E.b.S.2.		29 86	143	
	9				29 83	110	
	6	Cloudy	N.N.E.1.		29 80	112	
21.	12	Hot and	E.b.N.2.		29 76	148	
	9	Fair	N.E.3.		29 75	120	
	6	Fair	N.E.2.		29 72	112	
22.	12	Hot and					
	9	Dry			29 66	115	
	6	Cloudy	N.E.b.N.1.	N.b.E.	29 66	109	
23.	12		E. 1.	N.	29 59	134	
	9	Fair	E. 1.	W.	29 49	145	
	6	Rain	N.N.E.3	N.b.E.	29 43	117	
24.	12					113	
	9	Fair			29 50	106	o 08
	6	Fair	N.N.W.2	N.b.W.	29 53	102	
25.	12	Hail	N.b.w.3.		29 55	120	
	9	Fair	E.b.S.o.		29 57	107	o 61
	6	Fair	E.b.S.1	N.b.W.	29 55	104	
26.	12	Rain	S.W.2.	W.b.S.	29 57	132	
	9	Fairer	W. o.		29 62	113	o 10
	6	Fair	S.W.1.		29 65	109	
27.	12	Cloudy	S.W.1.	S.	29 67	140	
	9	Fair	S. o.		29 66	118	
	6	Fair	E. 1.	S. E.	29 61	122	
28.	12	Sultry	E. 2.	S.	29 57	150	
	9	Rain	E. o.	E.S.E.	29 58	131	
	6		E. o.	N. W.	29 63	124	o 09
29.	12						
	9						
	6						
30.	12						
	9						
	6	Hot and					
31.	12	Dry					
	9		W.b.S.2.		30 08	140	
						Total	2 67

JUNE. 1699.

D.	h.	Weather.	Winds:	Clouds.	Barom.	Ther.	Rain.
	6	very	S.W.2.	W.b.S.	30 08	132	
1.	12	Dry Hot					
	9	Day			30 00	138	
	6	Fair	s.w.b.s.o	S.w.b.S.	29 91	132	
2.	12						
	9	Rain			29 85	134	0 01
	6		W. 2.		29 90	123	
3.	12						
	9						
	6						
4.	12						
	9						
	6						
5.	12						
	9						0 01
	6	Fair					
6.	12	and					
	9	Dry	W.b.S.2		29 72	120	
	6		W.b.S.3.	W.b.N	29 78	121	
7.	12		W. 2.		29 82	142	
	9						
	6						
8.	12						
	9						
	6	great					
9.	12	Drough					
	9						
	6	Cloudy		N. W.			
10.	12		W.b.N.2	W.b.N.	29 67	146	0 53
	9	Fair	W. o.		29 73	125	
	6	Fair	W.b.S.1.		29 79	126	
11.	12	Hot					
	9	Cloudy	E. o.		29 87	128	
	6	Hot and	E. 1.	W.b.S.	29 86	138	
12.	12	very Dry					
	9		E.b.S.o.		29 81	136	
	6	Fair	E. 1.		29 76	131	
13.	12		E.b.S.1.	S.E.b.S.	29 71	158	
	9	Rain	S. 1.	S.b.E.	29 70	138	0 04
	6		S.S.W.3.		29 86	126	
14.	12		S.b.W.4.	S.W.b.S.	29 92	154	
	9						
	6						
15.	12						
	9						
	9						
16.	12						
	9						

D.	h.	Weather.	Wind.	Clouds.	Barom.	Ther.	Rain.
	6						
17.	12						
	9						
	6						
18.	12						
	9						
	6						
19.	12						
	9						
	6	Some					
20.	12	Cloudy	w.N.W.1		29 88	148	3 61
	9	some F.	w.N.W.o	N.W.b.N	29 92	128	
	6		W. o.	N.N.w.	29 95	130	
21.	12		S. 1.	N. W.	29 98	163	
	9						
	6						
22.	12						
	9						
	6	Fair					
23.	12	Hot	S. E. 1.		29 93	165	
	9	Day			29 93	141	
	6	Fair	S. E. 1.		29 94	140	
24.	12	Sultry	N.b.w.1	W.	29 94	165	
	9	Rain	E. 1.		29 93	140	0 20
	6	Fair	E. o.	W.b.N.	29 89	140	
25.	12	Hot	w.b.S.1.		29 87	166	
	9	Day	s.w.b.w.2		29 82	144	
	6		W. 2.	W.b.N.	29 76	142	
26.	12	Fair					
	9		N.W.2.		29 84	134	
	6		N.W.2.	N.w.b.N.	29 98	130	
27.	12	Same	S. 2.	W.	30 01	158	
	9				29 96	135	
	6		W.S.W.2	W.	29 90	133	
28.	12	Same	W.N.w.2	W.	29 91	161	
	9				29 92	125	
	6		W.N.w.2		29 96	118	
29.	12	Same	W.b.S.1		29 99	143	
	9				29 99	135	
	6		N.W.b.W.1	N. W.	29 99	135	
30.	12	Same.	N.W.b.W.3.		29 97	162	
	9		E. 1.	N.	29 97	130	
					Total		4 4

JULY. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6	Misling	N.E.b.E.1		30 00	134	
1.	12	Hot and	E.S.E.2	N.	30 00	150	
	9	Fair			29 97	122	
	6	Fair	E.S.E.1		29 96	125	
2.	12	and	N.E.2.		29 92	150	
	9	Hot			29 87	124	
	6		E. 1.		29 83	131	
3.	12	Same	E. 2.		29 82	157	
	9				29 78	129	
	6	Fair	E.b.N.1		29 74	120	
4.	12	Cloudy					
	9	Fair	N.E.b.N.1		29 80	135	
	6	Fair	N. 2.		29 85	123	
5.	12		N. 2.	N.N.E.	29 87	150	
	6	Cloudy			29 90	125	
	6		N.b.E.1		29 90	120	
6.	12	Cloudy	N.N.E.2.		29 90	143	
	9				29 86	115	
	6		N.E.b.N.0	E.b.N.	29 84	120	
7.	12	Fair	E. 1.		29 81	147	
	9				29 78	125	
	6	Fair	E.b.S.1.		29 79	116	
8.	12	and	W.N.W.1	w.b.N.	29 82	165	
	9	Hot	N.W.b.N.0		29 90	143	
	6		N.b.W.1		30 01	132	
9.	12	Same	N.W.b.W.1	N. W.	30 03	153	
	9				30 04	131	
	6				30 01	119	
10.	12	Same					
	9		W.		29 88	147	
	6	Hot &	w.b.S.2.		29 89	140	
11.	12	Dry	w.b.N.2.	N. W.	29 89	162	
	9				29 92	143	
	6	Sultry	E.b.N.0		29 97	140	
12.	12	Hot	E.N.E.1		29 97	178	
	9	Cloudy			29 97	143	
	6	Very	E.b.S.0.		29 96	133	
13.	12	Hot &	E.S.E.1	S. b. E.	29 97	173	
	9	Dry			29 90	142	
	6	Sultry	E. 1.		29 87	136	
14.	12	Rain and	E.b.S.2	E. b. N.	29 88	164	
	9	Thunder			29 91	139	0 64
	6	Cloudy	N.E.b.N.2.		29 93	136	
15.	12	Fair	N.E. 3.		29 90	164	
	9	& Dry			29 87	136	
	6	Fair	N.E. 2.		29 87	140	
16.	12	Hot &	E. 2.	N. E.	29 88	172	
	9	Dry			29 89	134	

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6		E.b.N.0		29 91	130	
17.	12	Same	E.b.N.2		29 93	167	
	9				29 99	131	
	6	Cloudy	N.b.E.3		30 03	130	
18.	12	Cool	N. 2.		30 06	142	
	9	Day			30 06	127	
	6		N. 2.		30 01	126	
19.	12	Same	N. 1.		29 98	138	
	9	Rain			29 92	123	
	6	Cloudy	N.N.w.2		29 86	115	
20.	12	and	N.W.b.N.2.		29 86	139	
	9	Cool			29 86	126	0 06
	6	Cloudy	N.N W.1		29 87	126	
21.	12		N N.W.1	N.N.E.	29 87	155	
	9	Fair	S. 1.		29 83	134	
	6	Fair	w.b.S.1.		29 81	122	
22.	12		N.W.1		29 80	159	
	9	Cloudy	S. E. 0.		29 78	135	
	6	Fair	S. E. 1.		29 78	131	
23.	12	Some	S. 2.		29 74	172	
	9	Drops			29 73	139	
	6	Fair	S.W. 1.		29 71	128	
24.	12	Rain	S. W.2.	W.	29 67	160	
	9	Fair			29 58	129	0 01
	6		S. S.E. 1.	S.	29 37	129	
25.	12	Rain			29 21		
	9		S. 1.		29 17	129	1 89
	6	Fairer	S. 1.	S. W.	29 21	118	
26.	12	Rain		S. S.W.	29 24	156	
	9	Fair	S. 2.		29 25	129	0 23
	6		S.b.W.2	S.W.b.S.	29 11	128	
27.	12	Same	S. 4.	S. S.W.		153	
	9				29 18	128	0 21
	6	Fair	S. 1.		29 24	125	
28.	12		S. W.4.	S. S. W.	29 27	147	
	9	Rain			29 28	129	0 34
	6	Fair	S.b.w.3.		29 30	129	
29.	12	Rain	S.W.b.S.4	S. W.	29 29	148	
	9	Thunder			29 35	124	2 21
	6		S.w.b.S.3	S. W.	29 38	122	
30.	12	Fairer	S. W. 4.		29 42	149	
	9				29 46	128	
	6	Rain	S. S.E. 1.	S. b.W.	29 36	126	1 04
31.	12		S. 4.		29 34	144	
	9	Fair			29 36	127	
					Total		6 63

AUGUST. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6	Fair	S.b.W.4.	S.S.W.	29 32	128	
1.	12	Rain	S.W.b S.4.		29 33	145	
	9	Cloudy	S.W.8.		29 36	130	0 07
	6	Fair	W.b.S.1.		29 62	118	
2.	12		W.S.W.1	W.b.S.	29 70	142	
	9	Cloudy			29 63	131	
	6	Cloudy	N.N.W.1	W.S.W.	29 56	123	
3.	12						
	9	Fair			29 72	117	
	6	Cloudy	N.N.W.o.	W.b.S.	29 75	105	
4.	12	Fair	E.b.S.2.	w.b.N.	29 71	147	
	9	Rain			29 50	123	
	6	Rain	E.b.S.o.	S.W.b.S.	29 37	125	4 38
5.	12		S.W.1.	W.	29 31	139	
	9	Fairer			29 63	127	0 46
	6		S. o.		29 67	125	
6.	12	Showry	S. 2.		29 59	139	
	9				29 50	139	0 08
	6	Fairer	S.W.4.		29 39		
7.	12						
	9	Rain			29 32	126	
	6	Fair	S.W.4.		29 30	118	0 75
8.	12		S.W.3.		29 33	141	
	9	Rain			29 55	117	0 66
	6		S.W.2.	w.S. w.	29 63	116	
9.	12	Fairer	s.W.b.W.3.		29 66	145	
	9				29 69	125	
	6	Fair	s.W.b.S.3.		29 70	119	
10.	12		S.W.3.		29 72	150	
	9	Cloudy			29 72	131	
	6	Fair	S. 1.	S.S.W.	29 65	116	
11.	12		S. 3.		29 58	152	
	9	Cloudy			29 43	137	
	6	Rain	N.W. 1.	W.b.S.	29 49	117	
12.	12	Fair	W.b.N.3.		29 57	140	
	9				29 65	120	0 44
	6	Cloudy	S.S.W.3.	N. W.	29 67	120	
13.	12						
	9	Rain			29 65	132	
	6	Cloudy	S.W.2.		29 61	131	0 17
14.	12		w.b.S.2.	N. W.	29 69	153	
	9	Fair			29 73	134	
	6	Fair	W.S.w.2	W.b.S.	29 73	139	
15.	12		W.S.W.3.		29 72	158	
	9	Rain			29 75	122	0 44
	6		N.W.1.		29 87	110	
16.	12	Fair	N.W.b N.2		29 98	132	
	9				30 00	111	
	6	Fair	N.N.W.1.		29 98	108	
17.	12						
	9	Cloudy			30 00	116	
	6		N.b.W.1.		30 01	110	
18.	12	Cloudy	N. 2.	N.N.E.	30 03	138	
	9				30 02	115	
	6		N. 2.		29 97	116	
19.	12	Cloudy	N.b.E.2.	N.N.E.	29 92	142	
	9				29 87	124	
	6	Cloudy	N.N.E.1.		29 82	119	
20.	12	Fairer	N.E.b.N.2.		29 80	140	
	9	Cloudy			29 76	127	
	6		N.E.1. E.b. N.		29 70	117	
21.	12	Fairer					
	9				29 56	129	
	6	Mist	N.N.E.o.		29 50	126	
22.	12		W.b.N.1.		29 53	150	
	9	Fair			29 59	122	
	6	Misty	S.b.w.o.	S.	29 63	118	
23.	12	Fair	S. 2.		29 64		
	9	Cloudy			29 56	128	
	6	Rain	S. 1.	S.b.W.	29 47	129	0 24
24.	12	Cloudy	S.b.W. 3.		29 43	148	
	9	Rain			92 37	127	0 21
	6	Cloudy	S.W.1.	W.	29 41	119	
25.	12		S.W.3.		29 53	149	
	9	Fair			29 64	124	
	6	Fair	S.W.1.	W.b.S.	29 71	116	
26.	12		S.b.E.2.		29 68	137	
	9	Rain			29 63	136	0 58
	6	Fair	S.W.b.S.2,		29 67	120	
27.	12		s.W.b.S. 3.		29 65	143	
	9	Cloudy	S. 4.	S.S.W.	29 45	128	
	6		S.W.5.	S.w.b.w.	29 48	118	
28.	12	Fair	W.b.S.5.	W.N.W.	29 59	140	
	9		W.S.W.1.	W.	29 80	117	
	6	Fair	S.W.o.	W.	29 86	112	
29.	12						
	9	Rain	S.W.1.		29 89	129	0 12
	6		S.S.w.2.	S. W.	29 89	121	
30.	12	Fair	S.S.w.2.	S.	29 89	150	
	9				29 78	121	
	6	Fair	E. 1.		29 60	115	0 01
31.	12						
	9	Rain	W. 2.		29 73	129	
					Total		8 57

SEPTEMBER. 1699.

D.	h.	Weather.	Winds.	Clouds	Barom.	Ther.	Rain.
	6	Mist	S. W. 0.		29 84	98	
1.	12		S.w.b.S.2.	S.	29 85	145	
	9	Fair	S. 0.		29 80	122	
	6		S. E. 0.	S. b. E.	29 77	112	
2.	12	Cloudy					
	9				29 77	130	
	6		S.S.E.0.	S.	29 67	122	
3.	12	Same	N.W.2.	N.w.b.N.	29 65	144	
	9				29 72	120	
	6		N.E.b.N.1.	S. S.E.	29 90	108	
4.	12	Fair	N. 2.	N.b.w.	29 18	138	
	9				30 12	115	
	6	Mist	N. 0.	E.	30 17	96	
5.	12		E. 1.		30 18	39	
	2	Fairer			30 15	112	
	6	Mist	E. 0.		30 07	92	
6.	12		E.S.E.1.	E.	30 03	142	
	9	Fair			30 01	115	
	6	Mist	E. 0.		30 03	97	
7.	12	Fair	N.E. 2.	N.N.E.	30 06	147	
	9	Cloudy			30 15	131	
	6	Misling	N.b.E.2.		30 21	123	
8.	12	Fair	E.N.E.3.	N. E.	30 22	137	
	9	Cloudy			30 22	121	
	6		N. 1.	N.E.b.N.	30 18	116	
9.	12	Fair					
	9				30 12	115	
	6		E. 0.		30 10	97	
10.	12	Fair	E. 2.		30 08	142	
	9				30 05	121	
	6	Mist	E. 0.		29 95	110	
11.	12		E. 1.		29 94	150	
	9	Fair			29 91	121	
	6		E. 0.		29 89	102	
12.	12	Same	E. 1.		29 90	152	
	9				29 90	127	
	6	Misty	E. 0.		29 91	114	
13.	12	somewh.	E.b.N.1.	E.	29 93	143	
	9	Cloudy			29 93	129	
	6	Misty	E. 0.		29 89	126	
14.	12	less					
	9	Cloudy			29 89	127	
	6		S.W. 1.	S.W.b.W.	29 91	122	
15.	12	Same					
	9	very Dry			29 93	134	
	6	Rain	S.w.b.S.0.		29 92	128	
16.	12		S.S.W. 1.		29 92	140	
	9	Cloudy			29 81	122	0 15

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6		E. 0.		29 59	112	
17.	12	Rain	S. W. 1.		29 50	141	
	9				29 60	116	2 36
	6		W.b.S.2.	N. W.	29 82	102	
18.	12	Fair	W.N.W.2.		29 88		
	9				29 91	106	
	6	Rain	S.S.W.2.	W.	29 80	115	
19.	12						
	9	Cloudy			29 65	130	0 01
	6	Rain	S.b.w.3.		29 41	127	
20.	12		S.w.b.S.4.	S.b. W.	29 42	125	
	9	Cloudy			29 36	115	0 34
	6	Fair	W.S.W.3.		29 44	106	
21.	12	Cloudy	S.b.w.4.	W:	29 46	132	
	9	Rain			29 38	116	0 16
	6	Fairer	S.W. 3.		29 14	112	2 57
22.	12	Rain	S.W.b.W. 4.		29 21	128	
	9	Stormy			29 21	116	1 01
	6	Fair	S.W.3.		29 05	103	0 27
23	12	Cloudy	S.w.b.S.5.		29 07	122	
	9	Rain			28 95	102	
	6	Fairer	w.b.S.2.	N.N.w.	29 08	100	0 77
24.	12		w.b.S.3.	W.b.N.	29 26	121	
	9	Rain			29 51	100	1 07
	6		w.b.S.1.		29 75	88	
25.	12	Fair					
	9				30 00	101	
	6	Misling	S.W. 1.		30 04	102	0 06
26.	12		W.N.w.1.	N.b.W.	30 10	130	
	9	Cloudy	N.b.w.0.		30 18	121	
	6		E.S.E.0.	E.N. E.	30 21	112	
27.	12	Fair	E.b.S.2.		30 23	123	
	9				30 23	101	
	6	Fair	N.b.W.		30 16	100	
28.	12	Small	N.b.E.2.		30 12	130	
	9	Rain			30 08	117	
	6		E. 0.	E.N.E.	30 12	117	
29.	12	Fair	E.b.N.2.		30 12	135	
	9		E.N.E.2.		30 11	122	0 29
	6		E.b.N.3.		30 08	122	
30.	12	Cloudy	E. 3.	E.b. N.	30 10	127	
	9		E.b.N.3.		30 08	123	
					Total		8 06

OCTOBER. 1699.

D.	h.	Weather.	Winds.		Clouds.	Barom.	Ther.	Rain.
	6	Fairer	E.b.N.1.		E.	29 97	122	
1.	12		E. 2.			29 93	132	
	9	Cloudy				29 93	123	
	6	Rain	E.b.N.2.			29 87	118	
2.	12	Fairer	E.b.N.1.			29 80	131	
	9	Rain				29 73	111	1 45
	6	Fairer	E.b.S.1.		S. S. W.	29 66	115	1 92
3.	12	Cloudy	S. W. 2.			29 67	128	
	9					29 73	118	
	6		S. W. o.			29 79	108	
4.	12							
	9							
	6	Cloudy						
5.	12							
	9	Fair				29 98	96	
	6	HoarFr.	N.N.W.1.			30 12	87	
6.	12	and	N. 1.			30 17	112	
	9	Fair				30 22	89	
	6		N. W. o.			30 18	99	
7.	12	Cloudy	w.b.N.1.			30 19		
	9	Rain				30 20	96	
	6		N.E.b.N.1			30 21	105	0 07
8.	12	Cloudy	E.b.N.1			30 20	119	
	9					30 16	110	
	6		E. o.			30 07	106	
9.	12	Same	E.b.N.2			30 06	119	
	9					30 01	99	
	6	Mist	E.b.N.o			29 92	92	
10.	12							
	9	Fair				29 85	104	
	6	Mist	E. 1.			29 80	99	
11.	12	Cloudy						
	9	Misling				29 80	120	
	6	Mist	S.E.b.E.o			29 75	109	0 42
12.	12	Warm	S. 2.			29 77	140	
	9	Fair				29 79	115	
	6	Cloudy	S. o.		S. b. W.	29 77	106	
13.	12	and	S.w.b.S.3			29 79	136	
	9	Warm				29 87	119	
	6		S.b. E. 2			29 87	119	
14.	12	Same	S. 2.			29 81	133	
	9					29 65	122	
	6	Cloudy	S. 3.		S. S.W.	29 57	129	
15.	12	Misling	S. 2.			29 57	136	
	9	Rain				29 54	127	
	6		E.S.E. 2		S.E.b.S.	29 52	122	
16.	12	Rain	S. E. 1		S. b. E.	29 48	130	
	9					29 50	122	0 64

D.	h.	Weather.	Winds.		Clouds.	Barom.	Ther.	Rain.
	6		E. 1.		S. E.	29 50	117	
17.	12	Fair	E. 1.		S.E.b.E.	29 56	130	
	9					29 61	111	
	6		N. E. 2			29 65	118	
18.	12	Cloudy	E.b.N.1			29 65		
	9					29 66	119	
	6		N.E. 2			29 68	116	
19.	12	Same	E.b.N.3			29 71	123	
	9					29 74	114	
	6	Cloudy	E. 3.			29 75	111	
20.	12	and	E.b.N. 3			29 80	111	
	9	Cool				29 85	93	
	6		E. 1.			29 89	79	
21.	12	First Ice	E. 3.			29 92	102	
	9					29 93	83	
	6	Frost	E. o.			29 91	73	
22.	12	and	E.b.S. 1			29 91	98	
	9	Fair				29 87	79	
	6		E. o.			29 77	70	
23.	12	Same	E.b.S. 2.		E.	29 77	101	
	9					29 70	82	
	6	Cloudy	E. 1.		S. W.	29 51	85	
24.	12		S. E. 3.		S.w.b.S.	29 32	111	
	9	Rain				29 07	109	1 95
	6	Fair	S. W. 3			29 18	94	1 04
25.	12	Cloudy						
	9	Rain				29 16	96	
	6		W. 1.		N.w.b.N.	29 18	92	0 90
26.	12	Fair	N.b.w.3		N. W.	29 32	110	
	9		w.N.w.o			29 51	88	
	6	Frost	w.S.w.o			29 51	82	
27.	12		S. 3.			29 42	107	
	9	Cloudy	S. W. 1.			29 43	111	
	6	Cloudy	S. W. o.			29 51	100	
28.	12		S.w.b.S. 1			29 51	114	
	9	Rain	E.S.E. 2			29 28	110	1 24
	6		S. 3.			29 08	117	0 31
29.	12	Rain	S.S.E. 2		S.	29 03	122	
	9		w.N.w.3.			29 16	96	0 43
	6		S.w.b.w.2			29 48	89	
30.	12	Fair						
	9					29 48	109	
	6	Cloudy	S. 4.		S. W.	29 36	115	3 12
31.	12							
	9	Rain				29 14	113	
						Total		13 49

NOVEMBER. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	8		W. 3.	W.S.W.	29 29	95	
1.	12	Fair	W.b.N.4.		29 42	103	
	9	Rain			29 67	99	
	8		S.W.b.W.o	W.b.S.	29 80	106	0 28
2.	12	Fair	S.b.W.2	S. W.	29 85	116	
	9	Cloudy			29 84	109	
	8	Fairer	S. 3.		29 53	105	
3.	12		S. 6.	S.b.W.	29 52	119	
	9	Rain			29 60	102	0 36
	8		S.W.3.	w.S.W.	29 85	96	
4.	12	Fairer			29 92	112	
	9				29 96	111	
	8	Fair	S.W.3.	N.N.W.	29 98	107	
5.	12	Cloudy	S.W.2.	W.	30 01	120	
	9	Fair			30 03	112	
	8		S.S.E.o.		30 02	100	
6.	12	Fair	S.S.E.1.	S.	30 02	115	
	9				29 97	97	
	8	Misty	S.S.W.2		30 02	110	
7.	12						
	9	Fair			30 22	94	
	8		W. o.		30 27	84	
8.	12	Mist	W. 1.		30 27	98	
	9				30 30	101	
	8		S.b.E.1.		30 29	100	
9.	12	Cloudy	S. E. 1.		30 28	107	
	9				30 22	87	
	8	Froft	E. 1.		30 16	80	
10.	12	and	E. 1.		30 18	103	
	9	Fair			30 27	92	
	8		N. o.		30 31	87	
11.	12	Foggy	N.b.E.o		30 30	101	
	9				30 33	96	
	8	Mist	N.N.E.o.	S.W.b.S.	30 30	94	
12.	12		E.b.N.o	S.w.b.w.	30 30	104	
	9	Cloudy			30 23	103	
	8	Cloudy	S.W.1.	W.b.N.	30 09	103	
13.	12	Fair	S.W.3		30 03	110	
	9	Cloudy			29 85	109	
	8	Fair	W.S.W.1		29 76	103	0 20
14.	12		W.S.W.4	N. W.	29 70	110	
	9	Stormy	W.S.W.8		29 36	114	
	8	Cloudy	W. 6.	N. W.	29 53	109	
15.	12		W.b.N.5	N. W.	29 63	115	
	9	Fair			29 84	94	
	8		W.b.S.1.	W.N.W.	29 87	89	
16.	12	Fair	W.S.W.2	W.	29 88	105	
	9				29 80	113	

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	8		N.W.3	W.	29 86	103	
17.	12	Fair	W. 1.		29 93	105	
	9				29 91	85	
	8	Froft	W.S.W.3		29 81	92	
18.	12		W.S.W3.		29 87	107	
	9	Fair			29 94	94	
	8	Froft	S.b.W.o	N. W.	29 94	79	
19.	12	and	S. 1.		29 94	97	
	9	Fair			29 91	92	
	8		S. 1.	S. W.	29 85	88	
20.	12	Same	W.b.S.2.		29 85	106	
	9				29 86	109	
	8	Cloudy	S.W.1.S.2.	W.S.W	29 84	112	0 05
21.	12	Mild	S.W.b.S.3.	W.b.S.	29 82	122	
	9	Fair			29 78	112	
	8	Rain	W. o.	N.W.b.W.	29 75	103	0 45
22.	12	Fair	N. 1.		29 83		
	9				29 89	85	
	8	Froft	N W o.	N.b.E.	29 89	80	
23.	12	and	N.W.o.		29 90	91	
	9	Fair			29 92	75	
	8	Froft	N.W.o		29 86	71	
24.	12	and	N.W.1		29 85	90	
	9	Cloudy	S.W.1.		29 83	95	
	8	Cloudy	S.W.o.		29 76	89	
25.	12						
	9						
	8						
26.	12	Rain					
	9						
	8	Froft					
27.	12	and					
	9	Fair					
	8						
28.	12	Hard Fr.					
	9						
	8						
29.	12	Snow					
	9						
	8	Snow					
30.	12						
	9	Fairer	N.b.E.2		29 60	60	0 59
						Total.	1 93

DECEMBER. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	8	Cloudy	N.N.W.o		29 71	73	
1.	12	Hard F.	N.W.o.		29 71	76	
	9	Fairer			29 58	60	
	8	Froft	E.b.S.3.		29 30	78	
2.	12	Cloudy	E. 4.		29 12	82	
	9	Snow			28 91	83	
	8		E. 3.		28 61	91	o 56
3.	12	Rain	E.b.S.3.		28 52	94	
	9				28 4	100	
	8	Cloudy	E.S.E.3.	S. S. E.	28 60	98	o 18
4.	12	Fair					
	9	Rain			28 74	99	
	8		S.b.E.o.	S.b. W.	29 01	99	o 13
5.	12	Fair	S. 2.	S. S. W.	29 14	110	
	9	Rain			29 28	103	
	8	Fair	S. 2.		29 26	107	o 74
6.	12	Rain &	S.b.E.3.	S.b. W.	29 32	115	
	9	Warm			29 39	108	
	8	Cloudy	S. 1.		29 50	106	o 36
7.	12	and			29 48	112	
	9	Warm			29 48	105	
	8	Cloudy	S.S.E.1.	S.b.E.	39 37	109	
8.	12	Misling	S.S.E.3.		29 32	116	
	9	Warm			29 36	114	
	8		S.E. 3.		29 19	113	
9.	12	Rain	S.S.E. 3.		29 19	117	
	9				29 29	112	o 38
	8		S.b.E.1.		29 41	103	
10.	12	Fair	S.b.E.2.		29 46	112	
	9				29 57	98	
	8	Fair	S. W.o.		29 88	92	o 06
11.	12	Cloudy					
	9	Rain			29 95	108	
	8	Cloudy	S.b.E.2.	S. b. W.	29 84	109	o 36
12.	12	& ſome	S. 1.	S. W.	29 78	115	
	9	Rain			29 73	108	
	8	Cloudy	S. W. 3		29 54	110	o 61
13.	12		S.W.b.W.		29 57	112	
	9	Fair			29 63	104	
	8		S. W. 1.	W. b. S.	29 51	102	o 21
14.	12	Rain	W.b.S.1		29 43	108	
	9				29 48	98	
	8	Fair	W.b.N.2.	N.N.W	29 64	100	
15.	12		N.N.W.1		29 69	103	
	9	Cloudy			29 91	99	
	8	Misling	N.N.w.1		30 07	95	
16.	12		N. 1.		30 14	101	
	9	Fair			30 27	87	
	8	Froft &	N. o.		30 25	73	
17.	12	Fair	S. W.1.		30 20	88	
	9	Rain			30 33	90	o 29
	8	Froft	N.W.1.		30 44	82	
18.	12	Hazy					
	9	Fair			30 35	76	
	8	Cloudy	W. 1.	N. W.	30 21	81	
19.	12	with	N.W.1.		30 20	93	
	9	Thaw			30 23	91	
	8	Cloudy	N.W.o.	N.	30 26	86	
20.	12		N.W.1.		30 27	102	
	9	Fair	W.N.W.o		30 31	94	
	8	Misling	N.b.W.o.		30 36	90	
21.	12		N.b.E.1		30 40	99	
	9	Fairer			30 47	94	o 03
	8	Misling	N. o.	N. E.	30 50	89	
22.	12		N. 1.		30 49	92	
	9	Cloudy			30 46	85	o 07
	8	Froft	N.b.W.o.		30 40	74	
23.	12	Fog	N. o.		30 38	88	
	9	Cloudy	S. b. E.		30 35	86	
	8		S. W. o.		30 21	86	
24.	12	Cloudy	S.w.b.S.2		30 19	94	
	9		S.S.W.1		30 15	91	
	8	Fairer	S.S.W.1		30 14	98	
25.	12		S.W.b.W.1		30 12	102	
	9	Rain	S.b.W.1		29 98	102	
	8	Cloudy	W. o.	N.W.b.W.	29 96	107	o 68
26.	12		W. 1.	N. W.	30 06	105	
	9	Fair			30 10	94	
	8		W.b. S.2.	N. N. W.	29 95	86	
27.	12	Fair	N.W.2.		29 94	98	
	9		W.b.N.o.	N.b.W.	29 94	91	
	8	Fog	W.b.N.o.		29 90	94	
28.	12	Misling	W.b.S.o	N.W.b.W.	29 86	108	
	9	Rain			29 80	106	o 27
	8		W.b.N.2.		29 72	96	o 58
29.	12	Fair	N.W.4.		29 83	100	
	9				30 03	82	
	8	Froft	S.W. 2.		30 01	89	
30.	12	Cloudy	S.W. 3.	W.b. S.	29 96	104	
	9	Rain			29 94	105	o 24
	8	Fairer	S. W. 3.		29 93	110	o 02
31.	12		S. W. 3.		29 92	112	
	9	Cloudy			29 95	108	
					Total		5 77

In these Tables, I have never set down the *Flying of the Clouds*, but when they varied from the Winds; which oftentimes happens, especially before the
n. 249. p. 46. Wind shifteth its Course. Mountains, *&c.* may cause some Variation, but as little at *Upminster* as almost any where. This last Column will be necessary, among other Uses, to shew the Reason why the *Mercury* varies sometimes: As suppose the Wind was in the Southerly Points, and the Clouds flew from the Northerly; the Rising of the *Mercury* would be readily accounted for.

n. 262. p. 527. My *Thermometer* is Graduated by Inches and Decimal parts. The Point of Freezing is about 80, or at most 82 Degrees, and consequently 'tis Cold at about 90, and Temperate at about 100 Degrees. I need not say, that the Degrees above 100 are warm or Hot; and those below 80 are Harder Frosts. The Degrees of my *Thermometer* reach to 240, although I could never make the Spirits descend with Artificial Freezing, much lower than 50, neither when exposed to the Heat of a pretty strong Sun, did they ascend above 225. It is placed in the open Air, and always defended from the Beams of the Sun. So that it sheweth only the true present Temperature of the Air.

The Winter has been so Mild (as appears by the *Thermometer*) that many of the Days of *Nov.* and *Dec.* were not much Colder than many of the Mornings and Evenings of the Warmer Months. These two last Months have been also much dryer than usual, so that had it not been for the Rains of *Oct.* perhaps a Drought had been a General Calamity.

I have had frequent Confirmations of what I Observed last Year, concerning the *Mercury* Rising in Foggy Weather. The like it doth also in Misling Weather; as may be seen in divers places of this Table. Particulary *Dec.* 22. The Weather being Misling, and Wind Northerly, it Ascended to 30,50 Inches, the Highest I ever saw it at *Upminster*.

Hurricanes and Storms by Mr. J. Templer. n. 71. p. 2156.

XXVIII. 1. *Octob.* 30. 1669. Between 5 and 6 of the Clock in the Evening, the Wind Westerly, at *Ashley* in *Northamptonshire* happened a formidable *Hurricane*, scarce bearing 60 Yards in its breadth, and spending it self in about 7 minutes of time. Its first discerned assault was upon a Milk-maid, taking her Pale and Hat from off her Head, and carrying her Pale many scores of yards from her, where it lay undiscovered some days. Next it storm'd the yard of one *Sprigge*, dwelling in *Westthorp*, where it blew a Waggon-body off of the Axletrees, breaking the Wheels and Axletrees in pieces, and blowing three of the Wheels so shattered over a Wall. This Waggon stood somewhat cross to the passage of the Wind. Another Waggon of Mr. *Salisburies* marched with great speed upon its Wheels against the side of his House to the astonishment of the Inhabitants. A branch of an Ash-tree, of that bigness that two lusty Men could scarce lift it, blew over Mr. *Salisburies* House without hurting it, and yet this branch was torn from a Tree an hundred Yards distant from that House. A Slate was forced upon a Window of the House of *Samuel Templer* Esq; which very much bent an Iron bar in it; and yet 'tis certain, that the neareſt place, the Slate was first forced from, was

near

near 200 Yards. At Mr. *Maidwell*'s Senior, it forced open a door, breaking the Latch, and thence marching through the Entry, and forcing open the Dairy-door, it overturned the Milk Veſſels, and blew out three Panes or Lights in the Window; next it mounted the Chambers, and blew out 9 Lights more. From thence it proceeded to the Parſonage, whoſe Roof it more than Decimated; thence croſſeth the narrow Street, and forcibly drives a Man headlong into the doors of *Thomas Briggs*. Then it paſſed with a curſory ſalute at *Thomas Marſton*'s, down to Mr. *George Wignil*'s, at leaſt a furlong's diſtance from *Marſton*'s, and two furlongs from *Sprigg*'s, where it plaid notorious Exploits, blowing a large Hovel of Peaſe from its ſupporters, and ſetting it cleverly upon the ground, without any conſiderable damage to the Thatch. Here it blew a Gate poſt, fixed two foot and an half in the ground, out of the Earth, and carried it into the Fields many yards from its firſt abode.

About ½ a Mile diſtant from the Town is a ſmall Wood on the Top of an Hill, and partly deſcending into a Vale encompaſſed by Northerly and Southerly Hills; ſo that the Wind may ſeem confined to the Vale as a Channel, before it aſſaulted the Town, and thereby enforced to ſpend it ſelf only in that Glaad. But I am unapt to think, that ſome *Flatus* from the deſcending Wood-ground might contribute to this accident, becauſe the Wind continued, ſo far as Men could Judge, as high in the Field afterwards; and the ſcite of the Town did expoſe (by reaſon of thoſe Valleys) a far greater part of the Town to this damage than was troubled, the Vally being above, 4 or 5 times the breadth of that part of the Town concerned in it.

2. *Oct.* 13. 1670. At *Braybrook* in *Northamptonſhire*, about 11 a Clock, the Wind in a ſtrange form aſſaulted a Peaſe Reek in the Field, uncovering the Thatch of it, and leaving another within 20 Yards unconcerned. Thence it proceeded to the Parſonage, where it carried not 12, ſcarce 8 Yards in Breadth, blowing up the end of a Barley-Reek, and therewith ſome Stakes in it of near 5 foot long: In the mean while it left a Wheat-hovel, within 6 Yards of the Barley-reek, and being without all Shelter untouched, no part of the Thatch of the Hovel being ſo much as furled. Nevertheleſs it beat down a Jack-daw from the Reek with that violence as forced the Guts out of the Body, and made it bleed plentifully at the Mouth. This I ſaw and took up in ſome Company the Daw very warm - Thence it went in a right Line to the Parſonage-houſe, took off the Cover of all the Houſe in its compaſs. From hence it paſſed over the Town without any damage, the reſt of the Town being low in Situation, and went on to a place call'd *Forthill*, where it uncloathed ſo much of a Mault-houſe as lay within its Line and Breadth, ſo as to expoſe the Mault upon the Floor to the open Air. *By Mr.* J. Templer. *ib. p.* 2157.

Braybrook ſtands in a Valley environed by Hills on 3 ſides at three quarter of a Miles diſtance from it. But (what I could chiefly obſerve) there is an Hill, call'd by the Name of *Clackhill*, within a Mile of it, and exactly in that point of the Compaſs in which the Wind then ſtood; no Hill in its way till the Wind had paſſed over all the places it endamaged: And, which is remarkable, there have been two Earthquakes in this Town within theſe 10 Years,

Years, when the then gentle Air (or Wind ſhall I call it) only vibrated upon that point of the Compaſs.

By Sir George Mackenzy. n. 114. p. 307.

3. *Dec.* 21. 1674. the Wind here (at *Tarbut*) was extraordinary: It broke a Standard-Stone, that ſtood as an *Obelisk* near an old Church; which Stone was about 12 Foot high, 5 Foot broad, and near 2 Foot thick. Whole Woods were overturned, and torn up from the Root, though in a low Scituation. It blew from the Northweſt, and of a long time the Wind had continued Weſterly.

By Mr. Scarburgh, n. 231. p 659.

4. *Oct.* 19. 1693. There happen'd a moſt violent Storm in *Virginia*, which ſtopped the courſe of the Antient Channels, and made ſome where never were any: So that betwixt the Bounds of *Virginia*, and *Newcaſtle* (in *Penſylvania*) on the Sea-bord-ſide, are many Navigable Rivers for Sloops and ſmall Veſſels.

By . . . . . n. 212. p. 192.

5. *Aug.* 1. 1694. There happened here (at *Warrington* in *Northamptonſhire*) between 1 and 2 a Clock a very terrible Whirlwind amongſt the Shocks of Corn, in that part of *Acrement Cloſe*, which is in the poſſeſſion of Mr. *Holt*, and took up into the Air about 80 or 100 Shocks, carried a great deal out of ſight; the reſt is ſcattered about the Field, or on the tops of Houſes or Trees thereabouts. I have ſeen of the Corn, which was carried a Mile diſtant from the Field; and it is reported by Perſons of good Credit, that ſome was carried 4 or 5 Miles diſtant. The Whirlwind continued in *Acrement Cloſe* full half an Hour; I my ſelf, and ſeveral other Perſons, ſaw at leaſt 3 or 4 Waggon Loads of Corn all at once whirled about in the Air.

A Spout, at Topſham *near* Exeter, *by Mr.* Zach. Maine. n. 215. p. 28.

XXIX. Theſe Appearances are frequent abroad, but very ſeldom or never ſeeen before with us; though ſome pretend to have ſeen of them in the *Downs*. The *French* call them *Trombs*, I ſuppoſe from the Figure and the Noiſe that they make; that Word ſignifying a ſort of a Humming Top. They are certain Elevations of Water during Storms and Tempeſts, reaching from the Superficies of the Sea to the Clouds. They happen ſeveral ways, ſometimes the Water is ſeen to boyl, and raiſe it ſelf for a conſiderable ſpace round about a Foot from the Surface, above which appears, as it were, a thick and black Smoak, in the midſt of which is Obſerved a ſort of Stream or Pipe reſembling a Tunnel, which ariſeth as high as the Clouds: At other times theſe Pipes or Tunnels are obſerv'd to come from the Clouds, and ſuck up the Water with great Noiſe and Violence. They move from the Place where they were firſt gathered according to the Motion of the Wind, and diſcharge themſelves ſometimes into the Sea, to the unavoidable Deſtruction of ſuch Ships as are in their Way, if they be ſmall Veſſels, and to their great Damage be they never ſo big: Sometimes on the Shoar, beating down all they meet with, and raiſing the Sand and Stones to a prodigious height. 'Tis ſaid that Veſſels, that have any Force, uſually fire their Guns at them loaden with a Bar of Iron, and if they be ſo happy as to ſtrike them, the Water is preſently ſeen to run out of them with a mighty Noiſe, but no further Miſchief.

One of theſe *Spouts* happen'd here at *Topſham*, *Aug.* 7. 1694. between 9 and 10 of the Clock in the Forenoon; 'twas then very near, if not quite Low-

Low-Water, which is lookt on as a ſpecial Providence, ſince had it been High-Water, 'tis concluded its ſtrength would have been much greater, and its conſequences more ſad. The Water that was near it ſeemed to fly hither and thither, as though it would fain make its eſcape from it: Yet I cannot find upon Enquiry that the Channel was at all wholy Dry. There was alſo ſome Wind, though not ſo violent as it had been before; and when the *Spout* or *Tromb* began to move, it went with the wind (which was then at *W. N. W.*) like a dark Smoak.

The Marks + ÷ + Shew the River; *O*, the *Spout*; *S*, Mr. *Seaward*'s Houſe, which it gently toucht with little Damage, blowing only off a few Tiles; *G*, Widow *Goldsworthy*'s Houſe, which it in part uncovered, and took off almoſt all the Thatch of her Garden Wall. It took off alſo an Apple-Tree, which was no way decayed, and between 15 and 16 Inches about, within 2 or 3 inches from the Ground, almoſt as exactly as any Saw could have done it, and carried it (as I Judge) between 20 and 30 Foot from the Place where it grew, and that not forward in the Path that it took, but almoſt directly backward, which makes me conclude that it had a double Motion; the one External from the Wind ſtrait forward, the other Internal and Circular, like the Fly of a Jack, which a Man may carry in his Hand, that will Strike any thing either forward or backward as it meets with it. *H*, Mr. *Green*'s Houſe, which was for the moſt part until'd. There were two Houſes more, *W*, *L*, very much damaged in their Coverings, yet Mr. *Moxam*'s *M*, tho' it ſtood between them, and was much higher than either, had only two or three Quarries of Glaſs broken. *EEEEE*, ſhews the March of the Spout. *X*, Planks that were blown ſome upright, ſome ſeveral Yards out of their place. *D*, a Ship newly lanched, of about one Hundred Tuns, which was much ſhaken, but not hurt. *K*, a Maſt of near a Tun weight, thrown out of its Place. *C*, an Anchor that was torn out of the Ground, and carried 7 or 8 Foot with a Boat that was faſten'd to it, and blown up into the Air; that Boat was rent from the Head to the Keel. *B*, another new Boat blown about 6 Foot High, and turned upſide down. *F*, A Fiſher Boat with one Man in it, which was near the place where the *Spout* was at firſt perceived, but through Mercy eſcaped. *P*, a Lane that goes from the River in which ſome Houſes ſuffered Damage, which ſhews that the Spout was divided in its March. 'Tis no ſmall Mercy that no Man, Woman, or Child received the leaſt injury in their *Perſons*. *Fig.* 19.

XXX. 1. *John Gill* Affirms, that he hath Obſerved on ſeveral Occaſions that being in a Calm, that way which the Sea began to Loom or move, the next Day the Wind was ſure to Blow. *Prognoſticks of the Wind*; *by* J. Gill. n. 26. p. 481.

2. It hath been the Cuſtom of our *Engliſh* and *French* Inhabitants of the *Caribee Iſlands* to ſend in, about the Month of *June*, to the Native *Caribees* of *Dominico* and *St. Vincent*, to know whether there would be any *Hurricanes* that Year; and about 10 or 12 Days before the *Hurricane* came they did conſtantly ſend them word, and it very rarely or ſeldom failed. From one of theſe *Indians*, (whom in 1657 I ingaged by Civilities to remain with me ſeveral Years,) I had the following *Prognoſticks*. *Prognoſticks of Hurricanes*, *by Capt.* Langford. n. 246. p. 407.

1. All *Hurricanes* come either on the Day of the Full, Change, or Quarters, of the Moon.

2. If he will come on the Full Moon, you being in the Change, then obſerve theſe ſigns;

That Day you will ſee the Skies very Turbulent, the Sun more Red than at other times, a great Calm, and the Hills clear of Clouds or Fogs over them, which in the Highlands are ſeldom ſo. Likewiſe in Hollows, or Concaves of the Earth, or Wells, there will be a great Noiſe as if you were in a great Storm, and at Night the Stars looking very bigg with Burs about them, and the North-Weſt Sky very Black and Fowl, the Sea ſmelling ſtronger than at other times, as uſually it doth in great Storms; and ſometime that Day, for an Hour or two, the Wind blows very hard Weſterly, out of his uſual Courſe.

On the Full of the Moon you have the ſame Signs, but a great Bur about the Moon, and many times about the Sun.

The like Signs muſt be taken Notice of on the Quarter Days of the Moon, in the Months of *July*, *Auguſt*, and *September*; for the *Hurricanes* come in thoſe Months; the ſooneſt that I ever heard of was the 25*th* of *July*, and the lateſt was the 8*th* of *September*, but the uſual Month they come in is *Auguſt*.

The Benefit I have had of Foretelling theſe *Hurricanes* is, that whereas heretofore they were ſo Dreadful, that all Ships were afraid to go to Sea, and did rather chuſe to ſtay in the Roads at Anchor, than to run the Hazard of the Mercileſs Sea, although never Ship eſcaped at Anchor, but was caſt a Shoar; many times by the Violence of the Storm, ſome Veſſels have been caſt ſo far on the Shoar, that when the Storm was over, they have been from 20 or 30 Yards Dry from the Waſh of the Shore, and the Veſſels ſet whole; and by this Means the Lives of thoſe that were in thoſe Veſſels were ſaved. But I finding that if a Man keeps his Ship Sailable, with good ſtore of Ballaſt, his Ports well Barr'd and Calked, his Topmaſts down, and his Tops too if he have time, his Yards a-Port laced, or long Ships, keeping ſecure his Doors and Windows of his Ship, and ſhe will lye as well as in other Storms; and they may, having their Ships in a readineſs, ſtay in the Road till the Storm begins, which is always firſt at North, ſo to the North-Weſt, till he comes round to the South-Eaſt, and then his Fury is over. So with the North Wind they may run away to the South, to get themſelves Sea-room for drift of the South-Weſt Wind, where he blows very fiercely; by theſe Means, I have, by God's Bleſſing, preſerved my ſelf in two *Hurricanes* at Sea, and in three at Shoar, in the Years 1657, 1658, 1660, 1665, and 1667. In thoſe at Sea I loſt not a Sail, Yard, or Maſt; they being two great *Hurricanes*. And in the Year 1667, I being a Shore at *Nevis*, there was a *Hurricane* on the 19 Day of *Auguſt*, and fourteen Days before I did take notice of the Foregoing *Signs* on a Full Moon; and I acquainted Sir *John Berry*, who was Commander of his Majeſty's Ship *Coronation*, and ſeveral other Commanders there, who did make their Ships ready for the Sea; and in the Morning about 4 of the Clock, the Wind coming

coming hard Northerly, they put to Sea; and by God's Bleſſing came all back, in 4 or 5 Days time, ſafe to the Road again. On the Shore, being Confident of the *Hurricane*'s coming, I took ſuch care before-hand to ſecure my Sugars and Goods in the Store Houſe, that when the *Hurricane* had carried away the Roof of the Houſe, all except one Hogshead of Sugar remained ſafe.

The Reaſons and Cauſes of theſe *Violent Storms*, according to my Judgment, may be theſe.

1. It is not unknown to all Men of Experience, that to the Southward of the *Tropick* there is conſtantly a *Trade-Wind*, or Eaſterly Wind, which goes from the North to the South Eaſt all the Year about; except where there are Reverſions of *Breezes*, and Inletts near the Land; ſo that when this *Hurricane*, or rather *Whirl-Wind*, comes in Oppoſition to the Conſtant *Trade-Wind*, then he pours down with that force and Violence, that it exceeds all Storms of Wind in the World; for he takes Trees away by the Roots, and thoſe that are extraordinarily ſtrong Rooted, he twiſts off in the Middle: In the *Hurricane* in 1667 at *Nevis*, I ſaw the High Mountain that was all Green with Trees, left in moſt places Bare, and the Wood lying in ſuch a Condition, with half Trees, or Stumps, or Quarters, that one would think it almoſt incredible.

2. It is remarkable by all Men that have been in thoſe parts where the Sun comes to a *Zenith*, that at his approach towards the *Zenith* there is always Fair Weather; but at his Return to the Southwards, it occaſions off the North parts of the *Æquinoctial* generally much Rains and Storms, as *Tornadoes*, and the like, which makes the Wind in the *Tornadoes* to come on ſeveral Points. But before it comes, it Calms the conſtant Eaſterly Winds; and when they are paſt, the Eaſterly Wind gathers Force again, and then the Weather clears up Fair.

3. The Wind being generally betwixt the *Tropicks* Eaſterly, unleſs at ſuch times as before declared, meeting with the Oppoſition of theſe *Hurricanes*, which comes in a contrary Courſe to that *Trade-Wind*, doth cauſe this Violent *Whirl-Wind*, on the Sun's leaving the *Zenith* of *Barbadoes*, and thoſe adjacent Iſlands; by which the Eaſterly Wind doth much decay of his Strength: and then the Weſt-Wind, which is kept back by the Power of the Sun, doth with the greater Violence and force pour down on thoſe parts where he encroaches. And it is uſual in our Sailing from *Barbadoes*, or thoſe Iſlands, to the North for a Weſterly Wind, when we begin to loſe our Eaſterly Wind to have it Calm, as it is before *Hurricanes*: And then the wind ſpringing up, cauſeth it, till it comes well ſetled, to be Various, but after the ſetled Weſterly Wind comes freſh, we have been conſtantly without thoſe Shufflings from Point to Point.

Here is to be obſerved, that all *Hurricanes* begin from the North to the Weſtward, and on thoſe Points that the Eaſterly Wind doth moſt violently Blow, doth the *Hurricane* Blow moſt fiercely againſt it; For from the *N. N. E.* to the *E. S. E.* the Eaſterly Wind bloweth freſheſt; ſo doth the *W. N. W.* to the *S. S. W.* in the *Hurricane* blow moſt violent; and when

he comes back to the *S. E.* which is the common Courſe of the *Trade-Wind*, then he ceaſeth of his violence, and ſo breaks up. So, with Submiſſion to better Judgments, I take the cauſe of *Hurricanes* to be the Sun's leaving the *Zenith* of thoſe parts towards the South. And Secondly, the Reverſe or Rebounding back of the Wind, which is occaſioned by the Calming of the *Trade-Wind*.

But it will be Objected, Why ſhould not this Storm be all over thoſe parts of the *Weſt-Indies*, as well as *Barbadoes* and the *Leeward-Iſlands*? To which I anſwer, That it hath, in about 25 Years of my Experience, taken its courſe from *Bermudoes*, or *Summer Iſlands*, to the *Caribee Iſlands*; but ſeldom or never doth he carry ſuch a Breadth, as from the Latitude of 16 to 32 Degrees, which is the Latitudes of the one and the other places; but it hath been obſerved, that when *Hurricanes* have been in *Martinico*, which is within two Degrees of Latitude, and two Degrees of Longitude, according to the Miles of that Circle, yet no *Hurricane* hath been in *Barbadoes*; nor could I ever call any of the former Storms at *Barbadoes Hurricanes*, till that in 1675. Again, it hath been noted, that *Hurricanes* have done the like to the Northwards: For when the *Hurricane* hath been in *Antegoa* and St. *Chriſtopher's*, thoſe Ships that were but in the Latitude of 20 Degrees had no *Hurricane*, but conſtant Weſterly Winds reaſonable Fair, and then there were no *Hurricanes* in *Bermudoes*; and when the *Hurricanes* were at *Bermudoes*, the *Leeward* or *Caribee Iſlands* had no *Hurricane*; nor had thoſe Iſlands the *Hurricane* when *Barbadoes* had it.

It will be further Objected, Why the *Hurricane* was never known to go farther to the Weſtward than *Porto Rico*, which lies in or near the Latitude of thoſe Iſlands of St. *Chriſtopher's*? To this I Anſwer, That from *Porto Rico* downwards, both that Iſland as well as *Hiſpaniola*, and other Iſlands there adjacent, are of vaſt Greatneſs and very High Lands, that of themſelves doth moſt commonly give Reverſal or Weſterly Winds at Night, through the Year: For there, for the Reaſons aforeſaid, the Eaſterly Wind, towards Night doth Calm, and thoſe Lands afford a *Land Wind*, which the other Iſlands cannot do, by Reaſon of the ſmallneſs of thoſe *Caribee Iſlands*, but very near the Shore, the *Trade-Wind* having his full Power till this General *Whirl-Wind* comes, for the Reaſons aforeſaid.

I do imagine ſo likewiſe to the Southwards of *Barbadoes*, where the *Tornadoes* come frequently, there is no *Hurricanes*; neither was there at *Barbadoes*, when theſe *Tornadoes* did commonly come there, which made ſome ſmall Reverſal, though it was but for 2 or 3 Hours: Yet the Eaſterly Wind, giving ſome Way by the Sun's Declining from that *Zenith*, doth prevent this Furious Reverſe, where it hath no Vent, till by the Violence of the two Winds it is forced.

An Experiment of the Evaporation of Water; by Mr. Edm. Halley. 189. p. 366.

XXXI. We took a Pan of Water (Salted to the ſame degree as is common Sea-Water, by the Solution of about a 40*th* part of Salt) about 4 Inches deep, and 7 Inches $\frac{2}{10}$ Diameter, in which we placed a *Thermometer*, and by means of

of a Pan of Coals, we brought the Water to the ſame Degree of Heat which is obſerved to be that of the Air in our Hotteſt Summers; the *Thermometer* nicely ſhewing it. This done, we affixed the Pan of Water, with the *Thermometer* in it, to one end of the beam of the Scales, and exactly counterpoiſed it with Weights in the other Scale; and by the application or removal of the Pan of Coals, we found it very eaſy to maintain the Water in the ſame degree of Heat preciſely. Doing thus, we found the Weight of the Water ſenſibly to Decreaſe; and at the end of two Hours, we obſerved that there wanted half an Ounce *Troy*, all but 7 Grains, or 233 Grains of Water, which in that time had gone off in Vapour; tho' one could hardly perceive it ſmoak, and the Water were not ſenſibly Warm. This quantity in ſo ſhort a time ſeemed very conſiderable, being little leſs than 6 Ounces in 24 Hours, from ſo ſmall a Surface as a Circle of 8 Inches Diameter. To reduce this Experiment to an exact *Calculus*, and determine the thickneſs of the Skin of Water that had ſo Evaporated, I aſſume the Experiment alledged by Dr. *Edw. Bernard* to have been made in the *Oxford Society*, *viz.* that the Cube Foot *Engliſh* of Water weighs exactly 76 Pounds *Troy*; this divided by 1728, the Number of Inches in a Foot, will give $253\frac{1}{3}$ Grains, or half Ounce $13\frac{1}{3}$ Grains for the Weight of a Cube Inch of Water; wherefore the Weight of 233 Grains is $\frac{233}{253\frac{1}{3}}$ or 35 parts of 38 of a Cube Inch of Water. Now the Area of the Circle, whoſe Diameter is $7\frac{9}{10}$ inches, is 49 Square Inches; by which dividing the quantity of Water Evaporated, *viz.* $\frac{35}{38}$ of an Inch, the Quote, $\frac{35}{1862}$ or $\frac{1}{53}$, ſhews that the Thickneſs of the Water Evaporated was the 53*d* part of an Inch: But we will ſuppoſe it only the 60*th* part, for the facility of Calculation. If therefore Water as Warm as the Air in Summer, Exhales the thickneſs of a 60*th* part of an Inch in two hours from its whole Surface, in 12 hours it will exhale the $\frac{1}{10}$ of an Inch; which quantity will be found abundantly ſufficient to ſerve for all the Rains, Springs, and Dews, and account for the *Caſpian Sea*'s being always at a Stand, neither Waſting nor Overflowing; as likewiſe for the Current ſaid to ſet always in, at the *Streights* of *Gibralter*, tho' thoſe *Mediterranean Seas* receive ſo many and ſo conſiderable Rivers.

To eſtimate the Quantity of Water ariſing in Vapour out of the Sea, I think I ought to conſider it only for the time the Sun is up, for that the Dews return in the Night, as much if not more Vapours than are then Emitted; and in Summer the Days being longer than 12 Hours, this exceſs is ballanced by the weaker Action of the Sun, eſpecially when Riſing before the Water be warmed: So that if I allow $\frac{1}{10}$ of an Inch of the Surface of the Sea to be Raiſed *per diem* in Vapours, it may not be an improbable Conjecture.

Upon this Suppoſition, every 10 Square Inches of the Surface of the Water yields in Vapour *per diem* a Cube Inch of Water; and each Square Foot half a Wine Pint; every ſpace of 4 Foot Square, a Gallon; a Mile Square, 6914 Tons; a Square Degree, ſuppoſe of 69 *Engliſh* Miles, will Evaporate 33 Millions of Tons: and if the *Mediterranean* be eſtimated at 40 Degrees long and 4 broad, allowances being made for the places where it is broader by thoſe where it is

nar-

narrower, (and I am ſure *I* gueſs at the leaſt) there will be 160 Square Degrees of Sea; and conſequently the whole *Mediterranean* muſt loſe in Vapour, in a Summer's Day, at leaſt 5280 Millions of Tons. And this quantity of Vapour, though very great, is as little as can be concluded from the Experiment produced: And yet there remains another Cauſe, which cannot be reduced to the Rule, I mean the Winds, whereby the Surface of the Water is lick'd up, ſometimes faſter than it Exhales by the Heat of the Sun, as is well known to thoſe that have conſidered thoſe Drying Winds which Blow ſometimes.

The *Mediterranean* receives theſe conſiderable Rivers; the *Iberus*, the *Rhone*, the *Tiber*, the *Po*, the *Danube*, the *Neiſter*, the *Boryſthenes*, the *Tanais*, and the *Nile*, all the reſt being of no great Note, and their quantity of Water inconſiderable. We will ſuppoſe each of theſe nine Rivers to bring down Ten times as much Water as the River *Thames*, not that any of them is ſo great in reality, but to comprehend with them all the ſmall Rivulets that fall into the Sea, which otherwiſe I know not how to allow for.

To Calculate the Water of the *Thames*, *I* aſſume that at *Kingſton Bridge*, where the Flood never reaches, and the Water always runs down, the Breadth of the Channel is 100 Yards, and its Depth 3, it being reduced to an equality, (in both which Suppoſitions *I* am ſure *I* take with the moſt). Hence the Profile of the Water in this place is 300 Square Yards: this Multiplied by 48 Miles, (which *I* allow the Water to run in 24 Hours, at 2 Miles in an Hour) or 84480 Yards, gives 25344000 Cubick Yards of Water to be Evacuated every Day, that is, 20300000 Tons *per diem*; and *I* doubt not but in the exceſs of my meaſures of the Channel of the River, *I* have made more than ſufficient allowance for the Waters of the *Brent*, the *Wandel*, the *Lea*, and *Darwent*, which are all worth notice, that fall into the *Thames* below *Kingſton*.

Now if each of the aforeſaid 9 Rivers yield Ten times as much Water as the *Thames* doth, 'twill follow that each of them yields but 203 Millions of Tons *per diem*, and the whole 9 but 1827 Millions of Tons in a Day; which is but little more than $\frac{1}{3}$ of what is proved to be raiſed in Vapour out of the *Mediterranean* in 12 hours time.

The Evaporation of Water in a Cloſe Room at Greſham Coll. 1693. *by Mr.* Edm. Halley. n. 212. p. 183.

XXXII. In Order to explain the Circulation of Vapour Experimentally, *I* cauſed an Experiment of the Quantity of Vapour ariſing ſimply from the Warmth of the Water, without being expoſed either to Sun or Wind, to be made in *Greſham Colledge*, which was performed with great care and Accuracy by Mr. *Hunt*, *Operator* to the *Royal Society*. Having added up into one Sum the Evaporations of the whole Year, *I* find, that from a ſurface as near as could be meaſured of 8 Square Inches, there did Evaporate during the Year, 16292 Grains of Water, which is 64 Cube Inches of Water, and that divided by 8 Inches, the Area of the Water's Surface, ſhews that the depth of Water Evaporated in one Year amounts to 8 Inches. But this is much too little to anſwer to the

the Experiments of the *French*, who found that it Rained 19 Inches Water in a Year at *Paris*; Or thoſe of Mr. *Townley*, who by a long continued ſeries of Obſervations, has ſufficiently proved, that in *Lancaſhire*, at the Foot of the Hills, there falls above 40 Inches of Water in the Year's time. Whence it is very obvious, that the Sun and Wind are much more the cauſes of Evaporation, than any internal Heat or agitation of the Water.

The ſame Obſervations do likewiſe ſhew an odd quality in the Vapours of Water, which is that of adhering to the Surface that Exhaled them, which they cloath as it were with a Fleece of Vaporous Air, which once inveſting it, the Vapour riſes afterwards in much leſs Quantity: which was ſhewed by the ſmall quantity of Water that was loſt in 24 hours time, when the Air was very ſtill from Wind, in proportion to what went away when there blew a ſtrong gale, although the Experiment were made in a place as cloſe from the Wind as could well be contrived. For which reaſon *I* do not at all doubt, that had the Experiment been made where the Wind had come freely, it would have carried away at leaſt three times as much as we found, without the aſſiſtance of the Sun, which might perhaps have doubled it.

By the ſame Experiment it likewiſe appears, that the Evaporations in *May*, *June*, *July*, and *Auguſt*, (which are nearly equal) are about three times as much as what Evaporated in the four Months of *November*, *December*, *January*, and *February*, which are likewiſe nearly equal; *March* and *April* anſwering nearly to *September* and *October*.

This *Fleece* of Vapour in ſtill Weather hanging on the ſurface of the Water, is the occaſion of very ſtrange Appearances, by the Refraction of the ſaid Vapours differing from that of the Common Air, whereby every thing appears raiſed; as Houſes like Steeples, Ships as on Land above the Water, and the Land raiſed, and as it were lifted from the Sea, and many times ſeeming to overhang. And this may give a tolerable account of what I have heard of ſeeing the Cattle, at High water time, in the *Iſle* of *Dogs* from *Greenwich*, when none are to be ſeen at Low-water, (which ſome have endeavoured to explain, by ſuppoſing the *Iſle* of *Dogs* to have been lifted by the Tide coming under it). But the evaporous Effluvia of Water, having a greater degree of Refraction than the Common Air, may ſuffice to bring thoſe Beams down to the Eye, which when the Water is retired, and the Vapours ſubſided with it, paſs above, and conſequently the Objects ſeen at the one time may be conceived to diſappear at the other.

Jan.

JANUARY 1693.					FEBRUARY 1693.				
D.	Grains.	Ther.	Barometer.	Weather.	D.	Grains.	Ther.	Barometer.	Weather.
1	31½	5	29, 7	Froſt.	1	36	29	30, 0	
2	21	14	29, 7	Some Rain.	2	27	26	30, 2	
3	21	12	29, 7		3	33	25	30, 2	
4	23½	8	29, 7		4	48	16	29, 9	
5	23½	8	30, 1		5	30½	20	29, 9	Some Rain.
6	26½	1	30, 5	Froſt.	6	26	16	29, 9	Small Rain.
7	31	—3	30, 5	Froſt.	7	26	17	29, 8	
8	25	—5	30, 4	Froſt.	8	28	11	29, 9	A Fogg.
9	23	—3	30, 4	Froſt.	9	23	16	30, 0	
10	18	0	30, 4		10	26	20	30, 0	
11	18	0	30, 4		11	39	8	30, 0	
12	18	0	30, 4		12	40	5	29, 8	
13	22	—6	30, 3	Froſt.	13	52	—1	29, 4	High Wind.
14	20½	—7	30, 3	Froſt.	14	35	6	29, 2	
15	21¼	—10	30, 3	Froſt.	15	35	11	29, 4	Some Rain.
16	24	—15	30, 4	Froſt.	16	24	20	29, 2	Rain.
17	18	—13	30, 3½	Froſt.	17	39	20	29, 5	Rain.
18	18	—11	30, 2	Froſt.	18	39	19	29, 8	
19	14	—10	30, 1	Froſt.	19	35½	17	29, 7	
20	14	—3	29, 6		20	35½	16	29, 3	
21	21	0	29, 9		21	35	17	29, 0	Rain
22	18	2	29, 9		22	29	10	29, 2	
23	18½	0	30, 0	Froſt.	23	35	5	29, 3	
24	18½	—3	30, 0	Froſt.	24	37	1	29, 2	
25	14½	9	29, 9		25	35	—5	29, 4	
26	14½	14	29, 7		26	23½	—8	29, 0	Snow.
27	20	17	29, 2		27	21	—11	29, 4	Froſt.
28	36	10	29, 7		28	24	—14	29, 3	Froſt.
29	27½	15	29, 5	Some Rain.					
30	27½	15	29, 7						
31	27	27	29, 6						
	675 Grains.					690½ Grains.			

MARCH. 1693.					APRIL. 1693.				
D.	*Grains.*	*Ther.*	*Barometer.*	*Weather.*	*D.*	*Grains.*	*Ter.*	*Barometer.*	*Weather.*
1	25	— 12	29, 2	Froſt.	1	32	15	29, 4	
2	31½	— 12	29, 1	Snow	2	39	15	29, 5	
3	28	— 13	29, 3	Snow Froſt	3	37½	14	29 7	
4	28	—12	29, 6	Froſt	4	37	23	29 6½	
5	28	—8	29, 3	Froſt	5	38	29	29 2	
6	20	—1	29 1		6	29	32	29, 2	
7	35½	5	29, 3	Rain	7	32	33	29, 3	
8	39	9	29, 7		8	32	35	29, 4	
9	42½	8	30, 0		9	28½	40	29, 2	
10	39	14	30, 0		10	35	33	29, 4	
11	33	21	30, 0		11	37	33	29, 4	
12	42	21	29, 8		12	34	37	28, 9	
13	42	22	29, 6½		13	39	32	29, 4	
14	46	23	29, 4		14	39	33	29, 5	
15	62½	14	29, 6		15	39	29	29, 7	
16	41	19	29, 5		16	35	30	29, 8	
17	42½	12	29, 4		17	37	31	29, 6½	
18	50	10	28, 9		18	36½	36	29, 4	
19	51½	7	29, 2		19	33½	36	29, 3½	
20	45	8	29, 2		20	36	32	29, 3	
21	41	7	29, 0		21	39	37	29, 2	
22	50	8	29, 4		22	46	35	29, 4	
23	37	10	29, 5		23	42½	35	29, 5	
24	33½	6	29, 4		24	52	35	29, 2	
25	27½	7	29, 3		25	50	35	29, 3½	
26	30	11	29, 4		26	56	36	29, 7	
27	57	9	29, 6		27	38	44	29, 5	
28	38	4	29, 6		28	43	46	29, 7½	
29	30	17	29, 5		29	40	49	29, 6	
30	30	20	29, 4½		30	52	42	29, 9	
31	20	24	29, 3						
	1166 *Grains*					1203 *Grains*			

MAY. 1693.					JUNE. 1693.			
D.	*Grains.*	*Ther.*	*Barometer.*	*Weather.*	*D.*	*Grains.*	*Ther.*	*Barometer.*	*Weather.*
1	56	35	30, 1		1	78	65	29, 9	
2	61	26	30, 0		2	85	62	30, 0	
3	66	21	30, 1		3	95	54	30, 2	
4	61	19	30, 1		4	77	52	30, 1½	
5	52	31	30, 1		5	63	50	29, 9	
6	48	45	29, 8		6	49	60	29, 7½	
7	59½	35	29, 8		7	46	67	29, 7	
8	51	34	29, 7		8	63	63	29, 7	
9	51	31	29, 6		9	63	69	29, 8	
10	43	35	29, 5		10	63	71	29, 8	
11	49	30	29, 5		11	55	70	29, 8½	
12	54	32	29, 6		12	58	87	29, 8	
13	59	26	29, 7		13	59	75	29, 9	
14	59	32	29, 7½		14	86	72	29, 7	
15	46½	35	29, 7		15	63	79	29, 8	
16	46½	34	29, 8½		16	58	78	29, 9	
17	56	36	30, 1		17	86	79	30, 0	
18	70½	36	30, 3		18	81	66	30, 0	
19	58½	47	30, 1		19	92	57	30, 1	
20	76	50	30, 0		20	81	60	30, 0	
21	62	52	30, 1		21	80	71	29, 9	
22	73	64	30, 1		22	76	67	29, 8	
23	78½	64	30, 1		23	63	69	29, 7	
24	90	62	29, 9½		24	63	62	29, 6	
25	61	74	29, 9		25	57	65	29, 8	
26	67½	68	29, 9½		26	46	70	30, 0	
27	64	75	29, 9½		27	49½	68	30, 0	
28	71	67	30, 1		28	52	74	30, 0	
29	80	69	30, 2		29	59	68	30, 2	
30	89½	70	30, 2		30	62	69	30, 2	
31	106	68	29, 9						
	1968 *Grains.*					2008½ *Grains.*			

JULY. 1693.					AUGUST. 1693.				
D.	Grains.	Ther.	Barometer.	Weather.	D.	Grains.	Ther.	Barometer.	Weather.
1	75	67	30, 0		1	80	71	29, 5	
2	75	67	30, 0		2	77	73	29, 6	
3	63	62	30, 0		3	77	63	29, 8	
4	62	61	30, 1		4	78	64	29, 9	
5	60	63	30, 1		5	79	73	29, 9	
6	74	65	30, 0		6	81	70	29, 9	
7	61	65	30, 0		7	94	83	29, 6	
8	51	65	30, 0		8	79	86	29, 6	
9	46	74	29, 9		9	68	82	29, 7	
10	52	77	29, 9		10	70	83	29, 8	
11	72	74	29, 8		11	92	85	29, 8½	
12	74	82	29, 4		12	70	80	30, 0	
13	88	75	29, 7		13	81	73	29, 9	
14	83	62	29, 9		14	68	75	29, 7	
15	84	65	30, 1		15	69	74	29, 9	
16	84	68	29, 8		16	77	72	29, 8	
17	71	58	30, 1		17	77	77	29, 7	
18	77	65	30, 2		18	84	77	29, 7	
19	66	78	30, 1½		19	86	64	29, 5	
20	71	78	30, 1		20	78	68	30, 0	
21	72	82	30, 0		21	68	67	29, 7	
22	90	74	30, 0		22	71	65	29, 7	
23	99	68	30, 0		23	75	55	29, 9	
24	85	71	30, 0		24	64	54	29, 5	
25	85	81	29, 9		25	63	57	29, 5	
26	94	75	29, 9½		26	58	59	29, 4	
27	97	70	29, 8		27	60	55	29, 5	
28	81	78	29, 7		28	53	55	29, 9	
29	87	67	29, 9		29	53	58	29, 7	
30	78	64	29, 9		30	53	56	29, 7	
31	78	79	29, 3½		31	63	48	29, 7	
	2335 *Grains.*					2246 *Grains.*			

SEPTEMBER. 1693.					OCTOBER. 1693.			
D.	Grains.	Ther.	Barometer.	Weather.	D.	Grains.	Ther.	Barometer. Weather.
1	53	53	29, 7		1	40	35	29, 9
2	55	50	29, 6		2	37	41	29, 6
3	61	50	29, 7		3	41	35	29, 7
4	61	48	29, 7		4	27	49	29, 6
5	63	44	29, 8		5	29	48	30 0
6	74	40	29, 7		6	31	49	30, 2
7	62	39	29, 6		7	29	58	30 0
8	59	49	29, 5		8	37	60	30, 0
9	40	52	29, 5		9	39	59	30, 2
10	50	48	29, 6½		10	37	55	30, 1
11	46	41	29, 7		11	34	55	29 9
12	48	43	29, 8		12	38	55	29, 8
13	46	53	29, 7		13	39	42	30, 0
14	43	57	29, 5		14	49	38	29, 8
15	46	70	29, 2		15	44	28	29, 7
16	49	54	29, 3		16	44	19	29, 7
17	46	52	29, 1		17	35	23	29, 1
18	52	45	29, 0		18	34	24	29, 2
19	48	45	29, 3		19	34	20	29, 2
20	50	44	29, 6		20	35	21	29, 5
21	43	42	29, 9		21	35	17	29, 9
22	41	51	29, 5		22	24	28	29, 7
23	46	45	29, 9		23	28	25	29, 7
24	44	52	29, 7		24	39	20	30, 0
25	41	47	29, 8		25	41	13	30, 0
26	43	47	29, 6		26	34	16	29, 9
27	46	45	29, 7		27	33	13	30, 0
28	47	40	29, 9		28	32	18	29, 8
29	50	44	29, 8		29	33	10	29, 8
30	40	42	29, 5		30	35	5	29, 7
					31	28	7	29, 4
	1495 *Grains.*					1095 *Grains.*		

NOVEMBER. 1693.					DECEMBER. 1693.				
D.	Grains.	Ther.	Barometer.	Weather.	D.	Grains.	Ther.	Barometer.	Weather.
1	18	22	29, 6		1	34½	—16	30, 0	Froſt.
2	15	30	29, 7		2	16¼	—10	30, 0	Rain
3	24	34	29, 6		3	12	—0	29, 9	
4	26	30	29, 7		4	12	7	29, 4	Some Rain.
5	33	21	29, 8		5	17½	10	29, 2	
6	33	10	29, 8		6	33	15	29, 4	Some Rain.
7	29	9	29, 7		7	19½	15	29, 1½	
8	20	23	29, 5		8	18	20	29, 0	Rain & much W
9	21	21	29, 9		9	18	27	28, 6½	R. and Storm.
10	21	30	29, 7		10	25	16	28, 9	Some Rain.
11	32	27	29, 7		11	28¾	13	29, 6	
12	22½	34	29 5		12	28	9	29, 5	
13	31	23	29, 4		13	25	14	29, 2	
14	25½	15	28, 9		14	15	20	29, 2	Some Rain.
15	27	10	29, 4		15	19	20	29, 5	
16	25½	3	29, 6		16	22½	15	29, 5	
17	26	—7	29, 5		17	17½	20	29, 5	
18	21	—1	29, 5	great Fog.	18	21½	10	30, 1	
19	21	—2	29, 5	great Fog.	19	22	3	30, 0	
20	19	2	29, 6		20	16	6	29, 8	
21	15	5	29, 8	Fog.	21	14½	9	29, 6	
22	11½	12	29, 7	Some Rain.	22	16½	14	29, 3	
23	20½	14	29, 7		23	22	11	28, 5	Stormy.
24	24½	8	29, 8		24	23	4	29, 0	
25	24½	5	29, 9		25	22	0	29, 5	Froſt.
26	33	—12	29, 9	Froſt.	26	22	5	29, 2	Rain.
27	33½	—12½	29, 9	Froſt.	27	16	10	29, 3	
28	27	—14	29, 8	Froſt.	28	20	6	29, 0	
29	42	—16	29, 8	Water	29	25½	0	29, 2	Froſt.
30	42	—17	29, 9	Frozen.	30	19½	5	28, 6	Stormy.
	764 *Grains.*				31	24	7	29, 2	
						646 *Grains.*			

Note, That in the Column of the *Thermometer*, —denotes Degrees of Cold below the Freezing Point; and that from the 10*th*. of *Nov.* to the End, belong to the foregoing Year 1692.

The Changes of Weather from the Alterations of the Gravity of the Atmosphere; *by Dr.* Garden. n. 171. p. 991.

XXXIII. 1. The Air agrees with all other Fluids in this, that it *Gravitates*; and it has this peculiar Property (which is not so much observed of other Fluids,) that its *Specifical Gravity* is not always the same. Now you know according to the certain Rules of the ballancing of Fluids amongst themselves, every Fluid *Specifically Lighter* than another will Ascend and Emerge above it, and every Fluid *Specifically Heavier* than another will Descend and Subside below. Now there is some certain proportion between the *Specifical Gravities* of the Fluid of Air, and of that which Ascends in Vapours and Falls down again into Rain; and if this proportion were still the same, 'tis like we would have no commixture of those Fluids, but the Vapours would either always float above or always stay below. But this proportion of their *Specifical Gravity* is frequently changed; for it is known that water when Warm and Tepid is Lighter than when it is Cold, and the dayly Observations of the different Heights of the *Mercury* in the *Baroscope* do make appear, that the *Atmosphere's* Gravity is not always the same. And now from these known properties may be easily deduced a Statical account of the Rising of Vapours, their being carried in the Air in Clouds, and their falling down again into Rain. For if we may be allowed to suppose that when the *Atmosphere* is Heaviest, there is some such proportion between its *Specifical* Gravity, and that of the Fluid of Vapours, as there is between Water and Oyl; the Vapours according to the known Laws of Fluids must needs Ascend, and so long as this proportion continues they must needs Float above in the Air: But when the *Atmosphere's* Gravity is changed, the Vapours must Fall down again.

I do not know any determinate Instrument that will indicate the Ascent of Vapours, as certainly as the *Baroscope* does the Change of the Air's Weight (for our common *Hygroscopes* are not very exact, and besides I suppose their Change by moisture shews rather the Falling than the Rising of Vapours) yet there are two or three Observations which seem certain Indications of their Ascent: as first, if the *Horizon* and the remote Hills seem Smoaky and inconspicuous, so that nothing can be seen at any distance, and that tho' the Heavens be not Cloudy but Clear, and tho' there be no Fog nor yet any Cap of Clouds upon the Hills (which do rather indicate the falling of Vapours). Again, if when you look to any distant part of the Country, round about you, it appear all in an Undulating Motion, this seems to be a Sign of the plentiful Rising of Vapours, for this is only occasioned by looking through an unequal Waving Medium, which makes frequent Inflections of the Beams of Light, as you see any Object seems to have a Tremulating Motion in all its parts when you look upon it through Smoak. Another Indication of the Ascent of Vapours seems to be the copious Rising of Steams above Waters, Marish grounds, and Fens, which is frequently seen in Frosts, and in Cool nights in Summer. To these *I* may add the Redness of the Sun (so as to be eatily look'd upon) and Moon, a considerable time before their Setting, or after their Rising. Now since I have had occasion to make Observations of the *Baroscope*; *I* have always taken notice of all these when the *Mercury* was Rising, and consequently in the Increase of the *Atmosphere's* Gravity: But on the contrary, when the *Mercury* has been Low in the *Baroscope*, and so the *Atmosphere's* Gravity less, *I* have observed none of these Effects, but the Remote Hills were Clear and Distinct (unless

(unleſs ſometimes a Cloud had fall'n down upon them,) and no Waving to be obſerved in the Air, nor Steams from the Waters. *I* know not whether *I* may add here a conjecture about the great Light, and the *Capræ Saltantes*, which are ſome Nights to be ſeen in the North. *I* have taken notice of them uſually when the *Mercury* has been High in the *Baroſcope*, and then they appearing in that quarter of the Heavens where the Sun is at that time below the *Horizon*; this has given me occaſion to think, that perhaps the Steams of Vapours may have Aſcended ſo far in the *Atmoſphere* as to be beyond the Earth's Shadow, in that part of the *Horizon*, and ſo by Refracting the Beams of Light toward us to occaſion that Light, and thoſe *Capræ Saltantes*. It may be conſidered alſo whether the Red Skies in the Evening, which betoken Fair Weather, do not proceed from the Height of the Clouds occaſioned at that time by the Increaſe of the *Specifical Gravity* of the *Atmoſphere*.

Now as to the Falling down of the Vapours again; it is viſible by their gathering into thick and dark Clouds, by the Falling down of Clouds and Miſts on the Tops of Hills, and thick Fogs in the Air, and by their Dropping down into Rain, Snow, *&c.* and that theſe do uſually fall out only when the *Mercury* ſubſides a little, and conſequently when the *Atmoſphere*'s Gravity is leſs, is the conſtant Obſervation of thoſe who have had occaſion to take notice of the Changes of the *Baroſcope*.

Againſt this it may be Objected, that it is obſervable many times that even when the *Mercury* in the *Baroſcope* is Riſing there will be Rain, and particularly ſometimes in North-Eaſt Winds. To this *I* anſwer, that if the Clouds have been carried for ſome while towards one Quarter of the Heavens by the Winds, and then if the Winds do ſuddenly Change into another Quarter, theſe Vapours, which were formerly ſcattered into ſmall particles, and ſo did eaſily float, are ſuddenly driven together into little Drops, and ſo muſt needs Fall down into Rain: and therefore the Falling of Rain while the *Mercury* is Riſing is obſervable only upon the ſudden Change of contrary Winds.

But let us conſider in the next place, whether thoſe frequent commotions in the Air, which we call Winds, may not be accounted for upon the ſame Principles. That known Definition of *Archimedes* is univerſally acknowledged, *Quod earum partium minùs preſſæ expellantur à magis preſſis*; ſo that if there be any portion of a Fluid of a far leſs Preſſure and Reſiſtance than the reſt, the whole Fluid runs in a Current thither, till all be reduced to an *Æquilibrium*. Now it is evident, that the Preſſure of the Air is not always the ſame: And 'tis very probable (which Experience will determine, by making joint Obſervations of the *Baroſcope* in ſeveral places of the Earth at the ſame time) that the Air's Gravity is not alike chang'd throughout the whole *Atmoſphere* in an Inſtant. So that when the Air becomes *Specifically Lighter* in one place, or its Preſſure leſſened, the Neighbouring parts of the *Atmoſphere*, whoſe Weight is not thus leſſened, run thither in a Current, till the *Atmoſphere* thereabouts be reduced to an *Æquilibrium* again; and according to the portion of Air thus changed, and the leſſened or acquir'd degrees of the Weight and Spring, the Currents or Winds are Strong or Weak, of a long or ſhort continuance. Now Obſervation and Experience do agree with this, the *Mercury* being found to

Subſide

Subſide for the moſt part in the *Baroſcope* at the Riſing of Winds; at leaſt it is obſerved to be in Motion, and either Riſing or Falling, and conſequently there is a Change in the *Atmoſphere*'s Preſſure at that time.

But the great difficulty remains ſtill, how to account for the different Changes of the *Specifical Gravity* of the *Atmoſphere*. Of this there can hardly be expected a ſatisfactory account, till we come to know the cauſe of Gravity in general, and of the Air's Weight in particular; and therefore I ſhall only here offer 2 or 3 Hints, which perhaps may incite others to conſider it more narrowly. And *firſt*, it is now almoſt generally acknowledged, that there muſt needs be a Fluid much more Subtile than common Air, and of a far greater Preſſure than Air, which is the cauſe of the Continuity and Coheſion of all Terreſtrial Bodies; and in which the Air ſeems as it were to Float and to have the ſame relation to it, as the Vapours do in and have to the Air, and therefore if we could reach its Nature and Properties, it might be conſidered what Influence this may have upon the Change of the Air's Gravity. Or *Secondly*, ſeeing the Infuſion of one Liquor into another, in Chymical Preparations, will alter its *Specifical Gravity*, ſo that the bodies which were formerly born up in it, will fall down and be Precipitated (as the particles of Gold floating through *Aqua Regis* will be Precipitated by the infuſion of another Chymical Liquor,) it may be conſidered, whether plenty of Nitrous Steams, or ſome ſuch mixture, may not alter the Air's *Specifical Gravity*. Or 3*dly*, we may poſſibly come to a nearer reſolution of this, by conſidering the Influence which the Heat and Cold have upon the Air's Spring. The Air you know has this peculiar Property, which is not ſo much obſerved of other Fluids, that it is endued with *Elaſticity* as well as Gravity, and therefore we are to conſider what Influence the change of its *Spring* may have upon the change of its Weight; and it ſeems evident, that the increaſe of its Spring doth diminiſh its Weight, and the leſſening of its Spring will increaſe it: for upon the increaſe of the Air's Spring, the Air is Rarified, and ſo a leſſer portion of it Preſſes upon the ſubjacent Fluid: but when it is leſſened the Air is Condenſed, and ſo a greater Portion of it Preſſes upon the ſubjacent body. For example, let us ſuppoſe the Springy particles of Air, to be like the Springy hairs of Wool, or the Spring of a Watch; and that many Millions of Rows of them go to make up the Cylinder of Air, which from the top of the *Atmoſphere* Preſſes upon the *Mercury* in the *Baroſcope*, and keeps it ſuſpended to the Height of 30 Inches; let us ſuppoſe this Air Rarified, ſo that all its Springy particles expand themſelves, and therefore ſhut off of this Cylinder ſome Thouſands of thoſe Rows; this Cylinder, being now made up of a far leſſer number of thoſe Rows of particles, muſt needs have a leſſer Preſſure upon the *Mercury*, ſo that it will Subſide, perhaps to 29. And thus it continues till the Air's Spring be weakened, and ſo the particles crowded again into narrower room. Now if this be found to hold in the *Theory*, Experience ſeems very well to anſwer it: for I have hitherto obſerved, that in Cold Weather, and Sharp Froſts, the *Mercury* Riſes higheſt in the *Baroſcope*, and if the Foreign Meaſures agree with ours, it is uſually Higher here than in *France* or *Italy*.

I ſhall

I ſhall here after all ſubjoin two or three Obſervations, which may ſerve to confirm what has been ſaid. The firſt is of the Courſe of the Weather under or near the *Line*. I have read in the *2d* and *4th* parts of *Purchas* his *Pilgrims*, (and I doubt not but later Travellers atteſt the ſame truth,) That, in *Braſil* and *Guiana* in *America*; in *Guinea*, *Congo* and *Æthiopia* in *Africa*; in the *Eaſt Indies* and the *Maldive Iſlands*; they have almoſt continual Floods of Rain from about the beginning of *May* to the end of *Auguſt*, which they call their Winter, and the reſt of the Months of the year Fair and Clear Weather, which they call their Summer: So that when the Sun is neareſt to them, they have conſtant Rains, and when remoteſt, Fair Weather. And this I impute, amongſt other cauſes, to the extraordinary Rarefaction of the Air, and leſſening of its *Specifical Gravity* there at that time, ſo that the Vapours in the Neighbouring parts of the Air do all flow thither, and Deſcend as it were in Floods of Rain. And as this is reckoned to be the Cauſe of the *Inundation* of the *Nile*, and ſome other Rivers, ſo perhaps this may be the reaſon alſo, why thoſe Countries which are Neighbouring to them, and ſomewhat remoter from the *Line*, ſuch as *Ægypt* and the like, have ſeldom or never any Rain.

My Second Obſervation is of the *Baroſcope*, *viz.* that when the Wind is North, North-Eaſt, or North-Weſt, the *Mercury* ever Riſes, and ſo the Air is Heavier; but when the Wind comes from the South, South-Eaſt, or South-Weſt, it Falls and ſo the Air's Gravity is leſs: by which we may ſee what Influence the Cold and Heat have upon the Air's Weight; and you know a Cold Wind is ſaid to drive the Sails of a Ship much more forcibly than a Warm.

My third Obſervation is of an Experiment of the Honourable Mr. *Boyle*; I made, *ſaith he*, by Diſtillation a Blood-Red Liquor, which chiefly conſiſted of ſuch Saline Spirituous particles as may be obtained from the Maſs of Blood in Humane bodies; this Liquor is of ſuch a Nature, that if a Glaſs Viol about half filled with it, be kept well ſtopt, the red Liquor will reſt as quietly as any ordinary one, without ſending up any ſmoak: But if the Viol be unſtop't, ſo that the External Air be permitted to come in, within a quarter of a Minute or leſs, there will be elevated a copious white Smoak, which will not only fill the upper part of the Glaſs, but plentifully paſs out into the open Air, till the Viol be again ſtopped. *And a little after he adds*, If the unſtop't Viol were placed in our *Vacuum*, it would not Emit any viſible Steams at all, nor ſo much as appear in the upper part of the Glaſs it ſelf that held the Liquor; whereas when the Air was by degrees reſtor'd at the ſtop-cock, the returning Air would preſently Raiſe the Fumes firſt into the vacant part of the Viol, whence they would Aſcend into the Capacity of the Receiver; and likewiſe when the Air that was requiſite to ſupport them was Pumped out, they alſo accompanied it, as their unpleaſant ſmell evinced, and the Red Spirit, tho' it remain'd unſtopped, Emitted no more Fumes till the new Air was let in again. *So far He.* Such you ſee was the proportion between the Gravity of the Vapours of this Red Liquor and the Air, that the Air being in its ordinary degree of Gravity theſe Vapours did Aſcend: but the Air's Gravity being much leſſened in the Receiver, by the Pumping out a great deal of it, and ſo expanding the Spring of the reſt, it was not able to Elevate thoſe Vapours.

n. 63. p. 2048.

n. 171. p. 1090.

By Dr. Wallis. *ib.* p. 1002.

2. That there is in our Air a Body more ſubtile than are the Fumes and Vapours mingled with it in our Lower Region, and which with it do make up that Heterogeneous mixture which we commonly call Air, I think to be very certain: But whether that ſubtile body, be (as Dr. *Garden* ſeems to ſuppoſe,) much Heavier, than our common Air, I much doubt; and do rather think it is not, not having hitherto obſerved any Cogent Experiment, either to prove it Heavy or Elaſtick: But it may, for ought I know, be void as well of Weight as Spring; and, what we find of either, in our common Air, may be attributed to the other mixtures with it. For the Air being of a different Gravity, in different times and places, (ariſing I ſuppoſe from the different kinds and quantities of the Fumes and Vapours and other particles which are ingredients in it, and the different force of the Sun's Heat acting thereupon, increaſing or allaying the Spring thereof, and otherwiſe) we are therefore to conſider of the Air as a Fluid whoſe parts are in ſome places Heavier, and others Lighter. And therefore much of a like nature as if they were different Fluids, of different *Specifick* or Intenſive Gravity, one from the other.

Now when ſeveral Fluids, or ſeveral parts of a Fluid, are thus of different Weights, they will (from the general nature of Heavy Fluids,) when undiſturbed, change places with one another, till the Heavier becomes Loweſt, and the Lighter Higheſt.

And this, not only as to the Minuter parts; as is obſerved in Chymical Precipitations, or the ſinking of Sand in Water, or its ſmaller Earthy particles which ſubſide in a muddy ſediment, and the like of other Liquors when at reſt, and the Atoms (as they were wont to be called) flying in the Air when diſturbed, but ſubſiding in the form of duſt when at reſt, all which according as they be ſmaller do (*cæteris paribus*,) ſubſide more ſlowly: But much more as to larger parcels; as when Oyl, Wine, Water, Beer, or other the like Liquors, are put together in the ſame Veſſel, as will be obſervable to the Eye, eſpecially when their Colours are conſiderably different.

And the ſame will happen, if ſome parts of the ſame Liquor, do accidentally acquire (by expanſion or otherwiſe,) a greater degree of Lightneſs than the other parts; thoſe Lightned parts aſcending, the heavier ſubſide; as when Water, Beer, or other thin Fluids, be gradually heated by a Fire underneath, the lower parts, being firſt warmed, Aſcending to the top, while the Colder and heavier Subſide; whence we find in ſuch caſes that Bubbles do ariſe, and that at the top is warmer than that at the bottom: But in caſe what is warmed be of a thicker conſiſtence, ſo as that the parts cannot readily ſhift places, that at the bottom will be hotter; and in caſe it be heated by Fire over it, there will (I ſuppoſe) be no ſuch Bubbling, (or not ſo much of it,) that at the top being firſt heated.

From ſuch conſiderations as this, Dr. *Garden* doth well obſerve, that ſome parts of the Air being thus (by Rarefaction, or increaſing the Spring thereof, or otherwiſe,) become Lighter than others; theſe Heavier parts, ruſhing into the places of thoſe Lighter, may cauſe a Wind as from ſuch parts; (in like manner as, on a like occaſion, a Tyde or Current would ariſe in Water;) and other Accidents of a like nature. And contrarywiſe, on a contrary occaſion.

And

And this I take to be very true, (though ſuch accidents happening very variouſly and uncertainly, will cauſe ſuch confuſion of Motions, and diſturbance of each other, that it will be hard to reduce them to a regular Adjuſtment.)

But I add thereunto, that the Earth's Diurnal Motion, compounded with its Annual, (if we admit that *Hypotheſis*, as moſt do now a-days) the one in ſome parts Accelerating, in others Retarding the other; and its difference in different times of the year, (by reaſon of the Obliquity of the *Zodiack* to the *Æquinoctial*) and in different times of the Month (becauſe of the Moon's different Poſition, which is an Appendance to the Earth's Motion, and doth thereby differently affect it,) and according to the different place of the Earth and Moon, as to the *Aphelion* or *Perihelion* of the one, and the *Apogæum* or *Perigæum* of the other; ſeem to me to be of much greater conſideration, not only as to the *Ebbing* and *Flowing* of the Sea, but as to the Winds alſo: Eſpecially the *Briezes* and *Trade-Winds*, which at certain times of the day, or of the Year, or of the Month, are obſerved to Blow conſtantly (or moſt frequently,) from ſuch or ſuch a Coaſt.

And I am not ſure, that the Body of Earth and Water (or Terraqueous Globe,) is exactly Spherical (allowing only for the ſmall inequalities of Hills and Dales, which in a Body of that greatneſs, are inconſiderable,) but may have ſomewhat of an *Oblong Spheroeid*, having a longer Axis from *Pole* to *Pole*, than at the *Equator*. And though this cannot be much; becauſe of the Earth's Shadow in the Moon's Eclipſe appearing Circular; and the Deſcent of Heavy Bodies being always (as to ſenſe) in a Perpendicular to the *Horizon*: yet if it be but little, this (with the Compound Motions before mentioned,) will give the Air a conſiderable diſturbance.

To which I may add alſo, that we are not ſure, that the Seas and Continents (which are of very different comparative Weights, Earth being heavier than Water,) are ſo adequately adjuſted the one to the other, as that its Center of Gravity (by which a Plain paſſing divides it into parts Æquiponderant,) is the ſame with its Center of Magnitude (by which it is divided into parts equally Great,) which if it happen to be otherwiſe will (with the reſt,) make the Confuſions of the Air's Motions yet greater.

From the Comparative Weight or Lightneſs of the Air at different times he deduceth alſo the Riſing or Falling of Vapours in it. As if, when ſuch Fumes or Vapours; or other the like matters, are Lighter than the Air, they ought (according to the exact rules of *Hydroſtaticks*,) to Aſcend therein; but when Heavier than ſo, to Fall down. And this certainly (*cæteris paribus*) is to be admitted alſo. Only I add thereto; that theſe *Statick Principles* do chiefly take place, when things are otherwiſe at Reſt and Quiet: But when they are in Commotion, it is many times much otherwiſe. And, in ſuch caſes, we muſt, beſide the Reſpective Gravity, take into conſideration, the Force, Impulſe, or Impetus, that is ſuperadded to the Reſpective Gravity of the parts or matter. Thus, if a Bottle be ſhaken, the Sediment at the bottom (though Heavier, and for which cauſe it did before Subſide) will be mingled with the ſupernatant (finer and lighter,) Liquor. And, if a room be ſwept, it will (as we uſe to ſpeak,) make a duſt, that is, the ſmall Earthy particles of duſt, will Riſe and

mingle with the Air: not becauſe they be Lighter than it, (for we ſee that at leaſure they will Subſide again,) but becauſe by a Force upon them they be put into Motion. And this I take to be the Cauſe of Fumes, Vapours and other like matters (moſt of them) which Aſcend in the Air, not becauſe Lighter than it, but becauſe Impelled upward out of the Bowels of the Earth, or from the ſuperficial parts of it, either by ſome Subterraneal Heats or other Ferments, that put them into Motion, and Force them upward where they remain ſuſpended in the Air, ſo long as that Force continues, or the Force of others ſent after them on the like Errand (which rather Impels them farther, then gives them leave to Fall,) till either ſuch Force abate, or the great Weight of ſo many things ſuſpended doth overpower, not only the Air's Weight, but the Strength of that that Impelled them. And that there are ſuch Fumes, and other like matter, Projected upwards from the Bowels of the Earth, and ſome of them with great violence, is undeniable, not only from Earth-quakes and other Eruptions (with great noiſes,) as well of Vapours, as of Burning Mountains; but even Poiſonous Steams (and others,) in Mines and Bubbling Springs (where Bubbles of Air are ſeen to make their paſſage through the Water,) and other perſpirations of Air or Vapour through Cranies or ſmall paſſages of the Earth, diſcoverable by Steams (whereof ſome will take Fire at the light of a Candle,) or by the moving of Leaves and other light things laid on the Mouths of ſuch private paſſages, and by many other means. And to ſuch cauſes I do principally attribute the *Origine* of *Winds*, and the Aſcent of moſt other things, which from this Lower World, mount into the Air: And, without this, the Comparative Gravity of the Air and them, would give us but a lame account of them.

There is yet another Notion ſuggeſted, which is alſo very conſiderable as to this affair, which is the Weakning or Strengthning the Spring of the Air. That water hath (of it ſelf,) nothing of Spring or Elaſticity (otherwiſe than by reaſon of ſome Airy parts, or other Elaſtick bodies, which may be included within it,) is generally held; at leaſt none conſiderable, ſuch as by any Experiments hitherto made can be clearly evinced ſo to be. But, that the Air (ſuch Air at leaſt as is the common Air which we are converſant with,) is Elaſtick, is I think out of doubt: the Experiments which prove its Spring being ſo many and evident, beyond Exception. And that this Spring of the Air is ſometimes Stronger, and ſometimes Weaker, I think, is undoubted alſo; And that the Spring of the Air is Strengthned both by Compreſſion, and by Heat, but in a different manner. If the ſame Quantity of Air be Compreſſed into a leſſer room, the Spring is certainly Stronger: as is undoubtedly ſeen in the Wind Gun, and other Compreſſive Engines. And the ſame quantity of Included Air in a cloſe Veſſel (ſo as not to communicate with the external Air,) will by application of Heat to it have its Spring Strengthned, and drive its counterpriſe farther off, or (if need be,) Compreſs it: as is to be ſeen in *Thermoſcopes* of all ſorts.

If the Spring be Strengthned by Compreſſion; it is manifeſt that the Intenſive Gravity muſt be thereby increaſed; becauſe the ſame Quantity of Air, and conſequently of Weight, extenſively taken, is now contracted into a leſſer room,

room, which therefore muſt be Intenſively Heavier, (as being the ſame Weight in a leſſer Bulk.) Now this may poſſibly, as a greater Preſſure or Stronger Spring, force up the Vapours under it with a greater Impetus (according to the Notion I mentioned before) and ſo make them fly higher: (unleſs we ſhould ſuppoſe it may be relieved, by ſhortning the Height of the *Atmoſphere*:) but not ſo as to make them Lighter; but rather the contrary, as preſſing them cloſer: much leſs to make them (as the Phraſe is,) *Specifically Lighter* than is the Air it ſelf (though thus Compreſſed,) and it leaves leſs room to receive them between the particles of the Compreſſed Air, as being now thruſt cloſer together.

If the Spring be Strengthned the other way; ſo as by Heat it uſeth to be: this doth rather diminiſh its Intenſive Gravity, by thruſting its parts further aſunder, and ſo poſſeſſing a Larger room. Now in caſe this Air be, by a cloſe Veſſel, confined ſo as not to Expand upward; it will certainly preſs the harder on the ſtagnant *Quickſilver* under, and make that in the *Tube* Riſe higher. But in caſe it be unconfined, as in the Open Air, it may as well relieve it ſelf upward, by making the *Atmoſphere* in this part ſo much the higher.

Nor is there any neceſſity, as to the ſubjacent parts, that the *Atmoſphere* ſhould be every where of the ſame Height. But the Laws of *Staticks*, as to the ſubjacent parts, be equally preſerved without it, the greater Altitude compenſating for the Levity of the parts, as when a portion of the Sea is covered with a Fleet of Ships; the under parts are equally Preſſed, partly by Water, and partly by Ships, though the tops of the Ships over ſome parts be higher than the Surface of the Water over others. Only, in ſuch caſe, the upper part of the *Atmoſphere*, being Fluid, may Flow collaterally over the other parts on either ſide if lower. And ſo, at leiſure,(if thus remaining otherwiſe undiſturbed,)reduce it ſelf to an equal Height in all parts. Like as the Sea would do, in a perfect Calm, though otherwiſe its Waves and Billows are far from being in all places perfectly plain and even.

But however, though the Spring fortified by Heat, may thus relieve it ſelf upward, (yet becauſe it preſſeth every way,) it muſt endeavour the like downward alſo, and thereby preſs harder what is under it; and becauſe it will require time to work upward gradually before the effect reach the top of the *Atmoſphere*; and becauſe by ſuch Dilatation of its parts, more room is left in the Intervals to receive what is forced: 'tis reaſonable to believe that in ſuch caſes, the preſſed Vapours (*cæteris paribus*) may Riſe more copiouſly, than when the Spring of the Air, (for want of Heat,) is leſs Strong. The rather becauſe the ſame Heat which thus fortifies the Spring of the Air, doth alſo Rarify the Vapours and make them Lighter: and may alſo fortify the Subterraneal Heat (or what ever elſe it is,) that Drives them up. Notwithſtanding all which, we have more Rains in Winter; which ſhould argue, that more Vapours do then ariſe to ſupply them.

But I ſuſpect that in this whole buſineſs (of Strengthing the Spring) there may be a fallacy put upon us: and what we think to be done upon the Open

Air,

Air, is indeed done upon the *Quick-Silver*; or rather upon the Air latent therein. My meaning is this; We find that in very Hot Weather, and alſo in Froſty Weather, the *Quick-ſilver* in the Tube commonly ſtands very High; from whence we are apt to conclude, that therefore the outward Air preſſes very hard on the Stagnant *Quick-Silver*, without the Tube: Wherein I am not ſatisfyed; For we are to conſider, that, in filling the Tube with *Quick-Silver*, before it be inverted, if great care be not uſed to cleanſe it from Air, many Airy particles will remain mixed with it; which, while their Spring is Weak, are eaſily preſſed by the Weight of the *Quick-Silver* ſo cloſe as hardly to be diſcerned otherwiſe than by the Effect: but when, by the external Heat, their Spring is Strengthned, they Expand themſelves, and cauſe the *Quick-ſilver*, wherein they are, to ſwell in Bulk, without increaſing its Weight; and conſequently to ſtand Higher though not to Preſs heavier.

And the ſame account, perhaps, may ſerve for its ſtanding ſo High in Froſty Weather. Water we know, though it contract with Cold, yet when it comes to Freeze, doth Expand it ſelf. (Which makes Ice lighter than Water, and to ſwim on the top of it.) Now whether this be purely of it ſelf, or (in part at leaſt,) from the Particles of Air lodged in it, may not perhaps be ſo eaſie to determine. However, if there be the like Effects on Air, as on Water, (namely that it Expands with Freezing,) or if in the *Quick-Silver* there be lodged particles of Water as well as of Air; we have, either way, an account of this *Phænomenon*. For, then the ſmall Particles, whether of Air, or of Water, lodged in the *Quick-Silver* being thus Expanded by Freezing, will make the *Quick-Silver* Swell, and ſo ſtand Higher, without increaſing its Weight; and conſequently, without arguing a greater Weight of External Air preſſing on the ſtagnant *Quick-Silver*.

The Circulation of Watry Vapours; by Mr. Edm. Halley. n. 192. p. 468.

XXXIV. I have formerly attempted to explain the manner of the Riſing of *Vapours* 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 Principle 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 Boyling Cauldron, wherein likewiſe the Velocity of the Aſcent of the *Vapours* does viſibly Decreaſe till they diſappear, being diſperſed into and aſſimulated with the ambient Air.

Vapours

Vapours being thus *Raiſed* by Warmth, let us for a firſt Suppoſition put, that the whole Surface of the Globe were 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 ſpatious 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 come 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 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 the 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*, gleeting 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 Guts 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 into 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,

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 Ridge 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 St. *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 is 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 off 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-Water*, 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 drive 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 within 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 whether 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 diſtill *Freſh Water* for the uſe of Man and Beaſt, and their Heights to give a Deſcent to thoſe *Streams* to run gently,

like

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 with 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*.

The Cauſe of Trade-Winds, *by Dr.* M. Liſter. n. 156. p. 494.

XXXV. The *Trade* or *Tropick Winds* ſeem in great part to ariſe from the daily and conſtant Breath of the *Sargoſſe*, or *Lenticula Marina*, which grows in vaſt Quantities from 36 to 18 Degrees Northern Latitude, and elſewhere upon the deepeſt Seas: becauſe the Matter of that *Wind*, coming (as we ſuppoſe) from the Breath of only one Plant, it muſt needs make it conſtant and Uniform; Whereas the great Variety of Plants and Trees at Land muſt needs furniſh a Confuſed Matter of *Winds*. Again the *Levant Breezes* are briskeſt about Noon, the Sun quickning the Plant moſt then, cauſing it to breath faſter and more vigorouſly; and that Plants moſtly languiſh in the Night is evident from many of them, which contract themſelves and cloſe at that time; alſo from the Effects of our Winters upon them, which cauſe them to caſt both Fruit and Leaves too; whereas they are ſaid (the ſame Plants for Kind) univerſally to Flouriſh all the year alike within the *Tropicks*.

As for the Direction of this *Breeze* from Eaſt to Weſt, it may be owing to the General *Current* of the Sea; for a gentle Air will ſtill be led with the Stream of our Rivers, for Example. Again every Plant is in ſome meaſure an *Heliotrope*, and bends it ſelf and moves after the Sun, and conſequently emits its Vapours thitherward; and ſo its Direction is in that reſpect alſo owing in ſome meaſure to the Courſe of the Sun.

The Cauſe of Winds, *and of the Change of* Weather; *by Dr.* George Garden. n. 175. p. 1148.

XXXVI. 1. It is generally known that there are continual Eaſtern Winds under the *Line*, which they call *Briſes*, and therefore the accounts of Spaniſh Voyages bear, that in their going to the *Weſt-Indies* they ſail Southwards from *Spain*, along the Coaſt of *Africk*, till they be beyond the *Tropick* of *Cancer*, within 20 *Deg.* of the *Line*, where they preſently find an Eaſterly Wind, and ſo they ſail on Weſtwards with full Winds, ſo as they have ſcarce any need to touch their Sails in the whole Voyage: and this they give as the

reaſon why the Voyage from *Spain* to the *Weſt Indies* is ſhorter, more eaſie, and more aſſured, than the Return to *Spain*. In the *South Sea* alſo, going from *New Spain* or *Peru* to the *Philippines* or *China*, their Voyage is eaſie, Sailing always from Eaſt to Weſt near the *Line*, where the Eaſterly Winds blow in their Poop. *Acoſta* reports, that in the Year 1584, there went a Ship from *Calloa* in *Lima* to the *Philippines*, which ſailed 2700 Leagues without ſight of Land, and this in two Months, their Courſe being almoſt under the *Line*.

Now theſe continual Eaſterly Winds between the *Tropicks*, I ſuppoſe to proceed both from the Motion of the Earth and the Vertical Influences of the Sun, after this manner. As you know the Vaſt Fluid and Æther, in which the Earth floats in its Annual Motion, moves forward with the Earth in that Motion, or rather carries the Globe of the Earth along with it; even ſo the *Atmoſphere*, and a large Vortex of Æther beyond the Moon, goes round with the Earth in its Diurnal Motion, which tho' according as it is removed from the Earth it may be proportionably ſlower in its Motion, yet that portion of the *Atmoſphere*, which is neareſt the Earth and ſurrounds it, may be ſuppoſed to keep equal pace with the Earth in its Motion; and if there were no changes in the *Atmoſphere's* Gravity, I ſuppoſe it would always go along with the Globe of the Earth from Weſt to Eaſt in an Uniform Motion, which would be wholly inſenſible to us. But that portion of the *Atmoſphere* under the *Line*, being extreamly Rarified, its Spring expanded, and ſo its Gravity and Preſſure much Leſs than the neighbouring parts of the *Atmoſphere*, and conſequently uncapable of the Uniform Motion to the Eaſt, it muſt needs be preſt Weſtwards, and make that continual *Briſe* from Eaſt to Weſt between the *Tropicks*.

2. The ſame accounts bear, that on this ſide the *Tropick*, about 28 or 30 *deg.* there are to be found conſtant Weſterly Winds, and therefore the *Spaniſh* Fleets from the *Weſt Indies* do not Return the way they went, but thoſe both from *Peru*, and *New-Spain*, Sail along the Coaſt Northward till they touch at *Havana* in *Cuba*, and being joyned together there, they ſeek their Height without the *Tropicks*, where preſently they find Weſterly Winds which ſerve them till they come in view of the *Azores*, and from thence to *Sevill*. In like manner in the *South-Sea*, thoſe which return from the *Philippines*, or *China*, to *Mexico*, to the end they may recover the Weſtern Winds, mount a great Height till they come right againſt the Iſlands of *Japan*, and diſcovering *California* they return by the Coaſt of *New-Spain* to the Port of *Acapulco*, from whence they parted. So that tho' they Sail eaſily from Eaſt to Weſt, in both Seas, within the *Tropicks*, for that the Eaſtern Winds reign there; yet returning from Weſt to Eaſt they muſt ſeek the Weſtern Winds without the *Tropicks* in the height of 27 *Degrees*.

Now the Reaſon of this ſeems to me clearly deducible from the former; for the Preſſure of Air between the *Tropicks* being continually leſs than the neighbouring parts of the *Atmoſphere*, and ſo conſequently by them preſſed Weſtward, way being thereby given to the neighbouring Air for ſome *Deg.* without the *Tropicks*, its motion from Weſt to Eaſt is proportionably increas'd

creas'd beyond that uniform motion it would have if the whole *Atmosphere* were of an equal Pressure, and consequently there will blow a constant Wind from West to East for some *Degrees* beyond the *Tropicks*.

3. Those Easterly Winds between the *Tropicks*, by what I can collect from the accounts of *Eastern* Voyages, do not Blow constantly from the same Point, nor directly from the East; but for the one Half of the Year, *viz.* from *April* to *November* or thereabouts, they come from the South East, and for the other Half of the Year, *viz.* from *November* to *April*, they Blow from the North East. And these I suppose they call their *Monsoons*, and *Trade-Winds*. Hence it is that they who Sail from *China*, *Japan*, &c. to *Bantam*, must wait the Northerly *Monsoon*, which falls between *November* and *April*; and they who return from *Bantam*, must go back again when the Southerly *Monsoon* comes, which is between *April* and *November*; and the *Currents* of the *Seas* are said to observe the same Motion, and Changes, with the Winds. I know not whether these *Monsoons* do Blow exactly from the same Points, in all parts, for it is like where there are Bays, High-lands, and Islands, &c. the *Monsoons* may Blow from different Points; but this is chiefly to be understood of Open Seas.

Now these *Monsoons* I think may be easily accounted for from what has already been said, anent the Cause of the continual Easterly Winds between the *Tropicks*, for seeing the lessening of the Air's Pressure under the *Line*, and the Pressure of the Neighbouring parts of the *Atmosphere* thereupon, occasion these continual *Brises*, if the Sun were constantly in the *Æquinoctial Line*, it is like the Wind would Blow still directly from the East, but in that he is the one Half of the Year on the one side of the *Line*, and the other Half on the other, there must of necessity follow a Change of these *Brises* into stated *Monsoons*. For Imagine the *Atmosphere* to be divided into two equal Hemispheres by the *Æquinoctial* Plane, if the Sun were always in the Plane, there would be still an Equal Pressure from both these Hemispheres upon the Air under the *Line*, and the *Brise* should be directly from the East. But now when the Sun comes on the North side of the *Line*, as far as the *Tropick* of *Cancer*, and back again, there is not an Equal Ballance, but the Pressure of the Southern Hemisphere of the Air must needs be greatest, and consequently the *Brise* must Blow all that Season from the South East, and when the Sun returns again to the Southward of the *Line*, as far as *Capricorn*, and back again, the Pressure of the Northern Hemisphere must needs preponderate, and make the Wind Blow all that Half Year from the North East. And this seems to accord very well with Experience, for their Northern *Monsoons* are in our Winter Season, when the Sun is in the Southern *Signs*, and their Southern ones in our Summer when he is in the Northern *Signs*.

4. The Rivers of *Indus* and *Ganges*, where they enter the Ocean, do contain between them a large *Chersonesus*, which is divided in the middle by a Ridge of high Hills, which they call the *Gate*, which run along from East to West and quite thorough to the Cape *Comori*. On the one side is *Malabar*, and on the other *Coromandel*. On the *Malabar* side between that Ridge of Mountains and the Sea, it is after their appellation Summer from *September* till *April*; In

which time it is always a clear Skie, without once, or very little, Raining. On the other ſide the Hills, on the Coaſt of *Coromandel*, it is at the ſame time their Winter, every day and night yielding abundance of Rain. And from *April* to *September* it is, on the *Malabar* ſide, their Winter, and on the other ſide their Summer: ſo that in little more than 20 Leagues Journey in ſome places, as where they croſs the Hills to St *Thomas*, on the one ſide of the Hill you Aſcend with a fair Summer; on the other you Deſcend with a Stormy Winter. The like is ſaid to be at Cape *Razalgate* in *Arabia*. And Dr. *Trapham* relates the ſame of *Jamaica*, intimating that there is a Ridge of Hills which runs from Eaſt to Weſt thro' the midſt of the Iſland, and that the Plantations on the South-ſide of theſe Hills have from *November* to *April* a continual Summer, whilſt thoſe on the North ſide have as conſtant a Winter, and *è contra* from *April* to *November*.

From theſe and ſuch like accounts it ſeems evident, that a bare leſſening of the *Atmoſphere's* Gravity will not occaſion Rain, but that there is alſo needful either a ſudden Change of Winds, or a Ridge of Hills to meet the Current of the Air and Vapours, whereby the Particles of the Vapours are driven together, and ſo fall down into drops of Rain. And hence it is, that whilſt the Wind Blows from the North Eaſt, *viz.* from *November* to *April*, there are continual Rains in the Northerly Plantations of *Jamaica*, and on the ſide of *Coromandel* in the *Eaſt-Indies*, becauſe the Winds beat againſt that ſide of the Hills; and ſo there is fair Weather on the other ſide of theſe Hills, in *Malabar* and the Southern Plantations of *Jamaica*, there being no Winds to drive the Vapours together. But in the Southerly *Monſoon*, *viz.* from *April* to *November*, *Malabar* and the Southern Plantations of *Jamaica* have floods of Rains, the Wind beating againſt that ſide of the Hills, whilſt in *Coromandel* and the other ſide of *Jamaica* there is Fair and Clear Weather. The Maps make thoſe Mountains of *Gate* run South and North, and if ſo the *Monſoons* muſt Blow from other Points by reaſon of the neighbouring Countries and Iſlands, or elſe this is not the true cauſe of theſe *Seaſons*.

This ſerves alſo to clear the *Singularity* of *Seaſons* in *Peru*, beyond any other parts of the Earth, and ſeems to be aſſigned by *Acoſta* as the Cauſe of it. *Peru* runs along from the *Line* Southwards about 1000 Leagues. It is ſaid to be divided into three Parts, long and Narrow, which they call *Lanos*, *Sierras*, and *Andes*; the *Lanos*, or Plains, run along the *South-Sea* Coaſt; the *Sierras* are all Hills with ſome Vallies; and the *Andes*, ſteep and craggy Mountains. The *Lanos* have ſome ten Leagues in breadth, in ſome parts leſs and in ſome more, the *Sierra* contains ſome 20 Leagues in breadth, the *Andes* as much, ſometimes more ſometimes leſs; they run in length from North to South, and in breadth from Eaſt to Weſt. This Part of the World is ſaid to have theſe Remarkable things. 1. All along the Coaſt, in the *Lanos*, it Blows continually with one only Wind, which is South and South Weſt, contrary to that which uſually Blows under the *Torrid Zone*. 2 It never Rains, Thunders, Snows, or Hails, in all this Coaſt, or *Lanos*, tho there falls ſometimes a ſmall Dew. 3. Upon the *Andes* it Rains almoſt continually, tho' it be ſometimes more Clear than other. 4. In the *Sierra*, which lies betwixt

both

both the Extreams, it Rains from *September* to *April*, but in the other Seasons it is more Clear, which is when the Sun is fartheſt off, and the contrary when it is neareſt. Now the reaſon of all ſeems to be this. The Eaſtern *Briſes*, which Blow conſtantly under the *Line*, being ſtopt in their Courſe by the *Sierras* and *Andes*, and yet the ſame *Briſes*, being to be found in the *South-Sea* beyond *Peru*, as appears by the eaſy Voyages from *Peru* to the *Philippines*, a Current of Wind Blows from the South on the *Plains* of *Peru* to ſupply the Eaſtern *Briſe* in the *South-Sea*: and there being but One conſtant Gale in theſe *Plains*, and no contrary Winds, nor Hills for it to beat upon, this ſeems to be the reaſon why the Vapours are never, or very ſeldom, driven into Rain. And the *Andes*, being as High perhaps in many places as the Vapours Aſcend, in the higheſt degree of the *Atmoſphere*'s Gravity, this may probably be the Reaſon why the Eaſtern *Briſe*, beating conſtantly againſt theſe Hills, occaſion Rains upon them at all Seaſons of the Year. And the *Sierras* being it ſeems lower than the *Andes*, therefore from *September* to *April*, when the Sun is neareſt, and ſo the *Atmoſphere's* Gravity leſs and the Vapours lower, they are driven againſt the *Sierras* into Rain.

6. The Cauſes of thoſe Particular, Various, Uncertain, and Unconſtant Winds, which do Blow in the Countries without the *Tropicks*, and that moſt frequently in Mountainous Places, and more ſeldom in great Plains ſuch as *Poland*, I cannot ſo eaſily conjecture: but thoſe General Winds, which uſually fall out every where about both *Æquinoctials*, ſeem to proceed from ſome General Cauſe; and this I take to be the Change of the *Monſoons*, and *Trade-Winds*, about theſe times between the *Tropicks*. For there muſt needs be about theſe Seaſons a Change of the Ballance of the *Atmoſphere*, according to what I have diſcourſed on the *third* Head, and this I think cannot but occaſion Strong Winds over all the Earth.

2. Dr. *Garden* endeavours to Explain and give an Account of the *Trade-Winds*, within the *Tropicks*, from the different Gravity of the *Atmoſphere* at divers times of the Year. And yet it is aſſerted by Dr *Liſter*, That the *Mercury* is not affected with the Weather, or very rarely, let it be Cloudy, Rainy, Windy, or Serene, in St. *Helena*, or the *Barbadoes*, and therefore probably not within the *Tropicks*, unleſs in a Violent Storm or *Hurricane*. Now if the *Mercury* move little or nothing in the *Baroſcope*, 'tis likely there is little or no Change in the *Gravity* of the *Atmoſphere*, within the *Tropicks*.

By Mr. Will. Molyneux. n. 177. p. 1237.

vid. Sect. X. 1.

3. The Univerſal *Ocean* may moſt properly be divided into three Parts; *viz.* 1. The *Atlantick* and *Æthiopick* Sea. 2. The *Indian Ocean*. 3. The great *South-Sea*, or the *Pacifick Ocean*.

By Mr. Halley n. 183. p. 153.

1. In the *Atlantick* and *Æthiopick* Seas, between the *Tropicks*, there is a general Eaſterly Wind, all the Year long, without any conſiderable Variation; excepting that it is ſubject to be Deflected therefrom, ſome few Points of the Compaſs, towards the North or South, according to the Poſition of the Place.

1. Near the Coaſt of *Africa*, aſſoon as you have paſſed the *Canary Iſles*, you are ſure to meet a Freſh Gale of *N. E.* Wind, about the Latitude of 28°. North, which ſeldom comes to the Eaſtwards of the *E. N. E.* or paſſes the *N. N. E.* This Wind accompanies thoſe bound to the Southward to the Latitude of 10°. North, and about 100 Leagues from the *Guinea* Coaſt, where till the 4°. of North Latitude, they fall into *Calms* and *Tornadoes*. 2. Thoſe

2. Thoſe bound to the *Carribbe Iſles*, find, as they approach the *American* ſide, thar the aforeſaid *N. E.* Wind becomes ſtill more and more Eaſterly, ſo as ſometimes to be *E.* ſometimes *E. b. S*, but yet moſt commonly to the Northward of the Eaſt, a Point or two, ſeldom more. 'Tis likewiſe obſerved, that the Strength of theſe Winds does gradually decreaſe, as you Sail to the Weſtwards.

3. That the *Limits* of the *Trade* and *Variable* Winds, in this *Ocean*, are farther extended on the *American* ſide, than the *African*: for whereas you meet not with this Certain Wind till after you have paſſed the Latitude of 28° on this ſide; on the *American* ſide it commonly holds to 30, 31, or 32° of Latitude; and this is verified likewiſe to the Southwards of the *Equinoctial*, for near the *Cape of good Hope* the *Limits* of the *Trade-Winds*, are 3 or 4° nearer the *Line*, than on the Coaſt of *Brazile*.

4. That from the Latitude of 4° North to the aforeſaid *Limits* on the South ſide of the *Equator*, the Winds are generally and perpetually between the South and Eaſt, and moſt commonly between the South-Eaſt and Eaſt, obſerving always this Rule, that on the *African* ſide, they are more Southerly, on the *Braſilian* more Eaſterly, ſo as to become almoſt due Eaſt, the little Deflection they have being ſtill to the Southwards. In this Part of the *Ocean* it has been my fortune to paſs a full Year, in an Employment that obliged me to regard more than ordinary the Weather, and I found the Winds conſtantly about the South Eaſt, the moſt uſual point *S. E. b. E*; when it was Eaſterly it generally Blew Hard, and was Gloomy, Dark, and ſometimes Rainy Weather; if it came to the Southwards, it was generally Serene, and a Small Gale next to a Calm; but this not very common. But I never ſaw it to the Weſtwards of the South, or Northwards of the Eaſt.

5. That the Seaſon of the Year has ſome ſmall Effect on theſe *Trade-Winds*, for that when the Sun is conſiderably to the Northwards of the *Equator*, the South-Eaſt Winds, eſpecially in the Streight of this *Ocean* (if I may ſo call it) between *Braſile* and the Coaſt of *Guinea*, do vary a Point or two to the Southwards, and the North Eaſt become more Eaſterly; and on the contrary when the Sun is towards the *Tropick* of *Capricorn*, the South Eaſterly Winds become more Eaſterly, and the North-Eaſterly Winds on this ſide the *Line* were more to the Northwards.

6. There is in this *Ocean* a Tract of Sea, wherein the Southerly and South-Weſt Winds are perpetual, *viz.* all along the Coaſt of *Guinea*, for above 500 Leagues together, from *Sierra Leona* to the Iſle of St. *Thomas*; for the South-Eaſt *Trade-Wind* having paſſed the *Line*, and approaching the Coaſt of *Guinea* within 80 or 100 Leagues inclines towards the Shore, and becomes *S. S. E.* and by degrees, as you come nearer, it veers about to South, *S. S. W.* and in with the Land South-Weſt, and ſometimes *W. S. W*; which Variation is better expreſſed in the Map than it can well be in words. Theſe are the Winds which are obſerved on this Coaſt when it Blows True, but there are frequent Calms, Violent ſudden Guſts called *Tornado's*, from all Points of the Compaſs, and ſometimes unwholſom foggy Eaſterly Winds called *Hermitaa* by the Natives, which too often infeſt the Navigation of theſe Parts.

Fig. 20.

7. That

7. That to the Northwards of the *Line*, between 4 and 10 *deg.* of *Latitude*, and between the Meridians of *Cape Virde*, and of the Eaſtermoſt Iſlands that bear that name, there is a Tract of Sea wherein it were improper to ſay there is any *Trade-Wind*, or yet a *Variable*, for it ſeems condemned to perpetual Calms, attended with terrible Thunder and Lightning, and Rains ſo frequent, that our Navigators from thence call this Part of the Sea the *Rains*: the little Winds that are, be only ſome ſudden uncertain Guſts, of very little Continuance and leſs Extent; ſo that ſometimes each Hour you ſhall have a different Gale, which dies away into a Calm before another ſucceed; and in a Fleet of Ships in ſight of one another, each ſhall have the Wind from a ſeveral Point of the Compaſs; with theſe weak *Briſes*, Ships are obliged to make the beſt of their way to the Southward through the aforeſaid ſix *Degrees*, wherein 'tis reported ſome have been detained whole Months for want of Wind.

From the three laſt Obſervables is ſhewn the reaſon of two notable occurrents in the *Eaſt-India* and *Guinea* Navigations. The one is, why notwithſtanding the narroweſt part of the Sea between *Guinea* and *Braſile* be about 500 Leagues over, yet Ships bound to the Southward, ſometimes, eſpecially in the Months of *July* and *Auguſt*, find a great difficulty to paſs it. This happens becauſe of the South-Eaſt Winds, at that time of the Year commonly extending ſome *deg.* beyond the Ordinary Limit of 4 *deg.* North *Lat.* and withal they come ſo much Southerly, as to be ſometimes South, ſometimes a Point or two to the Weſt; there remains then only to Plie to Wind-ward, and if on the one ſide they ſtand away *W. S. W.* they gain the Wind ſtill more and more Eaſterly, but there is danger of not weathering the *Braſilian* Shore, or at leaſt the Shoals upon that Coaſt. But if upon the other Tack they go away *E. S. E.* they fall into the neighbourhood of the Coaſt of *Guinea*, from which there is no departing without running Eaſterly, as far as the Iſle of St. *Thomas*, which is the conſtant practice of all the *Guinea* Ships, and which may ſeem very ſtrange, without the conſideration of the *6th* Remark, which ſhews the reaſon of it. For being in with the Coaſt the Wind Blows generally at *S. W.* and *W. S. W.* with which Winds they cannot go to the Northward for the Land, and on the other Tack they can lie no nearer the Wind than *S. S. E.* or *S.* and with theſe Courſes they run off the Shore, but in ſo doing they always find the Winds more and more contrary; ſo that when near the Shore, they could lie South, at a greater diſtance they can make their way no better than *S. E.* and afterwards *E. S. E.* with which Courſes they fetch commonly the Iſle of St. *Thomas* and Cape *Lopez*, where finding the Winds to the Eaſtward of the South, they keep them favourable by running away to the Weſtward in the South *Lat.* of 3 or 4 *Deg.* where the *S. E.* Winds are Perpetual.

For the ſake of theſe General Winds, all thoſe that uſe the *Weſt-Indian* Trade, even thoſe bound to *Virginia*, count it their beſt Courſe to get aſſoon as they can to the Southwards, that ſo they may be certain of a Fair and Freſh Gale, to run before it to the Weſtwards; and for the ſame reaſon thoſe homewards bound from *America*, endeavour to gain the Latitude of 30 *Deg.*

aſſoon

aſſoon as poſſible, where they firſt find the Winds begin to be Variable; though the moſt ordinary Winds in the Northern part of the *Atlantick Ocean* come from between the South and Weſt.

As to thoſe furious Storms called *Hurricanes*, which are as it were peculiar to the *Caribbe Iſles*; and which ſo dreadfully afflict them in the Month of *Auguſt*, or not much before or after, they do not ſo properly belong to this place, both by reaſon of their ſmall Continuance and Extent, as likewiſe becauſe they are not Anniverſary; ſome Years having more than one, and ſometimes for ſeveral Years together there being none at all. But their Violence is ſo unconconceivable, and their other *Phænomena* ſo ſurpriſing, that they merit well to be conſidered apart.

What is here ſaid, is to be underſtood of the Sea-Winds, at ſome diſtance from the Land; for upon and near the Shores, the *Land* and *Sea-Brizes* are almoſt every where ſenſible; and the great Variety which happens in their Periods, Force, and Direction, from the Situation of the Mountains, Vallies, and Woods, and from the various texture of the Soil, more or leſs capable of Retaining and Reflecting Heat, and of Exhaling or Condenſing Vapours, is ſuch, that it were an endleſs Taſk, to endeavour to account for them.

2. In the *Indian Ocean*, the *Winds* are partly *General*, as in the *Æthiopick Ocean*, partly *Periodical*, that is half the Year they Blow one way and the other half near upon the oppoſite Points; and theſe Points and times of Shifting are Different in Different parts of this *Ocean*.

1. Between the *Latitudes* of 10 *deg.* and 30 *deg.* South, between *Madagaſcar* and *Hollandia Nova*, the *General Trade-Wind* about the *S. E. b. E.* is found to Blow all the Year long, to all intents and purpoſes after the ſame manner as in the ſame Latitudes in the *Æthiopick Ocean*, as it is deſcribed in the 4*th* Remark aforegoing.

2. That the aforeſaid *S. E.* Winds extend to within two *deg.* of the *Equator*, during the Months of *June*, *July*, and *Auguſt*, &c. to *November*, at which time between the South *Latitudes* of 3 and 10 *Deg.* being near the Meridian of the North End of *Madagaſcar*; and between 2 and 12 South *Latitude*, being near *Sumatra* and *Java*; the contrary Winds from the *N. W.* or between the North and Weſt, ſet in and Blow for half the Year, *viz.* from the beginning of *December* till *May*: and this *Monſoon* is obſerved as far as the *Molucca Iſles*, of which more anon.

3. That to the Nothward of 3 *Deg.* South *Latitude*, over the whole *Arabian* or *Indian Sea* and *Gulf* of *Bengall*, from *Sumatra* to the Coaſt of *Africa*, there is another *Monſoon*, Blowing from *October* to *April* upon the *N. E.* Points; but in the other half Year, from *April* to *October*, upon the oppoſite Points of *S. W.* and *W. S. W.* and that with rather more force than the other, accompanied with Dark, Rainy Weather, whereas the *N. E.* Blows Clear. 'Tis likewiſe to be noted, that the Winds are not ſo conſtant, either in Strength or Point, in the *Gulph* of *Bengall*, as they are in the *Indian-Sea*

where,

where a certain ſteady Gale ſcarce ever fails. 'Tis alſo remarkable, that the *S. W.* Winds in theſe Seas are generally more Southerly on the *African* ſide, more Weſterly on the *Indian*.

4. There is a Tract of *Sea* to the Southwards of the *Equator*, ſubject to the ſame changes of the Winds, *viz.* near the *African* Coaſt, between it and the Iſland *Madagaſcar* or St. *Lawrence*, and from thence Northwards as far as the *Line*: wherein from *April* to *October* there is found a conſtant Freſh *S. S. W.* Wind, which as you go more Northerly, becomes ſtill more and more Weſterly, ſo as to fall in with the *W. S. W.* Winds mentioned before in thoſe Months of the Year to be certain to the Northward of the *Equator*: What Winds blow in thoſe Seas for the other half Year, I have not yet been able to obtain to my full ſatisfaction: The account which has been given me is only this, that the *Winds* are much Eaſterly hereabouts, and as often to the North of the true Eaſt as to the Southwards thereof.

5. That to the Eaſtward of *Sumatra* and *Malacca*, to the Northwards of the *Line*, and along the Coaſt of *Camboia* and *China*, the *Monſoons* blow North and South: that is to ſay, the *N. E.* Winds are much Northerly, and the *S. W.* much Southerly. This Conſtitution reaches to the Eaſtwards of the *Philippine* Iſles, and as far Northerly as *Japan*. The Northern *Monſoon* ſetting in, in theſe Seas, in *October* or *November*, and the Southern in *May*, blowing all the Summer Months. Here it is to be noted, that the Points of the Compaſs from whence the Winds come in theſe Parts of the World, are not ſo fixt as in thoſe lately deſcribed; for the Southerly will frequently paſs a Point or two to the Eaſtwards of the South, and the Northerly as much to the Weſtwards of the North, which ſeems occaſioned by the great quantity of Land which is interſperſed in theſe Seas.

6. That in the ſame *Meridians*, but to the Southwards of the *Equator*, being that Tract lying between *Sumatra* and *Java* to the Weſt, and *New-Guinea* to the Eaſt, the ſame Northerly and Southerly *Monſoons* are obſerved; but with this difference, that the Inclination of the Northerly is towards the *N. W.* and of the Southerly towards the *S. E.* but the *Plagæ Venti* are not more conſtant here than in the former, *viz. Variable* 5 or 6 Points: Beſides, the times of the change of theſe Winds are not the ſame as in the *Chineſe* Seas, but about a Month or 6 Weeks later.

7. That theſe contrary Winds do not ſhift all at once, but in ſome places the time of the Change is attended with *Calms*, in others with *Variable* Winds; and it is particularly remarkable, that the End of the Weſterly *Monſoon* on the Coaſt of *Coromandel*, and the two laſt Months of the Southerly *Monſoon* in the Seas of *China*, are very Subject to be *Tempeſtuous*: The Violence of theſe *Storms* is ſuch, that they ſeem to be of the Nature of the *Weſt-India Hurricanes*, and render the Navigation of theſe Parts very unſafe about that time of the Year. Theſe *Tempeſts* are by our Seamen uſually termed, the *Breaking up of the Monſoons*.

By reaſon of the Shifting of theſe Winds, all thoſe that Sail in theſe Seas, obliged to obſerve the Seaſons proper for their Voyages, and ſo doing t

fail not of a Fair Wind and ſpeedy Paſſage; but if ſo be they chance to outſtay their time, till the contrary *Monſoon* ſet in, as it frequently happens, they are forced to give over the hopes of accompliſhing their intended Voyages, and either return to the Port from whence they came, or elſe put into ſome other Harbour, there to ſpend the time till the Winds ſhall come favourable.

3. That Navigation that there is on the *Mare Pacificum* is by the *Spaniards*, who go Yearly from the Coaſt of *New-Spain* to the *Manilha's*: but that is but by one beaten Tract; ſo that I cannot be ſo particular here as in the other two. What the *Spaniſh* Authors ſay of the Winds they find in their Courſes, and what is confirmed by the old accounts of *Drake* and *Candiſh*, and ſince by *Schooten*, who Sailed the whole breadth of this Sea in the Southern *Latitude* of 15 or 16 *deg.* is, that there is a great Conformity betwixt the Winds of this Sea, and thoſe of the *Atlantick* and *Æthiopick*; that is to ſay, that to the Northwards of the *Equator*, the predominant Wind is between the *E.* and *N. E.* and to the Southwards thereof, there is a conſtant ſteady Gale between the *E.* and *S. E.* and that, on both ſides the *Line*, with ſo much Conſtancy that they ſcarce ever need to attend the Sails, and Strength that it is rare to fail of Croſſing this vaſt *Ocean* in ten weeks time, which is about 130 Miles *per diem*: beſides, 'tis ſaid that Storms and Tempeſts are never known in theſe Parts; Wherefore ſome have thought it might be as ſhort a Voyage to *Japan* and *China*, to go by the *Streights* of *Magellan*, as by the *Cape* of *Good-Hope*.

The Limits of theſe *General* Winds are alſo much the ſame as in the *Atlantick* Sea, *viz.* about the 30*th.* degree of *Latitude* on both ſides; for the *Spaniards* Homewards bound from the *Manilha's*, always take the advantage of the Southerly *Monſoon*, blowing there in the Summer Months, and run up to the Northwards of that *Latitude*, as high as *Japan*, before they meet with *Variable* Winds, to ſhape their Courſe to the Eaſtwards. And *Schooten* and others, that have gone about by the *Magellan Streights*, have found the Limits of *S. E.* Winds, much about the ſame *Latitude* to the Southwards; beſides, a farther Analogy between the Winds of this *Ocean* and the *Æthiopick*, appears in that, that upon the Coaſt of *Peru* they are always much Southerly, like as they are found near the ſhores of *Angola*.

Fig. 20. To help the Conception of the Reader in a matter of ſo much difficulty, I believed it neceſſary to adjoyn a *Scheme*, ſhewing at one view all the various *Tracts* and *Courſes* of theſe Winds. The *Limits* of theſe ſeveral *Tracts* are Deſigned every where by prickt Lines, as well in the *Atlantick* and *Æthiopick*, where they are the Boundaries of the *Trade* and *Variable* Winds, as in the *Indian Ocean*, where they alſo ſhew the extent of the ſeveral *Monſoons*. The Courſe of the Winds is expreſt by Rows of ſtroaks in the ſame Line that a Ship would move, going always before it; the Sharp End of each little ſtroak pointing out that part of the *Horizon*, from whence the Wind continually comes; and where there are *Monſoons*, the Rows of the ſtroaks run alternately backwards and forwards, by which means they are thicker there than elſewhere. As to the great *South-Sea*, conſidering its vaſt extent, and the little Variety there is in its Winds, and the great Analogy between them, and thoſe

of

of the *Atlantick* and *Æthiopick-Oceans*; beſides that the greateſt part thereof is wholly unknown to us; I thought it unneceſſary to lengthen the *Mapp* therewith.

In the foregoing Hiſtory are contained ſeveral Problems, that Merit well the Conſideration of our acuteſt Naturaliſts, both by reaſon of the conſtancy of the effect, and of the immenſe extent thereof; near half the Surface of the Globe being concerned; wherein if I am not able to account for all particulars, yet 'tis hoped the thoughts I have ſpent thereon, will not be judged wholy loſt by the Curious in Natural Inquiries.

1. *Wind* is moſt properly defined to be the Stream or Current of the Air; and where ſuch Current is Perpetual and Fixt in its Courſe, 'tis neceſſary that it proceed from a Permanent unintermitting Cauſe, capable of producing a like Conſtant Effect, and agreeable to the known properties of the Elements of *Air* and *Water*, and the Laws of the Motion of Fluid Bodies. Such an one is, I conceive, the Action of the Sun's Beams upon the *Air* and *Water*, as he paſſes every day over the *Oceans*, conſidered together with the Nature of the Soil and Situation of the adjoyning *Continents*. I ſay therefore, *Firſt*, That according to the Laws of *Staticks*, the Air which is leſs Rarified or expanded by Heat, and conſequently more Ponderous, muſt have a Motion towards thoſe parts thereof which are more Rarified, and leſs Ponderous, to bring it to an *Æquilibrium*; and, *Secondly*, That the preſence of the Sun continually ſhifting to the Weſtwards, that part towards which the Air tends, by reaſon of the Rarefaction made by his greateſt Meridian Heat, is with him carried Weſtward, and conſequently the tendency of the whole Body of the lower Air is that way. Thus a *General* Eaſterly Wind is formed, which being Impreſſed upon all the Air of a vaſt Ocean, the parts impel one the other, and ſo keep moving till the next return of the Sun, whereby ſo much of the Motion as was loſt, is again reſtor'd, and thus the Eaſterly Wind is made *Perpetual*.

2. From the ſame Principle it follows, that this Eaſterly Wind ſhould on the North ſide of the *Equator*, be to the Northwards of the Eaſt, and in South *Latitudes* to the South thereof; for near the *Line*, the Air is much more Rarified, than at a greater diſtance from it; becauſe of the Sun's being twice in a Year Vertical, and at no time diſtant above 23 *deg.* and a half, at which diſtance the Heat, being as the Sine of the Angle of Incidence, is but little ſhort of that of the Perpendicular Ray. Whereas under the *Tropicks*, though the Sun ſtay long Vertical, yet he is as long 47 *deg.* off; which is a kind of Winter, wherein the Air ſo Cools, as that the Summer Heat cannot Warm it to the ſame degree with that under the *Equator*, wherefore the Air to the Northwards and Southwards, being leſs Rarified than that in the Middle, it follows, that from both ſides it ought to tend towards the *Equator*. This Motion compounded with the former Eaſterly Wind, Anſwers all the *Phænomena* of the General *Trade-Winds*; which if the whole Surface of the Globe were Sea, would undoubtedly blow all round the world, as they are found to do in the *Atlantick* and *Æthiopick Oceans*.

3. But ſeeing that ſo great *Continents* do interpoſe and break the Continuity of the *Oceans*, regard muſt be had to the Nature of the Soil and the Poſition

of the High Mountains, which I ſuppoſe the two Principal Cauſes of the ſeveral *Variations* of the *Winds*, from the former General Rule: for if a Country lying near the Sun prove to be Flat, Sandy, Low Land, ſuch as the *Deſerts* of *Lybia* are uſually reported to be, the Heat occaſioned by the Reflection of the Sun's Beams, and the Retention thereof in the Sand, is incredible to thoſe that have not felt it; whereby the Air being exceedingly Rarified, it is neceſſary that the Cooler and more Denſe Air ſhould run thitherwards to reſtore the *Æquilibrium*. This I take to be the Cauſe, why near the Coaſt of *Guinea* the Wind always ſets in upon the Land, blowing Weſterly inſtead of Eaſterly, there being ſufficient Reaſon to believe, that the Inland Parts of *Africa* are prodigiouſly Hot, ſince the Northern Borders thereof were ſo Intemperate, as to give the Antients Cauſe to conclude, that all beyond the *Tropick* was made *Uninhabitable* by exceſs of Heat. From the ſame cauſe it happens, that there are ſo conſtant *Calms* in that part of the Ocean, called the *Rains*, (deſcribed in the *7th* Remark on the *Atlantick Sea:*) For this Tract being placed in the middle, between the Weſterly Winds blowing on the Coaſt of *Guinea*, and the Eaſterly *Trade-Winds* blowing to the Weſtwards thereof, the tendency of the Air here, is indifferent to either, and ſo ſtands in *Æquilibrio* between both; and the Weight of the incumbent *Atmoſphere* being diminiſhed by the continual contrary Winds blowing from hence, is the reaſon that the Air here holds not the copious Vapour it receives, but lets it fall into ſo frequent *Rains*.

4. But as the Cool and Denſe Air, by reaſon of its greater Gravity, preſſes upon the Hot and Rarified, 'tis demonſtrative that this latter muſt Aſcend in a continued ſtream as faſt as it Rarifies, and that being Aſcended it muſt diſperſe it ſelf to preſerve the *Æquilibrium*; that is, by a *contrary Current*, the upper Air muſt move from thoſe parts where the greateſt Heat is: So by a kind of Circulation, the *N. E. Trade-Wind* below, will be attended with a *S. W.* above, and the *S. E.* with a *N. W.* Wind above. And that this is more than a bare conjecture, the almoſt inſtantaneous Change of the Wind to the oppoſite Point, which is frequently found in paſſing the Limits of the *Trade-Winds*, ſeems to aſſure us; but that which above all confirms this *Hypotheſis* is the *Phænomenon* of the *Monſoons*, by this means moſt eaſily Solved, and without it hardly explicable. Suppoſing therefore ſuch a Circulation as above, 'tis to be conſidered that to the Northward of the *Indian Ocean* there is every where Land within the uſual Limit of the *Latitude* of 30. *viz. Arabia*, *Perſia*, *India*, &c. which for the ſame reaſon as the Mediterranean Parts of *Africa* are ſubject to Unſufferable Heats when the Sun is to the North, paſſing nearly Vertical; but yet are Temperate enough when the Sun is removed towards the other *Tropick*; becauſe of a Ridge of Mountains at ſome diſtance within the Land, ſaid to be frequently in Winter covered with Snow, over which the Air, as it paſſes, muſt needs be much chilled. Hence it comes to paſs, that the Air coming, according to the General Rule, out of the *N. E.* in the *Indian* Seas, is ſometimes Hotter ſometimes Colder than that which by this Circulation is returned out of the *S. W.* and by conſequence, ſometimes the under Current or Wind is from the *N. E.* ſometimes from the *S. W.* That this has

no other Cauſe, is clear from the times wherein theſe Winds ſet in: *viz.* in *April*, when the Sun begins to warm thoſe Countries to the North, the *S. W. Monſoon* begins, and blows during the Heats till *October*, when the Sun being retired, and all things growing Cooler Northward, and the Heat increaſing to the South, the *N. E.* Winds enter and blow all the Winter till *April* again.

5. And it is undoubtedly from the ſame Principle that to the Southwards of the *Equator*, in part of the *Indian Ocean*, the *N. W.* Winds ſucceed the *S. E.* when the Sun draws near the *Tropick* of *Capricorn*. But I muſt confeſs, that in this latter occurs a difficulty, not well to be accounted for, which is, why this Change of the *Monſoons* ſhould be any more in this *Ocean*, than in the ſame *Latitudes* in the *Æthiopick*, where there is nothing more certain than a *S. E.* Wind all the Year.

6. 'Tis likewiſe very hard to conceive, why the Limits of the *Trade-Wind* ſhould be fixt about the 30th *Deg.* of *Latitude* all round the Globe; and that they ſhould ſo ſeldom tranſgreſs or fall ſhort of thoſe Bounds; as alſo that in the *Indian Sea*, only the Northern part ſhould be Subject to the changeable *Monſoons*, and in the Southern there be a conſtant *S. E.*

Theſe are particulars that merit to be conſidered more at large, and furniſh a ſufficient Subject for a juſt Volume.

XXXVII. Mr. *Henſhaw* has Obſerved, That *Dew* newly gathered, and Filtred through a clean Linnen Cloth, though it be not very Clear, is of a Yellowiſh Colour, ſomewhat approaching to that of *Urine*. *Obſervations upon* May-Dew; *by Mr.* Thomas Henſhaw. n. 3. p. 33.

That having endeavour'd to Putrify it, by putting ſeveral proportions into Glaſs-Bodies with Blind-Heads, and ſetting them in ſeveral Heats, as of Dung, and gentle Baths, he quite failed of his intention: for Heat, though never ſo gentle, did rather Clarify and preſerve it Sweet, though continued for two Months together; than cauſe any Putrefaction or ſeparation of parts.

That Expoſing of it to the Sun for a whole Summer in Glaſſes that holds about 2 Gallons, with narrow Mouths that might be ſtopped with Cork, the only conſiderable Alteration, he Obſerved to be produced in it, was that ſtore of Green ſtuff (ſuch as is ſeen in Summer in Ditches and ſtanding Waters) floated on the Top, and in ſome places grew to the ſides of the Glaſs.

That putting 4 or 5 Gallons of it into a Half-Tub, as they call it, of Wood, and ſtraining a Canvaſs over it to keep out Duſt and Inſects, and letting it ſtand in ſome ſhady Room for 3 Weeks or a Month, it did of it ſelf Putrify and Stink exceedingly, and let fall to the Bottom a black Sediment like Mudd.

That coming often to ſee what Alterations appeared in the Putrefaction, He Obſerved, that at the beginning, within 24 Hours, a Slimy Film floated on the top of the Water, which after a while falling to the Bottom there came another ſuch Film in its Place.

That if *Dew* were put into a long narrow Veſſel of Glaſs, ſuch as formerly were uſed for *Receivers* in diſtilling of *Aqua-Fortis*, the ſlime would Riſe to that Height, that he could take it off with a Spoon; and when he had put a pretty

Quantity

Quantity of it into a Drinking Glaſs, and that it had ſtood all Night and the Water drained from it, if he had turned it out on his Hand, it would ſtand upright in Figure of the Glaſs, in ſubſtance like boyled white ſtarch, though ſomewhat more tranſparent, if his Memory (*ſaith he*) fail him not.

That having once gotten a pretty Quantity of this Gelly, and put it into a Glaſs-Body and Blind-Head, he ſet it into a gentle Bath, with an Intention to have Putrified it, but after a few Days he found the Head had not been well Luted on, and that ſome Moiſture exhaling the Gelly was grown almoſt Dry, and a large *Muſhroom* was grown out of it within the Glaſs; It was of a looſe watriſh Contexture, ſuch an one as he had ſeen growing out of Rotten Wood.

That having ſeveral Tubs with good Quantity of *Dew* in them, ſet to Putrify in the Manner aboveſaid, and coming to pour out of one of them to make uſe of it, He found in the Water a great Bunch, bigger than his fiſt, of thoſe Inſects commonly called *Hog-Lice* or *Millepedes*, tangled together by their long Tails, one of which came out of every one of their Bodies about the bigneſs of a Horſe Hair. The Inſects did all Live and Move after they were taken out.

That emptying another Tub, whereon the Sun it ſeems had uſed ſometimes to ſhine, and finding upon the Straining it through a clean Linnen Cloath two or three Spoonfuls of Green ſtuff, though not ſo thick nor ſo Green as that above mentioned found in the Glaſſes purpoſely expoſed to the Sun, he put this Green ſtuff in a Glaſs and tyed a Paper over it, and coming ſome Days after to view it, he found the Glaſs almoſt filled with an innumerable Company of ſmall *Flyes*, almoſt all Wings, ſuch as are uſually ſeen in great Swarms in the Air in Summer Evenings.

That ſetting about a Gallon of this *Dew* (which, he ſaith, if he miſremember not, had been firſt Putrified and Strained) in an open Jarre-Glaſs with a wide Mouth, and leaving it for many Weeks ſtanding in a South-window on which the Sun lay very much, but the Caſements were kept cloſe ſhut; after ſome time coming to take Account of his *Dew*, he found it very full of little *Inſects* with great Heads and ſmall Tapering Bodies, ſomewhat reſembling *Tadpoles*, but very much leſs. Theſe, on his approach to the Glaſs, would ſink down to the Bottom, as it were to hide themſelves, and upon his retreat wriggle themſelves up to the Top of the Water again. Leaving it thus for ſome time longer, He afterwards found the Room very full of *Gnats*, though the Door and Windows were kept ſhut. He adds, that he did not at firſt ſuſpect, that thoſe *Gnats* had any Relation to the *Dew*, but after finding the *Gnats* to be multiplyed and the little watry Animals to be much leſſened in quantity, and finding great Numbers of their empty skins floating on the Face of his *Dew*, He thought he had juſt Reaſon to perſwade himſelf that the *Gnats* were, by a ſecond Birth, produced of thoſe little Animals.

That vapouring away great quantities of his Putrified *Dew* in Glaſs Baſons, and other Earthen Glaſed Veſſels, he did at laſt obtain, as he remembers, above two Pound of Grayiſh Earth, which when he had waſhed with more of the ſame *Dew* out of all his Baſons into one, and vapoured to Siccity, lay in

Leaves

Leaves one above another, not unlike to ſome kind of Brown Paper, but very Friable.

That taking this Earth out, and after he had well ground it on a Marble, and given it a ſmart Fire in a coated *Retort* of Glaſs, it ſoon Melted and became a Cake in the bottom when it was Cold, and looked as if it had been Salt and Brimſtone in a certain Proportion Melted together; but, as he remembers, was not at all *inflamable*. This ground again on a Marble, he ſaith, did turn Spring Water of a Reddiſh Purple Colour.

That by often Calcining and Filtring this Earth, he did at laſt extract 2 *Ounces* of a fine ſmall White *Salt*, which looked on through a good *Microſcope*, ſeemed to have Sides and Angles in the ſame Number and Figure, as *Roch-Petre*.

XXXVIII. 1. We had of late, in the County of *Limerick* and *Tipperary*, Showers of a ſort of Matter like Butter or Greaſe: If one rub it upon one's hand it will Melt, but lay it by the Fire and it Dries and grows Hard, having a very ſtinking ſmell. Some of it fell here at *Kilkenny*, *Nov.* 14. 1695. which I did ſee my ſelf the next Morning.

A kind of Dew *like Butter, in* Ireland; *by Mr.* Rob. Vans, n. 220. p. 223.

2. Having very diligently enquired concerning a very odd Phænomenon, which was obſerved in many parts of *Munſter* and *Leinſter*, the beſt account I can collect thereof, is as follows: For a good part of the Winter 1695. and Spring following, there fell in ſeveral Places a kind of Thick *Dew*, which the Country People call'd Butter, from the Conſiſtency and Colour of it, being Soft, Clammy, and of a Dark Yellow; it fell always in the Night, and chiefly in Mooriſh Low Grounds, on the top of the Graſs, and often on the Thatch of Cabbins; 'twas ſeldom obſerv'd in the ſame Places twice; it commonly lay on the Earth for near a Fortnight without changing its Colour, but then Dryed and turned Black, Cattle fed in the Fields where it lay indifferently as in other Fields. It fell in Lumps, often as big as the end of ones Finger, very thin and ſcatteringly; it had a ſtrong Ill Scent, ſomewhat like the ſmell of Church-yards or Graves: And indeed we had during moſt of that Seaſon very ſtinking Fogs, ſome Sediment of which might poſſibly occaſion this ſtinking *Dew*, tho' I will by no means pretend to offer that a Reaſon of it. I cannot find that it was kept long, or that it bred any *Worms* or *Inſects*: yet the Superſtitious Country People, who had Scal'd or Sore Heads, rubb'd them with this Subſtance, and ſaid it Healed them.

By the Biſhop *of* Cloyne. *ib.*

XXXIX. *Dec.* 6. 1631. Being in the *Gulf* of *Volo* riding at Anchor, about 10 of the Clock that Night, it began to rain *Sand* or *Aſhes*, and continued till two of the Clock the next Morning. It was about two Inches thick on the Deck; ſo that we caſt it overboard with Shovels, as we did Snow the Day before. There was no Wind ſtirring when theſe *Aſhes* fell; it did not fall only in the places where we were, but likewiſe in other Parts, as Ships were coming from *St. John D'Acre* to our Port; they being at that time 100 Leagues from us. We compared the *Aſhes* together, and found them both one.

N B. This Shower of *Aſhes* was upon an *Eruption* of Mount *Veſuvius*.

A Shower of Aſhes, *in the* Archipelago; *by Capt.* Will. Badily, n. 21. p. 377.

XL. This

A Shower of Ivy-Berries *Miſtaken for* Wheat; *by Mr.* Will. Cole. n. 188. p. 281.

XL. This City of *Briſtol* and the Country round, is filled with reports of Raining *Wheat* about *Warminſter* in *Wiltſhire*, and other places within 6 or 8 Miles of it, and many believe it. I have procured ſeveral parcels of it, and find it to be the Seed of *Ivy-B rries*, which from Towers, and Churches, Chimneys, Walls and high Buildings, were lately by very fierce Tempeſts of Wind and Hail driven away from the Holes, Chinks, and other parts, where Birds had brought them, eſpecially *Sterlings* and *Choughs*. It was (among many other Prodigious Stories) confidently affirmed, that thoſe Grains were found in the Hail, as Seeds in Comfits. I have by all ways I can imagine examined and compared them with the Seeds of *Ivy-Berries*, by the Taſte, Smell, Size; and Figure; with the Aſſiſtance of *Magnifying Glaſſes*, viewing them in both the ſuperficial and inward parts.

A Shower of Fiſhes, *in* Kent; *by Dr.* Rob. Conny. n. 243. p. 289.

XLI. On *Wedneſday* before *Eaſter*. *An.* 1696. a Paſture Field at *Cranſtead* near *Wrotham* in *Kent*, about two Acres, which is far from any part of the Sea or Branch of it, and a Place where are no Fiſh-Ponds, but a ſcarcity of Water, was all over ſpread with little *Fiſhes*, conceived to be *Rained* down, there having been at that time a great Tempeſt of Thunder and Rain. The *Fiſhes* were about the length of a Man's little Finger, and judged by all that ſaw them to be young *Whitings*, many of them were taken up and ſhewed to ſeveral Perſons. The Field belonged to one *Ware* a Yeoman, who ſhew'd ſome of them, among others, to Mr. *Lake* a *Bencher* of the *Middle-Temple*, who had one of them and brought it to *London*. The Truth of it was averr'd by many that ſaw the *Fiſhes* lye ſcattered all over that Field, and none in the other Fields thereto adjoyning. The Quantity of them was eſtimated to be about a Buſhel, being all together.

I had this Account from a worthy Gentleman of this Country, who had a Box full of the *Fiſhes*.

Hail-Stones *of an Extraordinary bigneſs*; *by Dr.* Nath. Fairfax. n. 26. p. 481.

XLII. *July* 17. 1666. About 10 in the Forenoon, there fell a violent Storm of *Hail* upon the Coaſt-Towns of *Suffolk*, tracing along *Seckford-Hall*, *Wood-bridge*, *Snape-bridge*, *Aldborough*, &c. more to the North-ward. The *Hail* was ſmall near *Yarmouth*; but at *Seckford-Hall*, one *Hail-Stone* was found by meaſure to be 9 *Inches* about. One of this Town (*viz. Wood-bridge*) found one at *Melton*, 8 *Inches* about. At *Snape-bridge* a Man affirmed, that he lighted on one about 12 *Inches* about. A Lady of *Friſton-Hall*, putting one of them into a Ballance, found it Weigh 12*s.* and 6*d.* Several Perſons of good Credit in *Aldborough* affirmed ſome *Hail-Stones* to have been full as big as *Turkeys Eggs*; (an ordinary Hen's Egg weighs but about 9 s.) *J. Baker* of *Rumborough*, had his Head broken by the Knocks of them through a ſtiff Country Felt; in ſome places his Head bled, in others bunneys aroſe: The Horſes were ſo pelted that they hurried away his Cart beyond all command. They ſeemed all White, Smooth without, Shining within. 'Tis ſomewhat ſtrange, methinks, that their Pillar of Air ſhould keep them aloft, if they were not clapt together

in

in the Falling; eſpecially at ſuch a time of the Year, when the Air is leſs Thickned, and its Spring Weaker.

XLIII. In *May* 1686. There fell at *Liſle* in *Flanders*, *Hail* of ſo great a bigneſs, that the leaſt exceeded Pidgeon's *Eggs*. Several of them were a quarter 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 Glaſs in the Windows on the Windward ſide. The Trees were broken, and ſome Beat down; and the *Partridges* and *Hares* kill'd in abundance.

Large Hail-ſtones, *in* Flanders; *by* ..... n. 203. p. 858.

XLIV. 1. A very Extraordinary *Hail* fell in theſe Parts *Apr.* 29. 1697. The Vapour that diſpoſed the Aqueous parts thus to Congeal, came with a South West Wind out of *Carnarvan-ſhire*, paſſing near *Snowdon* with a horrid black Cloud, attended with frequent *Lightnings* and *Thunder*. As yet I hear no further of it Weſtward than out of *Denbigh-ſhire*, where it left St *Aſaph* to the Right, and did much damage between it and the Sea, breaking all the Windows on the Weather-ſide, and killing Poultry and Lambs, and at Sr. *John Conway*'s at *Deſert*, a ſtout Dog; and in the North part of *Flint-ſhire* ſeveral People had their Heads broke, and were grievouſly Bruiſed in their Bodies. From *Flint-ſhire* it croſſed over the Arm of the Sea that comes up to *Cheſter*, and was only felt in *Cheſhire*, at the very *N. W.* Corner of the *Peninſula*, call'd *Wirall*, between the *Æſtuaria* of *Cheſter* and *Leverpoole*, at a Town called *W. Kirkby*, where it *Hailed* but for three Minutes, it being on the extream Point thereof, on the Right Hand, but it *Thundred* dreadfully, and was here at *Cheſter* about 3 in the Afternoon; but the main Body of it fell upon *Lancaſhire*, in a right Line from *Ormskirk* to *Blackborn*, which is on the Borders of *York-ſhire*; but whether it croſſed the Ridge of Hills into *Yorkſhire*, we know not. The Breadth of the Cloud was about 2 Miles; within which Compaſs it did incredible Damage, Killing all ſorts of Fowl and ſmall Creatures; and ſcarce leaving any whole Panes in any of the Windows where it paſſed; but which is worſe, it plowed up the Earth, and cut off the Blade of the Green Corn ſo as utterly to deſtroy it, the *Hailſtones* burying themſelves in the Ground; and the Bowling Greens, where the Earth was any thing ſoft, were quite defaced, ſo as to be rendred unſerviceable for a Time. This I had from an Eye Witneſs, The *Hailſtones*, ſome of which weighed 5 *Ounces*, were of differing Forms, ſome Round, ſome half Round, ſome Smooth, others Emboſſed and Crenulated, like the Foot of a Drinking Glaſs, the *Ice* very Tranſparent and Hard, but a *Snowy Kernel* was in the midſt of moſt of them, if not all; the Force of their Fall argued them to fall from a great Height. What I take to be moſt Extraordinary in this *Phænomenon* is, that ſuch a ſort of Vapours ſhould continue undiſperſt for ſo long a Tract, as above 60 Miles together, and in all the way of its Paſſage occaſion ſo Extraor-

Extraordinary Hail *in* Wales, Cheſhire, &c. *by Mr.* Edm. Halley. n. 229. p. 570.

dinary a *Coagulation* and *Congelation* of the Watry Clouds, as to encreaſe the *Hailſtones* to ſo vaſt a Bulk in ſo ſhort a Space as that of their Fall.

By ---------ib. p. 572.

2. We had only the extream Skirt of the Shower here, and there Fell not above 100 *Hailſtones* in our Court, but they were much Larger and Harder than the Oldeſt of us had ſeen. A Gentlewoman found one of them by Meaſure to be about 5 *Inches* about. A little while after the Shower was over, I found the *Stones* had fallen at good Diſtances one from another, and that they were melting very faſt, the Weather being very Hot, ſcarce any of them was ſo little as a Muſquet Bullet, but moſt of them far bigger, and of that Figure.

A Servant who was then at *Bootle-Mill*, tells me, That the Sea ſeemed to be riſen to an unwonted Height, and to bear the Appearance of a Wood; That he found *Hail-ſtones* as big as Poot Eggs. And that many Sea-Fowl and Land-Fowl were killed: and as an Inſtance of it, he took up a *Sea Swallow* on *Bootle Marſh*, whoſe Wing was broken with an *Icy Pellet* and brought her home. Upon this ſtory, I rid towards the Grounds which had ſhared moſt in the *Storm*. When I came to *Bootle*, I ſaw *Jane Mutche*'s Windows ill batter'd; I found the *Storm* had been as Violent at *Linaker*, I ſaw what Breaches it had made upon *Will. Halſal*'s Barns, what Boughs it had broke off from his Apple-Trees, and what Wounds the *Hailſtones* had made in the Green Brow by his Houſe. I meaſured ſeveral of the Holes and found them generally an Inch deep, and ſome an Inch and a half. *Will. Halſal* told me, that the great *Stones* fell ſo violently into the Marl Pit beſides his Houſe, that Spouts of Water roſe a Yard and a half high. This unriddled my Man's Story, that the Sea appeared like a Wood. Dr. *Tarleton* took up *Hailſtones* as big as Duck-Eggs upon *Aughton Common*: And Mr. *Shepherd* profeſſes that the Church-Yard at *Sephton* ſeem'd as ſtrew'd with Duck-Eggs; and that one of them was weighed, which amounted to full half a pound; two *Hailſtones* were weighed at *Ormskirk* which came to $\frac{3}{4}$ of a Pound a piece. At *Ince* the *Stones* were part as big as Duck and part as Gooſe-Eggs.

I ſent ſome People the next Morning early to the Sea-ſide, and they brought in ſeven ſorts of Fowls, as *Curliew*, *Sea Pye*, *Sea Swallow*, *Gorre*, and other we want Names for: and we hear that at the little Towns next the Sea they were picked up by Buſhels.

No *Hail* fell at *Everton*, *Lowhill*, or *Leverpool*, the *Storm* ending near *Walton*, but there was ſo thick a Darkneſs before the *Storm*, that in *Leverpool* many People ran out of their Houſes into the Street to look at the Face of the Sky; and it was marvellous Dark here. The Neighbours tell doleful Stories of the Effects of this Hail; As a Young Woman at *Bootle* was running for Shelter her Hat fell off, and a *Hailſtone*, that hit her behind the Ear, made her Tumble; a man was knockt off his Horſe by the *Hail*, but preſently got up again; Another having pulled down his Hat to ſave his Face, a *Stone* fell which tore the Brim from the Crown, ſo far that he could put his hand through the Hole; at *Ormskirk* 4 Pounds Damage was done to one Inn, and the Glaſs broke by the *Storm* in the whole Town could not be repaired for 60 *l.* the *Stones* there rebounded, many of them, two Yards high; at *Ince* two Horſes were

were knockt down in the Plough, and a Man fell at the ſame time; at *Croſby* ſome Beaſts were knock'd down; One *Jo. Holland* was found dead in *Skirmsdale* after the *Shower*, but whether by the *Hail* or *Lightning* (for it came with *Thunder* and *Lightning*) I have not yet heard; Two Women were ſo beaten by it, in a little while before they got covert, that they could hardly turn them in their Beds next Morning; They could hardly paſs the Lanes for Baskets, Panniers, Sacks, and People, which the Horſes had thrown down in their return from *Ormskirk*-Market.

XLV. On *Tueſday*, *May*. 4. 1697. (at *Hitchin* in *Hartfordſhire*) about 9 a Clock in the Morning, it began to *Lighten* and *Thunder* extreamly, ſome great Showers intervening; it continued till about two of the Clock in the Afternoon, when on a ſudden a Black Cloud aroſe *S. W.* of us, the Wind being Eaſt and blew hard: then fell a ſharp Shower, with ſome *Hailſtones*. I meaſured ſome of them 7 and 8 Inches about: but the extremity of the *Storm* fell about *Offley*, where a Young Fellow was killed, one of his Eyes ſtuck out of his Head, his Body was all over Black with the Bruiſes; another Perſon nearer to *Offley* eſcaped with his Life, but much Bruiſed; there was in the Houſe of Sir *Jo. Spencer*, 7000 Quarries of Glaſs broke, and there was great Damage done to all the Neighbouring Houſes thereabouts; the *Hail* fell in ſuch vaſt Quantities, and ſo great, that it tore up the Ground, ſplit great Oaks and other Trees in great Numbers; it cut down great Fields of Rye, as with a Scyth, and has deſtroyed ſeveral Hundred Acres of Wheat, Barley, *&c.* in ſo much that they Plough it up, and ſow it with Oates. The *Tempeſt* was ſuch when it fell, that in 4 Poles of Land, from the Hills near us, it carried away all the Staple of the Land, leaving nothing but Chalk; the *Hail* broke vaſt Numbers of Pidgeons Wings, Crows, Rooks and other Birds; the Flood came down, ſpreading 4 or 5 Acres of Land, rowling like the *Bay* of *Biſcay*; and which is very ſtrange, all this fell in the Compaſs of one *Engliſh Mile*. I was walking in my Garden, which is very ſmall, perhaps about 30 Yards ſquare, and before I could get out, it took me to my Knees, and was through my Houſe before I could get in, which I can modeſtly ſpeak was in the ſpace of a Minute, and went through all like a Sea, carrying all Wooden things like Boats on the Water, the greateſt part of the Town being under this Misfortune; the Surprize was ſo great, that we had ſcarce time enough to ſave our Children and Wives. There fell ſome Hundred thouſand Cart Loads: I ſaw them 4 days after; and if the Beds of *Hail* had not been broke by People's coming, and trampling of Horſes, it might have lain till *Michaelmas*. They have been meaſured from one to Thirteen and Fourteen Inches certain: Some People talk largely of it, Seventeen and Eighten Inches; but the other is certain Truth. The Figures of them are various, ſome Oval, others Round, others Picked, ſome Flat. We were not ſo curious to weigh them. The Dammage about us and in our Town, is near 4000 *l.*

A Storm of Hail *in* Hartfordſhire, *May*. 4. 1697; *by Mr.* Rob. Taylor, *ib. p.* 577.

XLVI. 1. In the Pariſh of *Weſthide*, not far from *Hereford*, there fell on the 6 of *June* 1697. ſo great a Quantity of *Hail*, that it deſtroyed all the Poultry, Garden-ſtuff, Corn, Graſs, and moſt of the Fruit-Trees in the Pariſh, but

A Storm of Hail *in* Herefordſhire, *June*. 6. 1697; *by . . . ib.* 578.

but killed no Men nor Cattle; but hurt ſeveral, and broke moſt of the Windows. Many of the *Stones* were meaſured above 9 Inches in Compaſs.

By Mr. Ed. Lhwyd. *ib.*

2. We had at *Ponty Pool* in *Monmouthſhire*, *Jun.* 6. 1697. an Extraordinary Shower of *Hail*, which extended about a *Mile*, and laſted near Half an Hour. It broke the Stalks of all the Beans and Wheat within that Circumference, and Ruined as much Glaſs at Major *Hanbury*'s Houſe, as coſt 4 Pounds repairing; ſome of the *Hail* were 8 Inches about, their Figure very Irregular and unconſtant, ſeveral of the *Hail-ſtones* being Compounded.

An Unuſual ſort of Snow; *By* M. Joh. Chr. Beckman. n. 39. p. 773.

XLVII. The firſt of *March* ($166\frac{7}{8}$) there fell an unuſual ſort of *Snow* at *Franckfort* in the *Oder*. It had none of the ordinary *Figures*, but was made up of little Pillars, whereof ſome were *Tetragonal*, ſome *Hexagonal*, with a neat *Baſis*. On the Top they were ſomewhat larger, as the *Heads* of *Columns* are. Conſidering the whole Shape, we thought fit to give it the name of *Nix Columnaris*.

Red Snow *near* Genoa; *Communicated by Sig.* Sarotti. n. 139. p. 976.

XLVIII. On St. *Joſeph*'s Day, upon the Mountains called *Le Langhe*, there fell upon the *White-Snow*, that was there already, a great quantity of *Red*, or if you pleaſe of *Bloody-Snow*; From which, being ſqueezed, there came a Water of the ſame Colour.

Obſervations on Snow; *by Dr.* Jo. Beale n. 56. p. 1138.

XLIX. I have ſeen the Water of diſſolved *Snow* perform a quick Cure, in taking out the Fire when the Fleſh was Burnt by a Warming-Pan of Braſs; which Metal commonly makes the Burning more difficult to be cured: Which did put me in mind, to examine the *Figures* of the *Snow*, which now fell in this extreme *Froſt*. I expected, that we might ſee through the ſmall Particles, at leaſt as through Lice, Fleas, Cheeſe-mites, *&c.* By ſome kind of Tranſparence: But I was deceived; my Aſſiſtants could make nothing of it, either by an ordinary or extraordinary *Microſcope*.

The Nature of Snow; *by Dr.* Nehemiah Grew. n. 92. p. 5193.

L. He that will enquire of the Nature of *Snow*, will do it beſt, not by the purſuit of his Phancy in a Chair, but with his Eyes abroad; where if we uſe them well fixed, and with good Caution, and this in a Thin, Calm, and Still *Snow*, we may by Degrees obſerve;

1. With M. *Des Cartes*, and Mr. *Hook*, that many parts hereof are of a Regular Figure; for the moſt part, as it were, ſo many little Rowels, or Stars, of 6 Points; being perfect and tranſparent *Ice*, as any we ſee upon a Pool or Veſſel of Water. Upon each of theſe 6 Points, are ſet other Collateral Points; and thoſe always at the ſame Angles as are the main Points themſelves.

2. Amongſt theſe Regular Figures, many others alike Regular, but far leſs, may likewiſe be diſcovered.

3. Looking ſtill more warily we ſhall perceive, that there are divers others, indeed Irregular, yet chiefly but the Broken Points, Parcels and Fragments of the Regular ones.

Laſtly, That, beſides the Broken parts, there are ſome others, which ſeem

to

to have loſt their Regularity, not ſo much in being Broken, as by various Winds, firſt gently Thaw'd, and then Froze into little Irregular Clumpers again.

From whence the true Notion and External Nature of *Snow* ſeemeth to appear, *viz.* That not only ſome few parts of *Snow*, but Originally the whole Body of it, or of a *Snowy* Cloud, is an infinite Maſs of *Icicles* Regularly Figur'd; not one particle thereof, I ſay, Originally, not one of ſo many Millions, being Indeterminate or Irregular: That is to ſay, a Cloud of Vapours being gathered into Drops, the ſaid Drops forthwith deſcend; upon which Deſcent, meeting with a ſoft Freezing Wind, or at leaſt paſſing through a Colder Region of the Air, each Drop is immediately Froze into an *Icicle*, ſhooting it ſelf forth into ſeveral Points or *Striæ* on each hand from-ward its Center: But ſtill continuing their Deſcent, and meeting with ſome ſprinkling and intermixed Gales of Warmer Air, or in their continual Motion, and Waftage to and fro touching upon each other, ſome are a little Thaw'd, Blunted, Froſted, Clumper'd, others Broken, but the moſt Hanked and clung in ſeveral parcels together, which we call *Flakes* of *Snow*.

Hence we underſtand why *Snow*, though it ſeems to be Soft, yet 'tis truly Hard, becauſe true *Ice*; the inſeparable property whereof is, to be Hard; ſeeming only to be Soft, becauſe upon the firſt touch of the Finger upon any of its Sharp Edges or Points, they inſtantly Thaw, or otherwiſe they would Pierce our Fingers as ſo many Lancets.

Why again, though it be true *Ice*, and ſo a Hard and Denſe Body, yet very Light; becauſe of the extream Thinneſs of each *Icicle* in compariſon of its breadth. For ſo Gold, which though of all Bodies the moſt ponderous, yet being beaten into Leaves, rides upon the leaſt breath of Air.

Alſo how it is White; becauſe conſiſtent of parts all of them ſingly Tranſparent, but being mixed together, appear White; as the parts of Froth, Glaſs, Ice, and other Tranſparent Bodies, whether Soft or Hard.

The *Eſſential Nature* of *Snow*, I think may be beſt underſtood, by comparing its general Figure with ſuch Regular Figures as we ſee in divers other Bodies; in that, where we ſee the like Configurations, we may believe there is the like *Subject* wherein, or the like *Efficient* whereby, both thoſe and theſe are made.

As for the *Figure* of *Snow*, 'tis generally one, *viz.* That which is above deſcribed: Rarely of Different ones, which may be reduced chiefly to two generals, Circulars and Hexagonals, either Simple or Compounded together: more rarely, either to be ſeen of more than 6 Points; but if ſo, then not of 8 or 10, but 12; Or in ſingle Shoots, as ſo many ſhort ſlender Cylinders like thoſe of *Nitre*: Or by one of theſe Shoots, as the Axle-tree, and touching upon the Center of a Pair of Pointed *Icicles*, joyned together as the two Wheels: Or the ſame Hexagonal Figure, and of the ſame uſual Breadth, but continued in thickneſs or profundity, like the Stone, which, as I remember, *Boetius* calls *Aſtroites*. All theſe I ſay are Rare; the firſt Deſcribed being the General *Figure*.

As for the *Configurations* of other Bodies, we ſhall find, that there are divers which

which have ſome a leſs, others a more near reſemblance hereunto. *Nitre* is formed, as is commonly known, into long Cylindrical Shoots, as alſo all *Lixivial Salts*, for the moſt part; reſembling, though not perfectly, the ſeveral Points of each Starry *Icicle* of *Snow*. *Salt* of *Harts-Horn*, *Sal-Armoniac*, and ſome other *Volatile Salts*, beſides their Main and longer Shoots, have others Shorter Branched out from them; reſembling as thoſe the Main, ſo theſe the Collateral Points of Snow. But the *Icicles* of *Urine* are ſtill more near: For, in *Salt* of *Harts-Horn*, although the Collateral Shoots ſtand at Acute Angles with the Main, yet not by Pairs at Equal Height; and in *Sal-Armoniac*, although they ſtand Diametrically oppoſite, or at Equal Height, yet with all at Right, not Acute Angles; Whereas in the *Icicles* of *Urine* they ſtand at Equal Height, and at Acute Angles both: In both, like thoſe of *Snow*. And it is obſervable, that the *Configuration* of *Feathers* is likewiſe the ſame: the Reaſon whereof is, becauſe Fowls having no Organs for the Evacuation of *Urine*, the *Urinous* Parts of their Blood are Evacuated by the Habit or Skin, where they produce and nouriſh *Feathers*.

From hence it ſhould ſeem, That every Drop of Rain aforeſaid, containing in it ſelf ſome *Spirituous* Particles (as from the Height to which they are advanced, the Prolifique Virtue of *Rain*, and its eaſy tendency to Putrefaction above other Water, is argued they do,) and meeting with others in their Deſcent of a *Saline*, and that partly *Nitrous*, but chiefly *Urinous*, or of an *Acido-ſalinous* Nature, the ſaid *Spirituous* Parts are apprehended by them, and with thoſe the Watry, and ſo the whole Drop is fixed: yet not into any indifferent and Irregular ſhape, depriving the *Spirituous* parts of their Motion in an inſtant; but according to the *Energy* of the *Spirituous* as the Pencil, and the ſpecifick Nature or determinate poſſibility of the *Saline* parts as the Ruler, 'tis thus Figured into a little *Star*.

A Freezing Rain *in* Somerſetſhire; *by Dr.* J. Beal. n. 90. p. 5138.

LI. 1. The *Freezing Rain*, which fell here the *9th*, *10th*, or *11th* of *December* 1672, (for I cannot confine the time exactly) hath made ſuch a Deſtruction of Trees, in all the Villages and High-Ways from *Briſtol* toward *Wells*, and towards *Shepton-Mallet*, and towards *Bath* and *Bruton*, and in other places of the *Weſt*, that both for the manner and Matter it may ſeem incredible; and is more ſtrange than I have found in any *Engliſh* Chronicle. You have the Proof and manner and beſt Meaſure of it in the following Tranſcript. "The late Prodigious *Froſt* (*ſaith a very worthy Perſon of unqueſtiona-*
"*ble Credit*) hath much diſabled many old Orchards, expoſed to the North-
"Eaſt; Had it concluded with ſome Guſts of Wind, it might have been of ſad
"importance; I weighed the Sprigg of an Aſh-Tree of juſt three quarters of
"a pound, which was brought to my Table; the *Ice* on it weighed 16 pounds,
"beſides what was melted off by the hands of them that brought it. A very
"ſmall Bent at the ſame time was produced, which had an *Icicle*, encompaſſing
"it, of 5 Inches round by meaſure. Yet all this while, when Trees and
"Hedges were loaden with *Ice*, there was no *Ice* to be ſeen on our Rivers, nor
"ſo much as on our ſtanding Pools. The like, or worſe and more ſtrange com-

complaints, I received from ſeveral other places, and from Eye Witneſſes of Credit. Some Travellers were almoſt loſt by the Coldneſs of the *Freezing* Air, and *Freezing Rain*. All the Trees, Young and Old, on the High-way from *Briſtol* to *Shepton*, were ſo torn and thrown down on both ſides the Ways, that they were unpaſſable. By the like Obſtructions the Carriers of *Bruton* were forc't to return back. Some were affrighted with the noiſe in the Air, till they diſcerned that it was the clatter of *Icy* Boughs, daſhed one againſt another by the Wind. Some told me that riding on the *Snowy* Downs, they ſaw this *Freezing Rain* fall upon the *Snow*, and immediately *Freeze* to *Ice*, without ſinking at all into the *Snow*; ſo that the *Snow* was covered with *Ice* all along, and had been dangerous, if the *Ice* had been ſtrong enough to bear them. Others were on their Journey when the *Ice* was able to bear them in ſome places, and they were in great diſtreſs.

Dec. 8. much *Snow* fell here; the 9*th* much *Rain* fell here; and all the *Snow* paſſed away, not leaving an *Icicle* amongſt us. The 10*th* Day, we had ſuddain fits of Cold and relaxing Warmneſs. On *Wedneſday* (*Dec.* 11.) I ſaw a Young Man, who returning home from a Journey of 5 Miles, and coming into a Warm room, cryed out of extream Torments in all parts of his Body. He affirmed, that the Air, and the Winds (which were then ſomewhat high) were ſo unſufferably Cold, that he was in utter Deſpair of coming home alive; yet all that day nothing but moiſt *Dew* fell under our Feet. If we ſay, the Earth did ſend forth Warm Steams to keep this *Freezing Rain* diſſolved on her Surface; whence ſhall we ſay, the Air, and Rain and Winds got theſe *Freezing Icicles*, which oppreſſed Men and Plants? When the Candid *Froſts* do cover our Fruit-Trees perfectly white (as I have ofttimes ſeen it hold for ſome Weeks together) it is ſo far from doing hurt to the Trees, that we have it in a Proverb for a good Sign of abundance of Fruit, in the enſuing Year: But this *Freezing Rain*, as ſoon as it touched any Bough, ſettled into *Ice*, and by multiplying and enlarging the *Icicles* (eſpecially where it could lay hold on Moſs or other aſperities of the Tree) it broke all down with the Weight.

This ſhews that a *Froſt* may be very Fierce and Dangerous in the Air, and on the Tops of ſome Hills and Plains, whilſt in many other places it keeps at two, three, or four foot diſtance above the Ground, Rivers and Lakes; and may wander, at ſome difference of time, in ſome places very Furious; in other places intermediate and not far aſunder, very Remiſs and abated; where it was Fierce always at the height of Trees at leaſt, never on the ground Vehement, that I could hear of, but on *Salisbury Plains*, which are very High Grounds. n. 116. p. 357.

As ſoon as theſe *Froſts* were over, we had *Glowing Heats*, which cauſed a general complaint amongſt us of exceſſive Sweating, by Night and Day. The Buſhes and many Flowers in the Garden appeared in ſuch forwardneſs, as if it were in *April* or *May*. I ſaw Young Coleworts growing; and not far from my abode, an Apple-Tree Bloſſomed before *Chriſtmas*. This I do not mention for extraordinary; but I think 'tis more than ordinary, that before *New Years-Tide* this Apple-Tree bore Apples perfectly knitted, and as big as ones Fingers end. n. 90. p. 5140.

2. The

At Oxford; *by Dr.* Wallis. n. 92 p. 5196. n. 231. p. 654.

2. The like ſtrange *Froſt* was with us at *Oxford*. It was rather a *Raining* of *Ice*, or at leaſt *Rain Freezing* as it fell; which made ſtrange *Icicles* hanging on Trees, and a ſtrange Noiſe by the rattling of them upon the Boughs motion by the Wind: but not ſo much as at the places you mention in *Somerſetſhire*. Yet more in the Country about us (as from ſeveral Relators I have heard,) than with us here. And the great *Warmth* ſoon after was alſo with us; in ſo much that not only Bloſſoms, but (as was then certainly affirmed, though I was not ſo curious as to get a ſight of any,) green Apples were obſerv'd on divers Trees; particularly in the Pariſh of *Holywell*.

Effects of Cold *in the Northern Countries; by M.* Joh. Scheffe-rus. n. 19. p. 350.

LII. 1. Mr. *Joh. Schefferus*, a Profeſſor in the *Sweediſh Univerſity* at *Upſal*, writes, That he hath ſeen and had *Hares*, which about the Beginning of *Winter* and *Spring* were half *White*, and half of their Native Colour: that in the midſt of *Winter* he never ſaw any but all *White*. That *Foxes* alſo are *White* in *Winter*; and *Squirrels* Grayiſh, mixt of a Dark and *White* Colour.

That Fiſhes are killed by reaſon of the *Ice* not being broken: but firſt, in Ponds only or narrow Lakes: next, in ſuch Lakes only, where the *Ice* is pretty thick; for, where 'tis thin, they Dy not ſo eaſily: Laſtly that thoſe Fiſhes that lye in Slimy or Clayie Ground Dy not ſo ſoon as others.

That in Great Lakes, when 'tis a very bitter *Froſt*, *Ice* is wont to be broken, either by the Force of the Waves, or of the impriſoned Vapours, raiſed by the Agitation of the Water, and then burſting out with an Impetuoſity; Witneſs the noiſe made by the Rupture of the *Ice* through the whole Length of ſuch Lakes, which he affirms to be not leſs Terrible than if many Guns went off together. Whereby it falls out, that *Fiſhes* are ſeldom found Dead in Great Lakes.

That neither Oil, nor a ſtrong Brine of Bay-Salt, is truly congealed into *Ice*, in thoſe Parts: That the *Froſt* pierces into the Earth, two Cubits or *Sweediſh Ells*; and what Moiſture is found in it, is White, like *Ice*. That Waters, if Standing, *Freeze* to a greater Depth, even to three ſuch *Ells* or more; but thoſe that have a Current, leſs: That Rapid Waters *Freeze* not at all; nor ever Bubbling Springs; and that theſe latter ſeem even to be Warmer in *Winter*, than *Summer*.

By M. Fehre. *ib.* p. 351.

2. M. *Febre*, Chief Secretary to Prince *Radzivil*, Aſſures us, that in the War againſt the *Muſcovites* and *Coſſacks* in *Jan.* 1655. at the Siege of *Bichow* in *White-Ruſſia*; all their Proviſions of *Spaniſh Wines* or *Peterſimen*, and Beer, were in one Night *Frozen* upon the Sleds, notwithſtanding they were covered with Straw; in ſo much that they were conſtrained to carry them into a Stove, to Thaw them, which they could not do in two whole Days, and were obliged to break the Veſſels, and put pieces of the *Icy Wine* into Kettles to Thaw them over the Fire, for Drink. But he obſerved that the *Hungarian Wine* reſiſted the Cold better than the *Peterſimen*: for it was not ſo much *Frozen*; unleſs it be that the Butler tranſported it ſooner into the Stove. That the Scrue of a Flagon of *Aqua-vitæ* being put to his Mouth, ſtuck cloſe to his Lips, that he could not draw it off without drawing Blood. That the Pool of the Village (where

(where they Quartered) was ſo thoroughly *Frozen*, that there was but very little Water left between the *Ice* and the Bottom.

That *Jan.* 2. 1665. the *Froſt* was ſo Bitter in *Poland*, That 3 Souldiers dyed of it in paſſing a long Ditch; and that divers Perſons loſt ſome of their Limbs. *ib. p.* 352.

LIII. 1. The paſt *Winter* 168¾. has been ſo Severe in my Territories, and where it could expugne the more defenſible and ſuch as were incloſed, it has Ravag'd all that lay open, and were abroad, without any mercy. *The Effects of the* Froſt 168¾; *by Mr.* J. Evelyn. n. 158. p. 559.

As to *Timber-Trees*; I have not many here of any conſiderable Age or Stature, except a few *Elms*, which (having been decayed many Years) one cannot well find to have received any freſh Wounds, diſtinguiſhable from old Cracks and Hollowneſſes; and indeed I am told by divers, that *Elms* have not ſuffered as the great *Oaks* have done; nor do I find amongſt innumerable of that Species (*Elms*) which I have Planted, and that are now about 25 and 30 Years ſtanding, any of them Touched: The ſame I obſerve of *Limes*, *Walnuts*, *Aſh*, *Beach*, *Horn-beams*, *Birch*, *Cheſnut*, and other Forreſters. But as I ſaid, mine are Young comparatively; and yet one would think, that ſhould leſs Protect them, becauſe more Tender: ſo as it ſeems the Rifting ſo much complain'd of, has happen'd chiefly among the overgrown Trees, eſpecially *Oaks*. My Lord *Weymouth* made his Lamentation to me, and ſo has the Earl of *Cheſterfield*, Lord *Ferrers*, Sir *William Fermor*, and others concerned in the ſame Calamity; which I mention, becauſe of their diſtant habitations. But if rightly I remember, one of theſe Noble Perſons lately told me, that ſince the *Thaw*, the Trees which were exceedingly Split, were come together and cloſed again, and I eaſily believed it; but that they are really as Solid as before, I doubt will not appear, when they ſhall come to be examined by the Axe, and converted to uſe. Nor has this Accident happen'd only to Standing Timber, but to that which has been Fell'd and Seaſon'd, as Mr. *Shiſh*, the Maſter Builder in his Majeſty's Ship-Yard here, inform'd me.

As for *Exotics*; I fear my *Cork Trees* will hardly recover. The *Conſtantinopolitan* or *Horſe-Cheſnut* is Turgid with Buds, and ready to explain its Leaf. My *Cedars* I think are loſt: The *Ilex* and *Scarlet-Oak* not ſo; The *Arbutus*, doubtful, and ſo are *Bays*; but ſome will Eſcape, and moſt of them repullulate and Spring afreſh, if cut down near the Earth, at the latter end of the Month. The *Scotch-Fir*, *Spruce*, and White *Spaniſh* (which laſt uſes to ſuffer in their Tender Buds by the *Spring Froſts*) have received no damage this *Winter*; I cannot ſay the ſame of the *Pine*, which bears the greater Cone, but other *Norways* and *Pinaſters* are Freſh. *Laurel* is only diſcoloured, and ſome of the woody Branches Mortified, which being cut to the quick will ſoon put forth again, it being a Succulent Plant. Amongſt our *Shrubs*, *Roſemary* is intirely Loſt; and ſo univerſal (I fear) is the deſtruction of this excellent Plant (not only over *England*, but our Neighbour Countries more Southward) that we muſt raiſe our next hopes from the Seed. *Halimus*, or Sea-Purſlan, (of which I had a pretty hedge) is alſo Periſhed, and ſo another of *French-Furſes*; The

Cypreſs are all of them Scorched, and ſome to Death, eſpecially ſuch as were kept Shorn in Pyramids; but amongſt great Numbers, there will divers eſcape, after they are well *Chaſtiz*'d, that is with a tough Hazel or other Wand, to beat off their Dead and Duſty Leaves, which growing much cloſer than other Shrubs, hinder the Air and Dews from refreſhing the Interior parts. This Diſcipline I uſe to all my *Tonſile Shrubs* with good ſucceſs, as oft as a Winter parches them. The Berry-bearing *Savine* (which if well underſtood and cultivated were the only beſt *Succedaneum* to *Cypreſs*) has not ſuffered in the leaſt; it perfectly reſembles the *Cypreſs* and grows very Tall and Thick. I think the *Arbor Thuya* is Alive, and ſo is the *American Acacia*, *Acanthus*, *Paliurus*, *Pomgranate*; my *Lauruſtinus* looks ſuſpiciouſly; Some large and old *Alaturnus's* are Kill'd, eſpecially ſuch as were more expoſed to the Sun, whereas thoſe that grow in the Shade eſcape; the reaſon of which I conjecture to be, from the Reciprocations of being ſomewhat Relaxed every Day, and then made Rigid and Stiff again all Night, which bending and unbending ſo often, opening and cloſing the Parts, does exceedingly Mortify them, and all other tender Plants, which growing in ſhady places undergo but one Thaw and Change. Moſt of theſe yet will Revive again at the Root, being cut cloſe to the ground. The *Phillyrea's anguſti*, and *Serratifolio's* (both of them incomparably the beſt for Ornamental Hedges of any the *Perennial Greens* I know) have hardly been ſenſible of the leaſt Impreſſion, more than Tarniſhing of their Leaves, no more have the *Spaniſh Jaſmines*, and *Perſian*; and I enumerate theſe particulars the more minutely, that Gentlemen who are curious, may take notice what Plants they may truſt to abroad, in all Events; for I ſpeak only of ſuch as are expoſed.

I need ſay nothing of *Holly*, *Yew*, *Box*, *Juniper*, &c. (Hardy, and ſponteous to our Country) and yet to my Grief I find an *Holly* Standard of near 100 Years old, Drooping and of Doubtful Aſpect; and a very beautiful Hedge (tho' indeed much younger) being Clip'd about *Michaelmas*, is Mortified near a foot beneath the Top, and in ſome places to the very ground; ſo as there's nothing ſeems proof againſt ſuch a *Winter*, which is late Cut, and Expos'd. This Hedge does alſo grow againſt the South, and is very Ruſſet, whilſt the contrary ſide is as Freſh and Green as ever; and in all other places of my Plantations that are Shaded, the Unſhorn *Hollies* maintain their Verdure, and are I judge Impregnable againſt all Aſſaults of *Weather*.

Among the *Fruit-Trees*, and *Murals*, none ſeem to have ſuffer'd ſave *Figs*; but they being Cut down, will Spring again at the Root. The *Vines* have eſcaped; and of the *Eſculent Plants* and *Salads* moſt, except *Artichokes*, which are univerſally loſt; and (what I prefer before any *Salad* whatever Eaten Raw, when young) my *Sampier* is all Rotted to the very Root: How to repair my loſs, I know not, for I could never make any of the Seed, which came from the *Rock Sampire* (tho' mine were of the very Kind) to Grow.

The *Arboreſcent* and other *Sedums*, *Aloes*, &c. (tho' Hous'd) periſhed with me; but the *Yucca*, and *Opuntia* eſcaped. *Tulips* many are loſt, and ſo the *Conſtantinople Narciſſus*, and ſuch *Tuberoſæ* as were not kept in the Chimney-Corner where was continual Fire. Some *Anemonies* appear, but I believe many are Rotted: But I have made no great ſearch in the Flowery Parterr, only

only I find that moſt Capillaries Spring, and other Humble, and Repent Plants, notwithſtanding all this Rigorous Seaſon.

My *Tortoiſe* (which by his conſtant burying himſelf in the Earth at approach of Winter, I look upon as a kind of Plant-Animal) hapning to be obſtructed by a *Vine*-Root, from Mining to the Depth he was uſually wont to Interr, is found ſtark Dead, after having many Years eſcaped the Severeſt Winters. Of *Fiſh* I have loſt very few; and the *Nightingales* (which for being a ſhort winged Bird, and ſo exceeding Fat, at the time of the Year, we commonly ſuppoſe them to change the Climate, (whereas indeed they are then hardly able to Flee an Hundred Yards) are as Brisk and Frollic as ever, nor do I think they alter their Summer Stations, whatever become of them all Winter.

2. In this Rigid Seaſon nothing ſeemed more Surpriſing to us, nor more generally known to be true, than the Cleaving or *Splitting* of Trees; as of the *Elms* by Mr. *Langley*'s Houſe the Miniſter of *Tamworth*; and *Aſhes* of conſiderable Bulk and Value, deſigned for and capable of diverſe uſes, as *Wind-Mill-Poſts*, Dreſſer-boards, and other neceſſary occaſions. Alſo *Wallnut-Trees* in diverſe places have ſuffered by this Calamity, and proved extreamly *Cleft*; tho' indeed it hath been moſt frequent among *Oaks*, many of which have been Divided to great Detriment in *England*, ſome being ſo Rent that a Man may ſee through them, and that many times the Cracks came with ſo great Noiſe, that as it is related from *Needwood-Forreſt* they made ſuch a *Noiſe*, that the Keepers there thought that the Deer were ſhot by the People of the Country, and that in ſeveral parts they were heard as loud as Guns, ſome having been cruelly affrighted eſpecially in the Evenings or Nights, as they have paſſed within the hearing of this ſo unexpected and ſurprizing a *Noiſe*. Which *Rifts* or *Clefts* were not at all to the ſame Point of the Compaſs, but ſometimes on one ſide only, ſometimes 2, and ſometimes 3, and ſometimes 4 ſeveral places, Dividing or quartering the Tree, and ſometimes quite through: And theſe *Clefts* were not only in the Bodies, but continued into the larger Boughs and Limbs of the Tree, and ſometimes Deſcended into the Superficial Roots, but not to thoſe very deep in the Earth; the *Froſt* though extream, not reaching conſiderably deep, comparatively to the Roots of Trees, and the hard binding of the Earth being ſo *Frozen*, would not eaſily admit of compreſſure: But ſeveral ſhallow Roots ſo knotted and knurled as not to be wrought upon with Beetle and Wedges, are known to be *Cleft* by the Froſt. But it is much to be doubted and ſuſpected whether any ſuch *Cloven* Trees were ſo perfectly Sound and Faithful Timber, if proved by the Saw and Axe, as they ought to be; for if ſo, all might equally ſuffer, the Air having impartial acceſs to one as well as the other, but ſome being taken with this Diſeaſe, and others left untouch'd, there certainly was ſome Cauſe or Defect in thoſe Liable to it, rather than the reſt. A great part of the Cauſe of it is ſuppoſed to be Imperfection in ſuch a Tree, and that generally from the too large *Sap-Veſſels* and unnatural Cavities therein, which ſome call *Wind-ſhaken*, and ſome *Lagg'd* Trees; the Cauſe whereof remains yet to be examined, whether the *Shaking* of the Wind may not, with its great Weight and Force, taking the whole Tree

By Mr. Jacob Bobart. n. 165. p. 766.

with its Boughs Limbs and Body, having one End firmly fixed in the Earth at ſome age or other, as well Work Wrack and make Splintering and ſtreached Pores, Paſſages, Cavities and ſuch like, in a Live and Growing Tree, at ſometime of continuance of its force with its oft repeated Beating, Twiſting, and Preſſing Blaſts, as well as the beſt choſen Maſt of a Ship may ſuffer damage by the ſame Cauſe, even to Total Fraction. By ſome this is ſuppoſed to proceed from Earthquakes, but whether or not, is yet to be examined. But the Opinion of ſome ſeems not to be extravagant, who think it to be an Original Diſtemper in the Tree, and to proceed from the *Soil*, or rather an Innate Diſeaſe from ſome tho' undiſcernable Imperfection in the *Seed* it ſelf, and yet not ſo much but that they Live many Years, and Grow to great Bulk and Stature, but are obſerved to bear leſſer Leaves and ſmaller Acorns; but whether the *Soil* be concerned, may be urged, the Trees about *Oxford* Weſtward, being generally affected with this Diſeaſe, and thoſe from the Eaſt ſide prove excellent Sound Timber, and the *Soils* ſeeming to reſemble one another.

But by what means ſoever this may come, it is certain that ſome Trees are much more Sound than other, and that ſome prove full of Inbred Diſeaſes and Cavities, before they are Cut down, which Cavities and ſtretcht Veſſels being fill'd with too great a quantity of Aqueous and undigeſted *Sap*, as it were *Hydropical* (for it is thought that the Genuine and Natural *Sap* of theſe our Native Trees, though undergoing Condenſation, will remain ſecure and ſafe as may be ſuppoſed from thoſe that are well and firmly ſtanding) are thereby rendred capable of not only Condenſation but *Glaciation* alſo by the continuance and ſeverity of the Airs *Frigefactive* Power; which being ſufficiently known to employ more room being *Ice*, than formerly Liquid, might probably Cauſe theſe *Breaches*, and if we conſider the Expanſive Motion and Spring of the Air included in the Cavities of the *Air Veſſel*, ſuffering more Preſſure than they are patient of, from the *Coagulated* and Contiguous Aqueous parts then *Congealed*, may be induced to ſuppoſe theſe *Strepitous* Eruptions to proceed from thence. But whether Mr. *Hobb*'s Hypotheſis will certainly hold, that the Swelling is cauſed by the Intruſion of the Air, is ſomewhat to be doubted.

It need not prove troubleſome to any to think the *Ice* to be able to *Tear* the *Oaks* or other Trees, who ſhall conſider the great Force and Elaſtick Power thereof; whereof that moſt Excellent and Curious Philoſopher of our Age Eſquire *Boyle* hath, in his *Hiſtory of Cold*, ſet forth ſeveral Experiments and Examples, as Veſſels of ſeveral kinds of Metals being made ſtrong on purpoſe, and fill'd with Water, cloſe ſtopp'd and expoſed to the *Cold*, which being not capable of withſtanding the Expanſive Force of the incloſed *Ice*, having been found *Cleft* and Broken; as for inſtance, the ſtrong Barrel of a Gun cloſe ſtopped, with Water in it, and *Frozen*, hath proved Rent long ways, and never a croſs the Veſſel, nor Bodies of the Trees we here mention. Another time a Braſs Veſſel of a Cylindrical form being made not more than 5 Inches deep and not 2 Diameter, filled with Water and afterwards *Frozen*, in one Night Lifted off the Cover prepar'd and cloſely fitted, with a Weight of 56 pounds that was laid upon it. *Olearius*, Secretary to the Duke of *Holſtein's* Embaſſy into

into *Ruſſia*, tells us that in the City of *Moſco* he obſerved (the *Cold* being very Intenſe) the Earth to be *Cleft* many Yards in length, and a Foot broad, which according to conjecture was occaſioned by the Heaving and Swelling thereof to enlarge its room, as here we ſee *Ice* Crackt and *Cleft* conſiderably long and broad according to its thickneſs along the Ridge or Turgid part thereof. And that the Earth doth ſo Riſe when *Frozen* is eaſily made manifeſt by little Sticks or Plants ſet into the Ground againſt the approaching Winter, which being Riſen 2 or 3 inches or more according to the depth and ſtrength of the *Froſt*, and upon the *Thaw* the Earth ſinking to its former Station leaves the unfixed Plants with their Roots naked above ground, as it were ſpewed out. And not ſuch Moiſt Bodies only, but Metals, as Braſs, Iron, &c. have been Swelled in the time of being *Frozen*, as hath been proved by Clocks, Locks and other Inſtruments, and become Laxed and plyant again upon the *Thaw*. Many more Examples might be eaſily produced to induce us to the thoughts, that the *Sap* is not right and Genuine in ſuch Ill-diſpoſed Trees, and that *Ice* might upon due examination be found in any ſuch *Burſten* Bodies, as we are informed hath been found and obſerved by ſome; and if *Ice*, then Preſſure, and if Preſſure then Breaking and *Exploſion*.

It may be doubted too, whether ſome of theſe Trees thus liable to the Fury of the *Froſt*, have not been *Coltie*? A Term commonly uſed among Timber Merchants and by them avoided; which is, towards the middle of the Tree, among the *Annual Circles*, ſome one is much larger than the reſt, and the *Sap-Veſſels* there ſeem much extended beyond their fellows, and upon Cleaving or Sawing ſuch a Tree, that incloſed or inward Heart, part thereof where that *Circle* is, will ſlip and drop from the other part oftentimes without any Force to Divide it, as an Inſtrument out of a Caſe or Mould made fit for it.

Some ſuppoſe that theſe *Wind-ſhaken* or *Lagg'd* Trees may be known or neerly gueſſed at by the outſide, when growing, by the great Ribbs, 2, 3, or 4, in a Tree from the Bottom to the Branches, and that they have been affected ſomewhat conſiderably with this Diſeaſe before, and perhaps *Cleft* (tho' not in ſo great a meaſure as now) and the Fiſſures cloſed up again; as we ſee theſe to do quickly after the *Froſt*, in ſo much that it is ſcarce diſcernable already, and the *Bark* having not been divided from the Body, upon coming together again each Turn and Twiſt of the Grain fitting its place prove freſh and vigorouſly growing: But that ever ſuch Trees will prove Whole and Sound doth ſcarcely conſiſt with Reaſon or our preſent thoughts. And this Calamity hath not been found in only Trees that were Freſh and Standing, but alſo in Trees Cut down, as is affirmed by Mr. *Shiſh* and others, but notwithſtanding it is thought to be only among ſuch Diſeaſed Trees as are before mentioned.

But it is yet to be Queſtioned whether *Vines* have proved *Cleft* and Crackt along the Bodies by the ſame way and reaſon as *Timber-Trees*, which Decay is eſpecially to be ſeen on Walls expoſed to the Southern Aſpect, ſo that the Sun our accuſtomed Friend now proved our great Enemy, by *Thawing* and Relaxing the *Sap* every Day, and then being *Frozen* and made Stiff again every Night: which often repetition of Bending and Unbending, Softning and Hardning, the

the Vivid Spirituous *Juice* being deſtroyed, and Day and Night the Drought vigorouſly acting, (the *Sap* being this Year diſordered and ſurprized, not gradually ſeaſoned, even before *Michaelmas* day, and the freſh *Sap* to ſupply its Defects being wholly detained from Ariſing, there then being none or very little Exhalations or Evaporations ariſing out of the *Frozen* and bound Earth) theſe poor Slender bodies fill'd only with Thin and not Viſcous *Sap*, have proved as great ſufferers as if by Amputation they had been deprived of their Natural ſuſtenance; for if they could have none from the Earth, and their own true Juice Mortified, and it be certain that *omne Siccum appetit Humidum*, it will follow, that ſuch Branches will by the conſtancy and continuance of ſuch Severity (the Day being as bad as the Night) prove as Dry as ſticks cut off long before: whereas thoſe of this kind and other ſorts alſo Growing in more Shadowy parts, and undergoing but one Change, have remained in good condition, eſpecially among *Red Grapes*, which ſeem much more Hardy than *White* ones.

We ſee other *Wall-Fruits* on the ſame poſition, as *Apricocks*, *Peaches*, *Plums*, *Cherries*, &c. are not at all injured or prejudiced by the Weather, which are of a more clammy *Viſcous* juice: Theſe we ſee Run ſometimes and give Gum; but the Leakage of *Vines* is as Thin as Water, which different *Juices* and *Saps* in other Trees and the degrees thereof, as well thoſe with Deciduous Leaves, as *Ever-greens*, may prove ſome Cauſe of the weakneſs and Decay of ſome, whilſt that of another ſort ſtanding by, remains Freſh and Vigorous, only ſtagnated ſedate and quiet, waiting for the benign Sun's Beams to actuate, Lenifie, and put its Spirits in motion, and its comfortable Refreſhment to ariſe in due Seaſon: And perhaps according to the degree of this Qualification in Trees and Plants (ſome being much more ſluggiſh than other) may be the *Cauſe* of their Earlier or Later *Germination*.

It is eaſily obſerved that in Dry, Mountainous, Rocky and Barren Plantations, where Trees, Greens, and other Plants having been ſparingly fed, and not pamper'd with ſuch Luxuriance and freeneſs of *Sap*, as in the Valleys and Richer Soils, have eſcaped tolerably well: and by this which in other Years proves their Poverty and Diſeaſe, now make them inſult over thoſe growing in the Fatter Vallies, proportional to the Height of the Hills they grow on.

We may obſerve Trees all the Winter, while the *Sap* remains Condenſed, to be ſafe and well, but if a flattering too early Glance happens in the Spring to ſet their parts in Action, and the *Juices* to become fluid, and a ſudden mutation of that Warmth to a freſh return of Winter, (which too frequently happens in *England*) that then we have not only our hopes of that Years Fruit blaſted, but even the paſſages in the Branches and Boughs ſtopped, and the crude *Sap* ſettling, commonly called *Bliting* (tho' there be many Cauſes of the Effects which go under that notion) becomes a Diſeaſe in Trees equal to that of *Child-blanes* in Juvenile Blood, which ſometimes takes whole Trees, and ſometimes Branches only: Hence is ſuppoſed the decay of the *Glaſtenbury-Thorn*, whoſe ariſing time being between *Michaelmas* and *Chriſtmas*, being Sappily pre-

prepared, by the beginning of the Hard *Froſt*, which hath almoſt affrighted it out of its Life.

Some *Trees* and *Shrubs* ſeem to have their *Veſſels* and paſſages ſo ſtreightned and as it were ſhrunk with *Cold*, that they appear equal to a Humane body *Sinew-ſhrunk* or *Paralytick*, that is not without much trouble able to move or bear his Decaying Limbs; Thus we ſee *Trees* with their Bark Shrivel'd, with their paſſages half ſtopt, whoſe *Sap* now only ſqueezing and difficultly paſſing, hath much ado to force its way through the Dryed and narrow Pores and paſſages of the Body and Branches: and ſometimes this Diſtemper is ſo prevalent, that whole Branches of a Tree are killed, when the other part is indifferent well.

Some Liquids, ſuch as *Eſſential Oyls*, do rather Shrink than encreaſe being *Frozen*, and *Empereumatical Oyls* will hardly *Freeze* but Waſte, which conſiderations may introduce the thoughts of what ſome Trees are made of, or do abound in, as *Firrs*, *Pines*, &c. which are capable of enduring the *Cold* of *Norway* and other Countries.

What *Timber-Trees* have ſuffered, are above ſpecified, but divers others of our Native *Trees* and *Shrubs* have ſcarcely proved able to withſtandthe Force of ſo rude an Enemy. *Yew* and *Holly* (things whoſe Tenderneſs was never ſuſpected) were in ſome places quite Kill'd, and in many places ſo diſcouraged, looſing their Leaves and blemiſhing the Bark, that it is to be feared they will never take on their priſtine Splendour and Verdure. The *Furze* in many places quite Killed, and in moſt places cut down and Spring again, but often the Reſurrection in vain expected. Common *Broom* proves a degree Hardier. In ſome places the Sunny ſide of a *Juniper-Buſh* proves Scorcht between Sun and Cold, but that proves one of the moſt Hardy of our Native *Greens*; ſo that it is hard to ſay what is Winter-proof even among our Natives, except *Box* and *Ivy*, which ſtand in Defiance of all.

In the Gardens (which generally are Nurſeries of *Exoticks*, and from Warm Countries) this Calamity hath principally bent its Force againſt *Winter-Greens*, ſuch as *Alaternus* (commonly known by the Name of *Phillurea*) and the true *Phillurea* alſo, which are generally Kill'd; though ſome upon Cutting down Spring again. Alſo common *Bays* ſeen in moſt places to be Kill'd down, and *Lawrel* ſeldom proving impatient, is in ſome places Kill'd, in ſome places Half-dead; *Roſemary*, *Lauruſtine*, *Halimus*, *Arbutus*, *White Jaſmine*, and other which ſeldom fail, are generally Kill'd through the whole Country. But in all theſe and other ſuch like, in Mountainous and Dry places (as was before obſerved) there is brisk Life and Verdure yet remaining, though rarely to be met with, but however enough to retain the ſeveral *Species* among us. But if for the future in ſuch times of Extremity, the Superficies of the Ground, and Bodies of ſuch things here recited, and *Fig-Trees*, were well covered with Strawy matter to keep off the *Froſt*, it might ſo preſerve them as to Spring out plentifully the Spring following, though their whole Tops being too large and high, and thereby incapable of ſuch covering, might loſe their preſent Leaves and Beauty; which might from ſuch reſpringing be eaſily repaired, and prove much more ſatisfactory than to begin the World anew, as we are generally forc'd to

do

do for *Cypreſſes*, which were uſed to be excellent Ornaments both in Summer and Winter, now it proving a very rare thing to ſee one well Alive; In ſome places there appears ſome lingring Life, but ſcarcely ſufficient to recover the whole, but in moſt places they are quite dead, that have faced 40, 50, or 60, Winters before.

Alſo among thoſe with *Deciduous Leaves*, divers have been ſufferers, as *Arbor-Judæ*, Young *Plane Trees*, though thoſe of conſiderable Stature have pretty well eſcaped, *Paliurus*, the *Aleppo Aſh*, in ſome places the *Locuſt-Tree*, and in moſt Hedges the great Common *Bramble*, and ſome other, which upon Cutting do ſome or moſt of them Spring again.

But ſuch *Greens* alſo as we receive from, and are the Glory of Warmer Countries, and very rare curious and pleaſant with us, ſuch as *Oranges*, *Lemons*, *Myrtles*, *Pomegranates*, and the Perfuming *Jaſmines*, and divers other Rarities, which are uſually kept in Pots and Caſes for the convenience of removing them into *Green-Houſes* and *Conſervatories*, not being able to endure our Milder Winters, have in many places extreamly ſuffered, eſpecially in Houſes of weaker defence: but where the Skill Care and due Management of their Keepers, have met with the convenience of good warm Houſes, with keeping conſtant Fires, (which is a matter to be regulated with great diſcretion,) according to the Proportion of which Combining Qualifications, the Plants have eſcaped; as in ſome Places moſt of them are well, in ſome places half, and in ſome places all dead.

Among *Plants*, *Herbs*, and *Flowers*, there hath been great Deſtruction alſo, and many of Common Uſe, as moſt of the *Artichokes* in *England*, and *Winter Coleflowers*, *Sage*, *Tyme*, *Maſtick*, *Lavender*, *Laven-Cotton*, and divers other were generally Kill'd: Except ſuch as happened to be new planted that Year, and ſo Low that they had the Enjoyment of the kind covering of a little *Snow*, which proves the moſt Natural Feeding and Warm Covering, of any thing to be mention'd; but what peeped its head above it ſeemed in great danger of being Killed; and as we may ſee in the *Corn-fields*, that thoſe ſides of the Lands of Corn facing the South, where the *Snow* was melted and the Corn deprived of its Covering, the want proved deadly, and in many places Husbandmen were forced to begin again in the Spring to Plough and Sow other Grain; which may eaſily teach us rather to heap *Snow* upon our Herbs, and Flowers, than fancy it a Cold unkind Enemy.

But after all this Repetition of Sorrows, we are to comfort our ſelves that ſuch Deſtruction and Calamity happens but very rarely, the like having not been known in the Memory of man, if ever before; and that with due Care and Obſervance the growing Cold might be kept off from ſuch things as are proved to be impatient of it; which are not all *Greens* in our Gardens, ſome being able to endure all the Cold that ever came, as *Firrs*, *Pines* of divers ſorts, *Cedars* of *Libanus* and *Virginia* (though that of *Bermudas* proves tender) *Arbor Vitæ*, all the *Savins*, whereof the Upright or *Berry-bearing* is the beſt *Succedaneum* to *Cypreſs*, capable of finer cutting into Pyramids or other Figures, or Hedges 6 or 8 Fot high, and is one of the beſt of the *Tonſile Shrubs*; alſo the *Pyracantha* proves exceeding Hardy, and makes good Hedges.

LIV. Th-

To Preserve Ice *and* Snow; *by Mr.* Will. Ball. n. 8. p. 139.

LIV. The *Snow* and *Ice-Houses* at *Livorne*, are commonly built on the side of a Steep Hill, being only a deep Hole in the Ground, by which means, they easily make a Passage out from the Bottom of it, to carry away all the Water, which if it should remain stagnating therein, would melt the *Ice* and *Snow:* But they Thatch it with Straw, in the shape of a Sauce-pan Cover, that the Rain may not come at it. The Sides (supposing it Dry) they line not with any thing, as is done in St. *James's Park*, by reason of the moistness of the Ground. This Pit they fill full of *Snow* or *Ice* (taking care that the *Ice* be made of the purest Water, because they put it into their Wine) overspreading first the Bottom very well with *Chaff*, but without any part of the Straw; I think they use *Barley-Chaff*. This done, they further, as they put in the *Ice*, or the *Snow*, (which latter they ram down,) line it thick by the Sides with such *Chaff*, and afterwards cover it well with the same; and in half a Year lying so, 'tis found not to want above an 8*th* part of what it weighed, when first put in. Whenever they take it out into the Air, they wrap it in this *Chaff*, and it keeps it to Admiration.

Cold *produced with* Sal-Armoniack; *by Mr.* Rob. Boyl. n. 15. p. 255.

LV. Among several Ways, by which I have made *Infrigidating* Mixtures with *Sal-Armoniack*, the most simple and facile is this: Take one Pound of Powder'd *Sal-Armoniack*, and about three Pints (or Pounds) of Water, put the *Salt* into the Liquor, either altogether, if your design be to produce an Intense, though but a short *Coldness*; or at two, three, or four several times, if you desire that the produced *Coldness* should rather last somewhat longer than be so Great. Stir the Powder in the Liquor with a Stick or Whalebone (or some other thing, that will not be injured by the Fretting Brine that will be made,) to hasten the Dissolution of the *Salt*; upon the Quickness of which depends very much the Intensity of the *Cold*, that will ensue upon this Experiment.

That a considerable Degree of *Cold* is really produced by this Operation, is very evident: *First*, to the Touch; *Secondly*, by this, that if you make the Experiment (as for this Reason I sometimes chuse to do) in a Glass-Body, or a Tankard, you may observe, that whilst the Solution of the *Salt* is making, the out side of the Metalline Vessel will, as High as the Mixture reaches within, be bedewed (if I may so speak) with a multitude of little Drops of Water, as it happens when Mixtures of *Snow* and *Salt*, being put into Glasses or other Vessels, the Aqueous Vapours, that Swim to and fro in the Air, and chance to glide along the sides of the Vessels, are by the *Coldness* thereof Condensed into Water. But *Thirdly*, the best and surest way of finding out the *Coldness* of our Mixture, is by plunging into it a good seal'd *Weather-Glass* furnish'd with Tincted Spirit of Wine. For, the Ball of this being put into our *Frigorifick* Mixture, the Crimson Liquor will nimbly enough Descend much lower, than when it was kept either in the open Air, or in common Water, of the same Temper with that wherein the *Sal-Armoniack* was put to Dissolve. And if you remove the Glass out of our Mixture into common Water, the Tincted

Spirit will Reaſcend; And this has alſo ſucceeded with me when I remov'd it into Water newly impregnated with *Salt Petre*.

This *Cold* in Summer and Hot Weather will ſoon decay and Expire: But if the Quantity of the *Salt* and *Water* be great, the Effect will be as well more laſting, as more conſiderable. I have reaſon too to ſuſpect, that there may be a conſiderable Diſparity, as to their fitneſs to produce *Cold*, betwixt ſeveral Parcels of *Salt* that are without Scruple look't upon as *Sal-Armoniack*. I have alſo often found that when the Tincted Liquor ſubſided but ſlowly, or was at a Stand, by putting in from time to time two or three Spoonfuls of Freſh *Salt*, and ſtirring the Water to quicken the Diſſolution, the *Spirit* of *Wine* would begin again to Deſcend, if it were at a ſtand or riſing, or ſubſide much more ſwiftly than it did before. And if you would lengthen the Experiment, it may not be amiſs, that part of the *Sal-Armoniack* be but groſly Beaten, that it may be the longer in Diſſolving, and conſequently in Cooling the Water. After this manner a ſenſible adventitious *Cold* has been made in the Spring, by a Pound of *Sal-Armoniack* at the utmoſt, to laſt about 2 or 3 Hours.

Experiments in *March* 27. The Tincted Spirit in the Seal'd *Weather-Glaſs* when firſt put into the Water, reſted $8\frac{5}{8}$ Inches: Being ſuffered to ſtay there a good while, and now and then ſtirr'd to and fro in the Water, it deſcended at length a little beneath $7\frac{5}{8}$ Inches. Then the *Sal-Armoniack* being put in, within about a Quarter of an Hour or a little more it Deſcended to $2\frac{11}{16}$ Inches, but before that Time, in Half a Quarter of an Hour it began manifeſtly to *Freeze* the Vapours and Drops of Water on the outſide of the Glaſs. And when the *Frigorifick* Power was arrived at the height, I ſeveral times found, that *Water* thinly placed on the outſide, whilſt the Mixture within was nimbly ſtirr'd up and down, would *Freeze* in a Quarter of a Minute (by a Minute Watch.) At about $\frac{3}{4}$ of an Hour after the *Infrigidating* Body was put in the *Thermoſcope*, that had been taken out a while before, and yet was riſen but to the loweſt *Freezing* Mark, being again put in the Liquor fell an inch beneath the Mark. At about $2\frac{1}{2}$ Hours from the firſt Solution of the *Salt*, I found the Tincted Liquor to be in the midſt between the *Freezing* Marks, whereof the one was at $5\frac{1}{2}$ Inches (at which height when the Tincture reſted, it would uſually be, ſome, though but a ſmall, *Froſt* abroad; and the other at $4\frac{3}{4}$ Inches; which was the Height, to which ſtrong and durable *Froſts* had reduced the Liquor in the Winter. At 3 Hours after the beginning of the Obſervation, I found not the Crimſon Liquor higher than the upper *Freezing* mark newly mentioned; after which it continued to riſe very ſlowly for about an Hour longer; beyond which Time I had not occaſion to obſerve it.

2. This *Frigorifick Mixture* having been made in a Glaſs-Body (as they call it) with a large and flattiſh Bottom, a Quantity of Water, which I (purpoſely) ſpilt upon the Table, was by the Operation of the Mixture within the Glaſs, made to *Freeze*, and that ſtrongly enough, the Bottom of the Cucurbite to the Table; that Stagnant Liquor being turned into ſolid *Ice*, that continued a conſiderable while unthaw'd away, and was in ſome places about the Thickneſs of a Half Crown piece.

3. At

3. At another time the ſame Spring the *Weather Glaſs*, which before it touched the common Water ſtood at $8\frac{1}{8}$, having been left there a conſiderable while, and once or twice agitated in the Water, the Tincted Liquor ſunk but to $7\frac{7}{8}$, or, at furtheſt, to $7\frac{6}{8}$, then the *Frigorifick* Liquor being put into the Water with Circumſtances Diſadvantagious enough, in (about) half a Quarter of an Hour the Tincted Liquor fell beneath $3\frac{3}{4}$; and the *Thermoſcope*, being taken out, and then put in again, an Hour after the Water had been firſt *Infrigidated*, ſubſided beneath 5 Inches, and conſequently within $\frac{1}{4}$ of an Inch of the Mark, of the Strongly *Freezing-Weather*.

The grand thing that is like to keep this Experiment from being generally uſeful, is the dearneſs of *Sal-Armoniack*. But to leſſen this Inconvenience, two things may be offered. Firſt, that *Sal-Armoniack* might be made much Cheaper, if inſtead of fetching it beyond Sea, our Country-men made it here at Home. Secondly, that though an *Armoniack* Solution being boyl'd up in Earthen Veſſels (for Glaſs ones are too chargeable) will, by piercing them, both loſe ſome of the more Subtile parts, and thereby ſomewhat impair the Texture of the Reſt; yet I was not deceived in Expecting, that the Dry Salt, remaining in the Pipkins, being re-diſſolved in a due Proportion of Water, would very conſiderably *Infrigidate* it; as may further appear by the following Experiment.

4. *Mar.* 29. The *Thermoſcope* in the Air was at $8\frac{7}{8}$ Inches; being put into a ſomewhat large Evaporating Glaſs, fill'd with Water, it fell (after it ſtayed a pretty while, and had been agitated in the Liquor) to 8 Inches: then about half the *Salt*, or leſs, that had been uſed twice before, and felt much leſs *Cold* than the Water, being put in and ſtirr'd about, the Tincted Spirit ſubſided with a Viſible Progreſs till it was fallen manifeſtly beneath 4 Inches; and then having cauſed ſome Water to be Freſhly pump'd and brought in, though the newly mentioned Solution were mixt with it, yet it preſently made the Spirit of Wine manifeſtly to Aſcend in the Inſtrument, much faſter, than one would have expected.

The Length of the Cylindrical Pipe of the *Seal'd Thermoſcope* wherewith theſe Obſervations were made was 16 Inches; the Ball, about the Bigneſs of a ſomewhat large Walnut, and the Cavity of the Pipe, by Gueſs, about an 8*th* or 9*th* part of an Inch Diameter.

To *Cool Drinks* with this Mixture, you may put them in thin Glaſſes, the thinner the better; which (their Orifices being ſtopp'd, and ſtill kept above the Mixture) may be moved to and fro in it, and then be immediately poured out to be Drunk. By the Help hereof pieces of Cryſtal, or Bullets, for the *Cooling* of the Mouth or Hands of thoſe Patients, to whom it may be allowed, may be potently *Cooled*; and other ſuch Refreſhments may be eaſily procured. In which and many other Uſes it will not be requiſite, to employ near ſo much as a whole Pound of *Sal-Armoniack* at a time. For, you may eaſily obſerve by a *Seal'd Weather Glaſs*, that a very few Ounces, well powder'd and nimbly Diſſolv'd in about 4 times the Weight of Water, will ſerve well enough for many purpoſes.

Experiments about Freezing; *by S.* Carolo Rinaldini. n. 72. p. 2169.

LVI. 1. A little Water being left on the Top of the *Mercury* in the *Toricellian* Experiment, and expoſed to the Air in *Froſty* Weather, was in one Night Congeal'd into *Ice* of a very good Conſiſtence. Afterwards *Rinaldini*, having compared this *Ice* with that which was produced in the Open Air, found, that the *Ice* in the Cane was in Subſtance altogether like that of *Hail*; that is, an Opaque and Whitiſh Body: Whereas that which was made in the Air wat tranſparent like Cryſtal. Beſides, he obſerved that the *Ice* made in the Cane was Heavier *in Specie* than that in the Ambient Air: Which he diſcovered by putting it into a Fluid, which was *in Specie* lighter than Water, but heavier than *Ice* made in the open Air; whereby he found, that, whereas the *Ice* made in the Cane Sunk, that in the Air Floated therein.

By Dr. Liſter. n. 167. p. 836.

2. *Decem.* 3. 1684. at Night, I expos'd 4 Glaſs Bottles in the Open Air upon the ground to *Freeze*; *viz.* of the *Red-Natron*-Water from *Ægypt*; of a ſtrong Solution of *Nitrum Murarium* in fair Water, of *Sea-Water* taken up at *Scarborough* and more than half Evaporated; of the *Sulphur-Well* at *Knasborough*, that is, of *Natural-Brine* Evaporated to the ſame Height with the *Sea-Water*.

The *4th* in the Morning, the Solution of *Nitrum Murarium* was half of it *Ice*, but not any of the reſt.

The *6th* in the Morning, the Bottle of *Nitrum Murarium* was moſt *Ice*; the *Sulphur-Water* had no *Ice* that I could perceive at all in it; the *Natron* had much *Ice* at the Bottom of the Bottle; and the *Scarborough-Sea-Water* was not without Flakes of *Ice*.

Fig. 21, 22.

The *Icicles* of the *Natron* were prettily Figured, as is repreſented in *Fig.* 21. The *Icicles* of the *Sea-Water* were alſo Figured in oblong Squares, as in *Fig.* 22. And were brittle and Tranſparent. I ſet the drained *Icicles* of *Natron* before the Fire, which did readily enough Melt and diſſolve into Water again; this *Ice* was both alike Salt in *Ice* and in *Water*, much like the Water, to the Taſte, out of which it was *Frozen*. In like manner having drained the *Sea-Water-Ice*, and expos'd it before the Fire; theſe *Icicles* became Soft and moiſt by Degrees, but at length rather Evaporated, than quite Melted away; and having taken up a good thick lump of common *Ice*, at leaſt 100 times their Thickneſs and Bulk, this in a few Moments at the ſame Diſtance before the Fire, grew wetter and wetter, and diſſolved into Water, whereas the *Salt-Icicles* after 3 Quarters of an Hour, lying before the Fire, did at length dry into a White Powder perfect *Salt*, the Moiſture Totally Evaporating. Alſo the Sea-Water *Icicles* taſted very Salt, when firſt taken out of the Water.

I repeated the ſame Experiment of expoſing to *Freeze* the Bottles of *Natural-Brine* of *Knasborough-Sulphur-Well*, half Evaporated, and *Scarborough*-Sea-Water, the ſame as formerly, the *7th* and *8th* Inſtant at Night, and with the like Succeſs; *viz.* no *Icicles* in the *Natural-Brine*, but the ſame large ones as above deſcribed I had in the *Sea-Water*, but not till after the *2d* Night's keen *Freezing*.

Theſe *Salt Icicles* continued unthawed in the Bottles, though they were brought into the Houſe, and kept in a Warm Room, long after all other *Ice* within

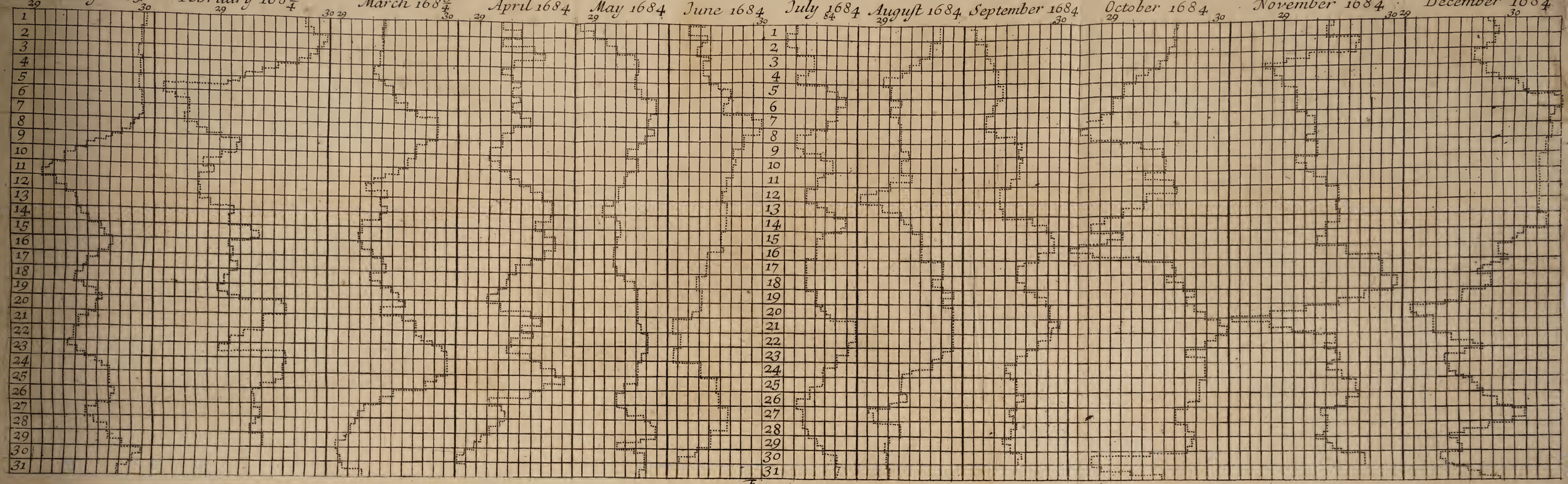


Fig. 17.

Plate 2. Vol. 2. Pag. 164.

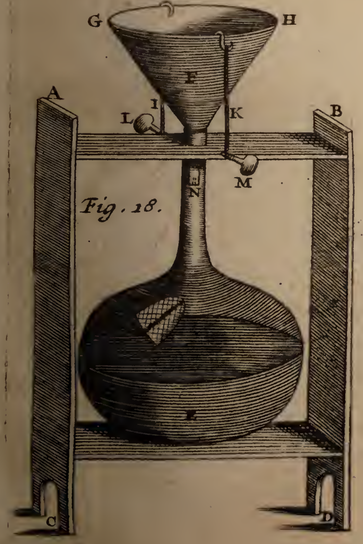


Fig. 18.

Fig. 19.

Fig. 21.

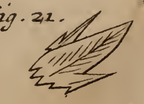
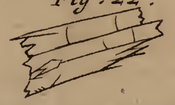


Fig. 22.



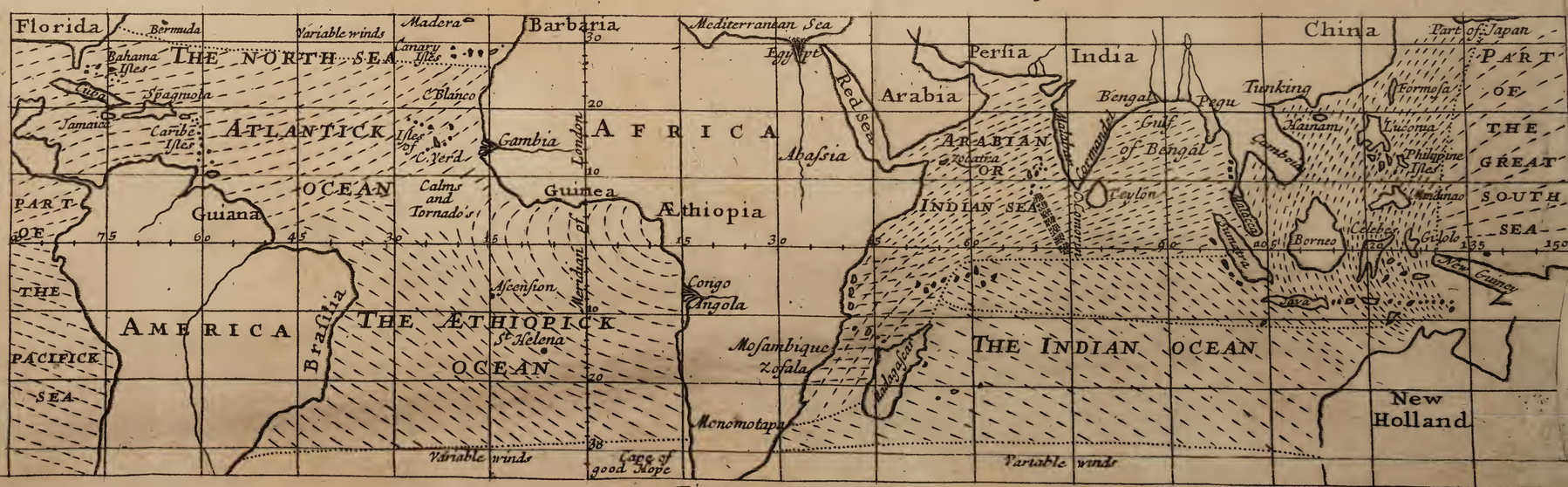


Fig. 20.

within Doors was gone; *viz.* 'till the 12 Instant at Night, when the *Icicles* also were dissolved and vanish'd.

From these Experiments we Note, 1. That there may be *Salt-Ice* from *Sea-Water Frozen*, which the Experiments of this *S.* of the last year did not seem to favour.

2. That there is a real Difference betwixt *Natural-Brine*, and *Sea-Water*; as there is betwixt the Salts themselves, which they yield.

3. That the great Floating Mountains of *Ice* in the *Northern-Seas* (if upon strict Tryal they shall be found to be Salt, which should be further enquired into,) are not only the Effects of many years *Freezing*, but also much of their Magnitude may be owing to the Natural Duration of that sort of *Ice*.

3. A Tube of $\frac{1}{4}$ of an Inch Diameter being filled with Water, to the Height of 2 Inches, and set to *Freeze* in a Mixture of Snow and Salt, the Water, when perfectly *Frozen*, appeared $\frac{5}{12}$ of an Inch, above the Mark it stood at before *Freezing*. *By M.* Des Maiters. n. 215. p. 384. n. 247. p. 439.

Another Tube, of almost an Inch Diameter, being fill'd with Water to the Height of 6 Inches, and set to *Freeze* as before, rose $\frac{7}{8}$ of an Inch above the Mark. The Water made use of in these Tryals, was, a sort of rough *Pump-Water*; which, according to what Tryals have been made with it, does, upon the Effusion of *Oyl* of *Tartar per Deliquium*, immediately turn Milky and Turbid. And the *Ice* made of this Water was a sort of very Rarified White *Ice*.

The Tube of almost an Inch Diameter being fill'd to the height of 6 Inches (as before) with *River-Water*, which would readily mix with *Oyl* of *Tartar* without the least Precipitation, and set to *Freeze* in a Mixture of Snow and Salt, it gained but $\frac{5}{8}$ of an Inch after it was *Frozen*; whereas the *Pump-Water* got $\frac{7}{8}$ of an Inch.

It was Observable, that when the Water (in all these Experiments) began to *Freeze*, a great many small *Bubbles* continually rose from the Bottom.

A Tube being fill'd with *Boyled-Pump-Water*, to the height of 6 Inches, and set to *Freeze* as before, it rose hardly to $\frac{6}{8}$ of an Inch above the Mark; when as the same Water *Unboyl'd* rose to $\frac{7}{8}$.

LVII. In *July* 1653. It was so furiously Hot in *Poland*, that in the Regiment of Foot which was the King's Guard, marching most of them Barefoot upon Sands, more than 100 fell down altogether disabled, whereof a Dozen Dyed outright, without any other Sickness. *Excessive* Heats *in* Poland; *by M.* Fehre. n. 19. p. 352.

LVIII. If the Action of the *Sun* be considered as the only Cause of the *Heat* of the *Weather*, I see no reason but that under the *Pole*, the Solstitial Day ought to be as Hot as it is under the *Æquinoctial*, when the Sun comes Vertical or over the *Zenith*: for this reason, that for all the 24 Hours of the Day under the *Pole*, the Sun's Beams are inclined to the Horizon, with an Angle of $23\frac{1}{2}$ *Deg.* and under the *Æquinoctial*, though he come Vertical, yet he Shines no more than 12 hours, and is again 12 Hours absent, and that for. *The Proportional* Heat *of the* Sun, *in all* Latitudes; *by Mr.* Edm. Halley. n. 203. p. 878.

3 Hours

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 *Sines* 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 *Sines* 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 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 $\frac{4}{10}$ 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, where in 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 ♋ *HH* ♋ is in the ſame proportion to the Heat for the ſame 6 Hours under the *Pole* on the Tropical Day; and ⊙*HHQ*, is proportional to the collected Heat of 12 Hours, or half a Day, under the *Pole*; which ſpace ⊙*HHQ* is Viſibly greater than the other Area *HZGH*, by as much as the Area *HGQ* is greater than the Area ZG⊙; 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 12 Hours under the *Æquinoctial*: 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.

Fig. 23.

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 *Æquinoctial*, the 12 Hours abſence of the Sun does very little ſtill the Motion 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 Sun 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 the thick Clouds, and perpetual Foggs and Miſts, and by that *Atmoſphere* of *Cold*, as the late Honourable Mr. *Boyle* was pleaſed 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

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 Soyl, 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 Thought, I have solved this *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 let the *Cylinder* $ABCD$, be cut obliquely with the *Ellipse* $BKDI$, and by the Center 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 $NOPQ$, cutting the said *Ellipse* in the 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 $RMSQDP$ is equal to the Rectangle of BL or MD and RS, or of 2 BL or AD and ST or VP; and the Curve Surface $QNPD$ is equal to $RS \times MD$— the Arch $RMS \times SP$, or the Arch $MS \times 2\,SP$: or, it is equal to the Surface $RMSQDP$, 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 Surface $RLSQOP$, or the Arch $LS \times 2\,SP$. Fig. 24.

This is most easily Demonstrated from the Consideration, That the *Cylindrick* Surface $IKLB$ is to the Inscribed *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.* 30, 37, and 38. and Doctor *Barrow*'s Learned *Lectures* on that Book, *Probl.* 9. and the Corollaries thereof.

Now to reduce our Case of the Sum of all the *Sines* of the Sun's Altitude in a given Declination and Latitude to the aforesaid *Problem*, let us consider the *Analemma* Projected on the Plain of the Meridian, Z the *Zenith*, P the *Pole*, HH the *Horizon*, $ææ$ the *Æquinoctial*, ♋ ♋ ♑ ♑ the two *Tropicks*, ♋ I the Sine of the Meridian Altitude in ♋; and equal thereto, but perpendicular to the *Tropick*, erect ♋ 1, and draw the Line T 1 intersecting the *Horizon* in T, and the Hour Circle of 6, in the Point 4, and 6,4 shall be equal to 6 R, 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 Ti 1. Through the point 4, draw the Line 4 5 7 parallel to the *Tropick*, and representing a Circle equal thereto; then shall the *Tropick* ♋ ♋ in *Fig.* 25. answer to the Circle $NOPQ$, in *Fig.* 24. 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 1 to BL, and the Arch ♋ T, to the Arch Fig. 25.

LS,

L S, being the Semidiurnal Arch in that Latitude and Declination; the Sine whereof, though not expreſſible in *Fig.* 25. muſt be conceived as Analogous to the Line *T S* or *V P* in *Fig.* 24.

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 M S Q D P*; 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 the 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 aforeſaid 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, and 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 in the other, ſhall be Proportional to all the Action of the Sun during that ſpace of time.

I forſee 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 Computaion of this Rule, which may ſeem difficult to ſome. Let the *Solſtitial Heat*, in ♋ and ♑, be required at *London*, *Lat.* 51, 32.

38°—28′	*Co. Lat.*		*Diff. Aſcen.*	33°—11′
23½—30	*Decl.* ☉		*Arc. Semidi.* Æſtiv.	123—11
61—58	*Sinus* =	0,882674	*Arc. Semidiur.* Hyb.	56—49. *Sin.* 0,836923
14—58	*Sinus* =	0,258257	*Arc.* Æſtiv. *menſura*	2,149955.
	Summa	1,140931	*Arc.* Hyber. *menſura*	0,991683.
	Diff.	0,624417		

Then 1, 140931 in, 0,836923 + 0,624417 in 2,149955 = 2,29734.
And 1, 140931 in, 0,836929 — 0,624417 in 0,991638 = 0,33895.
So that 2, 29734 will be as the *Tropical* Summer's day's *Heat*, and 0,33895 as the *Action* of the *Sun* in the Day of the Winter *Solſtice*.

After this manner I computed the following Table, for every tenth *Deg.* of *Latitude* to the Equinoctial and Tropical Sun, by which an Eſtimate may be made of the Intermediate *Degrees*.

Lat.

Lat.	*Sun in* ♈ ♎	*Sun in* ♋	*Sun in* ♑
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

From this Rule there follows ſeveral *Corollaries* worth Note: As, 1. That the *Æquinoctial 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. 2. That under the *Æquinoctial*, the *Heat* is as the Sine of the Sun's Declination. 3. 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 the Sun, they are as the *Sines* of the Latitudes; and generally they are as the *Sines* of the Latitudes into the *Sines* of Declination. 4. That the *Æquinoctial* Day's *Heat*, is every where as the *Co-ſine* of the Latitude. 5. 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. 6. From the Table I have added it appears, that the *Tropical* Sun under the *Æquinoctial* has of all others the leaſt Force. And under the *Pole*, it is greater than any other Day's *Heat* whatſoever, being to that of the *Æquinoctial*, as 5 to 4.

Vid. D. Wallis. *de Calculo* Centri Gravitatis. *Prop.* 13. *Cap.* 5.

From the Table and theſe *Corollaries* may a general Idea be conceived of the Sum of all the *Actions* of the *Sun* in the whole Year, and that Part of the *Heat* that ariſes ſimply from the Preſence of the Sun, be brought to a *Geometrical* Certainty: And if the like could be performed 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*.

LIX. 1. *May.* 10. 1666. About 5 of the Clock afternoon, the *Thunder* (which I had before heard at ſome diſtance) coming nearer to us, it began to *Rain*, and ſoon after (the Rain withal increaſing) the *Thunder* grew very Loud,

Accidents by Thunder *and* Lightning, *at* Oxford; *by Dr.* Wallis. n. 13. p. 222.

Loud, and frequent, and with long Ratling *Claps* (tho' not altogether ſo great) as I have ſometimes heard:) And the *Lightning* with *Flaſhes* very bright (notwithſtanding the Clear Day-light) and very frequent, (when at the faſteſt, ſcarce a full Minute between one *Flaſh* and another; many times not ſo much, but a ſecond *flaſh* before the *Thunder* of the former was heard:) The *Thunder* for the moſt part began to be heard about 8, or 10 ſecond-Minutes after the *flaſh*; as I obſerved for a great part of the time by my Minute-watch; but once or twice I obſerved it to follow (in a manner) immediately upon it, as it were in the ſame Moment; and the *Lightning* extream *Red* and fiery; ſo that had it been by Night as it was by Day, it would have been very terrible. And though I kept within Doors, yet I ſenſibly diſcover'd a ſtinking *Sulphurous* Smell in the Air. About 7 of the Clock it ended, before which time I had News brought me of a ſad Accident upon the Water at *Medley*, about a Mile or ſomewhat more diſtant from hence. Two Schollars of *Wadham-College*, being alone in a Boat (withour a Water-man) having newly thruſt off from Shore, at *Medley*, to come homewards, ſtanding near the Head of the Boat, were preſently with a ſtroak of *Thunder* or *Lightning*, both ſtruck off out of the Boat into the Water, the one of them ſtark dead, in whom, though preſently taken out of the Water (having been by relation, ſcarce a Minute in it) there was not diſcerned any appearance of Life, Senſe, or Motion: The other was ſtuck faſt in the Mud (with his Feet downwards, and his upper parts above Water) like a Poſt, not able to help himſelf out; but, beſides a preſent ſtonying or numbneſs, had no other hurt; but was for the preſent ſo diſturbed in his Senſes, as that he knew not how he came there out of the Boat, nor could remember either *Thundring* or *Lightning* that did effect it: And was very feeble and faint upon it; which, (though preſently put into a warm Bed) he had not throughly recovered by the next Night; and whether ſince he have or no, I know not.

Others in another Boat, about 10 or 20 Yards from theſe (as by their deſcription I eſtimate) felt a diſturbance and ſhaking in their Boat, and one of them had his Chair ſtruck from under him, and thrown upon him, but had no hurt. Thoſe immediately made up to the others, and ſome (leaping into the Water to them,) preſently drew them either into the Boat or on Shore; yet none of them ſaw theſe two fall into the Water (not looking that way) but heard one of them cry out for help preſently upon the ſtroke, and ſmelt a very ſtrange *ſtinking ſmell* in the Air, ſuch as is perceived upon the ſtriking of Flints together.

He that was dead, was the next Morning brought to Town; and Dr. *Willis*, Dr. *Millington*, Dr. *Lower*, and my ſelf, with ſome others, went to view the Corps, where we found no *Wound* at all in the Skin, the Face and Neck Swart and black, but not more than might be ordinary, by the ſettling of the Blood: On the Right ſide of the Neck was a little Blackiſh Spot, about an inch long, and about a Quarter of an inch broad at the broadeſt, and was, as if it had been *Sear'd* with a Hot Iron; and, as I remember, one ſomewhat bigger on the Left ſide of the Neck, below the Ear. Straight down the Breaſt, but towards the Left ſide of it, was a large place, about three quarters of a

foot

foot in Length, and about two Inches in breadth, in ſome places more, in ſome leſs, which was *Burnt* and Hard, like Leather Burnt with the Fire, of a deep Blackiſh Red Colour, not much unlike the Scorched Skin of a Roſted Pig: And on the fore-part of the Left Shoulder ſuch another Spot about as big as a Shilling; but that in the Neck was Blacker, and ſeemed more Sear'd. From the top of the Right Shoulder, ſloping downwards towards that place in his Breaſt, was a narrow Line of the like Scorched Skin; as if ſomewhat had come in there at the Neck, and had run down to the Breaſt, and there ſpread broader.

The Buttons of his Doublet were moſt of them off; which ſome thought might have been torn off with the *Blaſt*, getting in at the Neck; and then Burſting its way out: For which the greateſt preſumption was (to me) that, beſides 4 or 5 Buttons wanting towards the Bottom of the Breaſt, there were about half a Dozen together clear off, from the Bottom of the Collar downwards; and I do not remember, that the reſt of the Buttons did ſeem to be near worn out, but almoſt new. The Collar of his Doublet, juſt over the fore-part of the Left Shoulder, was quite broken aſunder, Cloath and Stiffening, Straight downwards, as if cut or chop'd aſunder, by a Blunt Tool; only the inward Linnen or Fuſtian Lineing of it was whole, by which, and by the view of the ragged Edges, it ſeemed manifeſt to me, that it was by a Stroak Inwards from without, not Outwards from within.

His Hat was ſtrangely Torn, not juſt on the Crown, but on the ſide of the Hat, and on the Brim. On the ſide of it was a great Hole, more than to put in ones Fiſt through it: Some part of it being quite ſtruck away, and from thence divers Gaſhes every way, as if Torn, or Cut with a Dull Tool, and ſome of them of a good length, almoſt quite to the Edges of the Brim. And beſide theſe, one or two Gaſhes more, which did not communicate with that Hole in the ſide. This alſo I judged by a ſtroak Inwards; not ſo much from the view of the Edges of thoſe Gaſhes (from which there was ſcarce any judgement to be made either way) but becauſe the Lineing was not Torn, only ript off from the Edge of the Hat (where it was ſow'd on) on that ſide, where the Hole was made. But his Hat not being found upon his Head, but at ſome diſtance from him, it did not appear againſt what part of the Head that Hole was made.

The Night following the three Doctors above mentioned and my ſelf, with ſome Chirurgeons (beſides a multitude of others) were preſent at the Opening of the Head, to ſee if any thing could be there diſcover'd; but there appear'd no ſign of *Contuſion*; the *Brain* full and in good order; the *Nerves* whole and ſound; the *Veſſels* of the *Brain* pretty full of Blood. But nothing was by any of them diſcern'd to be at all amiſs. Some of them thought, that they diſcerned a ſmall *Fiſſure* or Crack in the *Skull*; and ſome who held it, while it was ſawing off; ſaid they felt it Jarring in their Hands, and there ſeemed to the Eye ſomething like it, but it was ſo ſmall, as that by Candle-light we could not agree it certainly ſo to be.

Some of the *Hair* on the Right Temples was manifeſtly Singed, or Burnt; and the lower part of that Ear Blacker than the parts about it, but Soft; and

it might be only the ſetling of the Blood. The upper part of the Left Shoulder, and that ſide of the Neck, were alſo ſomewhat Blacker than the reſt of the Body; but whether it were by the Blow, which broke the Collar, and *Scorched* the round red Spot thereupon, or only by ſetling of the Blood, I cannot ſay; yet I think, it might very well be, that both on the Head and on this ſide of the Neck, there might be a very great Blow, and a *Contuſion* upon it, (and ſeems to have been ſo, by the Tearing of the Hat, and Breaking the Collar, if not alſo Cracking of the Skull) and yet no Sign of ſuch *Contuſion*, becauſe Dying ſo immediately, there was not time for the Blood to gather to the Part, and Stagnate there, (which in Bruiſes is the cauſe of Blackneſs,) and it was but as if ſuch a Blow had been given on a Body newly Dead; which does not uſe to cauſe ſuch a Symptom of a Bruiſe, after the Blood ceaſes to Circulate.

Having done with the *Head*, they Opened the *Breaſt*; and found that *Burning* to reach quite through the Skin, which was in thoſe *Scorch'd* places Hard and Horny, and Shrunk up, ſo as it was not ſo thick as the ſoft Skin about it: But no appearance of any thing deeper than the Skin; the Muſcles not at all Diſorder'd or Diſcolour'd (perhaps, upon the reaſon, that was but now ſaid of the Head, Neck and Shoulder.) Having then taken off the *Sternum*, the *Lungs* and *Heart* appeared all well, and well Colour'd, without any Diſorder.

In Hampſhire; *by Mr.* Tho. Neal. n. 14. p. 247.

2. *Jan.* 24. $166\frac{5}{6}$. one Mr. *Brooks* of *Hampſhire*, going from *Wincheſter* towards his Houſe near *Andover*, in very bad Weather, was himſelf ſlain by *Lightning*, and the Horſe he rode on, under him. For about a Mile from *Wincheſter* he was found with his Face beaten into the ground, one Leg in the Stirrup, the other in the Horſes Mane, his Cloaths all *Burnt* off his Back, not a piece as big as a Handkerchief left intire, and his *Hair* and all his Body *Singed*; with the force, that ſtruck him down, his Noſe was beaten into his Face, and his Chin into his Breaſt; where was a *Wound* Cut almoſt as Low as to his Navil. The torn pieces of his Cloaths were ſo ſcatter'd and conſum'd, that not enough to fill the Crown of a Hat could be found. His Gloves were whole, but his Hands in them *Singed* to the Bone. The Hip bone and Shoulder of his Horſe *Burnt* and *Bruiſed*; and his Saddle torn in little pieces. This was what appeared to the *Coroner's Inqueſt*.

At Stralſund *in* Pomerania; *By*..... n. 65. p. 2084.

3. *Jun.* $\frac{19}{29}$. 1670 (being Sunday) after ſeveral leſs ſtrong reports of *Thunder*, the whole Town, and particularly the Congregation in St. *Nicholas Church*, (when the Miniſter was Preaching) was ſtrangely ſurpriſed with a moſt Terrible Flaſh of *Lightning* and a fearful *Thunder-Clap*, which lighted down through the leſſer Steeple upon the Body of the Church, and through the large round Hole in the upper Vault within the ſame, in the ſhape (as ſome obſerv'd) of a Black Fiery *Ball*, directly upon the Altar, cauſing ſuch an Hideous Crack, Fire Flaſh, Smoak, and Damp there, as if many Fire-Balls had been thrown down thither from the ſaid Vault, and Burſted all at once; begetting a Diſmal Conſternation among the People, and leaving an ill *Sulphurous* ſmell behind.

The

The Candle on the South ſide of the Altar was put out by the Blow, the other remain'd burning. Two of the Chalices there were overthrown, and the Wine Spilt, and the Wafers ſcatter'd about: But the Empty Chalice ſtood firm. All three were ſomewhat *Smutted* at the Foot, and one of them a little Bent there, and in two places *Pierced* through, as if it had been by Hail-ſhot: And the Wafer-boxes were likewiſe a little *Smutted* towards the Bottom. The Church Book was flung on the inner paſſage: The Covers of the Altar were *Singed* in divers parts, as by Powder, and ſomewhat *Burnt* and *Smutted* here and there, as alſo Torn in ſome places. A ſtrong piece of Wainſcot with a Picture upon it, behind the great Altar, was Split in two. Of the Church-Clock, in the Weſt-end, at the ſame time, both the Braſs and Iron Wires of the Whole and Quarter-hour Hammers, were partly broken, and the reſt could not be found; and an Oaken Poſt, fixt in the Wall for the ſupport of the Dial, was half Torn, and beneath the ſame divers Bricks were Struck out of the two Head-Pillars ſupporting the Steeple. On the Top of the Southern Steeple, an Oaken Gutter, and a Strong Beam and Supporter were ſhatter'd.

One of the Miniſters, though ſitting near the Altar to the South, had no Hurt at all. Divers of the People ſeated round about the Altar fell down to the ground with the Fright. One Youth that ſtood next the ſaid Miniſter's Pew, not being able to recover his Senſes, was carried home. On the North-ſide of the Altar, four Perſons fell down, and one of the Oaken Seats being Split under him that ſate thereon, that Perſon was much Hurt by it, and more than any other. Some that ſtood in or by the Belfrey, near the Clock, were ſlightly Hurt here and there; and among them a Mariner, leaning on a Lined Oaken Seat there, had his right Arm Bruiſed; and another man, though but ſlightly hurt, yet could not remember how he got home from Church.

There iſſued forth a huge Damp like unto Smoak out of the Southern Steeple: But the Church Carpenter upon ſearch met only with a preſent Noiſe and thick Damp, which though it frighted him at firſt into an apprehenſion of *Fire*, yet getting to the Windows and opening them, the Damp iſſu'd with great Violence; but there appeared no *Fire* any where, ſave only a little in the ſhatter'd parts of the Steeple, which was ſoon Quenched.

The Church-Dial was alſo *Smutted* in ſundry parts, ſoiling the Guilt Figures that they could ſcarce be diſcerned. The Gilt Weather-Cocks upon both the Steeples were likewiſe *Smutted* on the one ſide of their Tails, without any other mark. Nor could it be in the leaſt diſcovered in either of the Steeples, which way the Claps entred by all the ſearch that was made.

It was obſerv'd afterwards, that among the 8 Perſons that were Hurt, one who ſtood in the Belfrey, had the upper back part of his Cloath-Coat, as alſo his Shirt and Skin, ſomewhat Torn; but the Lineing of that Coat, which was Red Frieze, had no Hurt at all.

Another, ſitting betwixt the reſt, in a Pew under the Organs, and leaning on the Door, whilſt the Pew-Lock (then cloſe to his Body) was ſo violently Struck out, that it hung only by one Nail, had no dammage at all by it himſelf, nor any other

that

that ſate or ſtood by there, when the Stroak happen'd; though they fell all to the ground by the Fright, at the inſtant when it was given.

And as for him that had his Arm Bruiſed, it was ſomewhat ſtrange that afterwards there was found a *Hole* paſſing his Coat, Waſt-coat, and Shirt, on the forepart of his Body, without in the leaſt Hurting the Body; the *Hole* appearing juſt as ſhot through. His Waſt-coat (being of a Red Sarcenet) kept its Colour every where, but at the place where the Arm was hurt: And the ſmall Silver-edging was *Smutted* almoſt every where, and about the Neck too, where the party wore a Cravat. One half of his Shoe was alſo Torn off, the Soal being *Pierced* as with Hail-ſhot: And a piece of his Stocking's foot on the ſame Foot ſtruck away, near an Hand-breadth, without any other Hurt to either Foot or Leg, but that for ſome days that Foot was benummed.

Laſtly, one of them that ſate by the Altar, had his Breeches and Leather drawers on both ſides *Pierced* through as by Hail-ſhot, and part of it plainly *Scorch'd* and Shrunk up, as by *Fire*: And divers of ſuch ſmall *Holes* in his Shirt too, yet without any Hurt in his Body; ſave that he found ſome pain in his Foot. One ſide of his Shoe was alſo Torn, and the Soal ſidewards *Pierced* through, as 'twere with Hail-ſhot.

At Dantzick; *by Mr.* Chriſt. Kirby. n. 96. p. 6092.

4. About the latter end of *March* and *April.* 1673. we had much and violent *Thunder* and *Lightning*, which had this unhappy Effect upon all the parcels of Wheat and Rye, of the laſt Years growth, in our Granaries, that, though over-night they were Dry, Sweet, and fit for Shipping, the next morning they were become Clammy and Stinking; ſo that the *Owners*, if they would not loſe their Grain, were forced to cauſe it to be Turned over two or three times a Day; and yet it required ſix Weeks, if not longer, before it was recovered. This is a thing which often happens to Corn that hath not lain in the Granary a whole Year, or not Sweat thoroughly in the Straw before it be thraſh'd out.

At Portſmouth; *by* ..... n. 177. p. 1212.

5. *Oct.* 23. 1685. On Board the *Royal James*, a Flaſh of *Lightning* and *Thunder* together took the Maſt, which was put into her for Careening, being a made Maſt, and bound with Iron Hoops from one end to the other, and *Shiver'd* it down to the Deck, breaking one of the Iron Hoops in the Body of the Maſt, ſo that Splinters are forc'd out of the middle of the Maſt a foot and ½ long, (and a *Ball* of *Fire* to run to and fro on the Deck) inſomuch that the Maſt is wholly unſerviceable and muſt be taken out.

On Board the *Coronation*, notwithſtanding the Ships Head was to Windward, a great *Ball* of *Fire* came into the Gun room Ports, and threw a Boy out of one of the Ports, and he was drowned; and ſeveral Workmen being on Board, as Carpenters, Joyners, and Seamen, were ſtruck down and made Senſeleſs for ſome time; and the *Ball* of *Fire* ran up and ſtruck on the Starboard ſide of the Wardrobe, and left a place *Scorched* round upon the ſide, and between the two Ring-bolts, as if it had been a Shot, and beat the Wainſcot, over to the ſide, all *Scorch'd* as if with *Fire*; and run up againſt the Doors and Hinges, away, and run into ſeveral *Balls* of *Fire* on the Deck

amongſt

amongſt the Men; and ſome part of it broke in at the Windows of the Round-Houſe, and Shivered off a great deal of the Wainſcot, and broke the Glaſſes of a Perſpective Glaſs, and made a *Hole* through a Letter that lay in the Window eight double, the circumference of a Musket Bullet and no more; it alſo Shivered the Timber that holds the Enſign-Staff on the Poop.

6. *Mar.* 20. 169⅔ about 8 at Night there aroſe a very Violent Guſt of Wind at South Weſt, which laſted an Hour and an half, during which time it Rain'd 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 happen'd two *Flaſhes* of *Lightning*, very Violent and ſtrange; It was extraordinary *Blew*, and of a *Sulphurous* Smell; it ſeemed to ſtand ſtill in the Houſe ſome conſiderable time, and was ſo great that a Gentleman who ſate below Stairs, thought that the Houſe had been on *Fire* above and 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. The ſecond *Flaſh* and *Clap* followed within a few Minutes of the firſt, but not with that Violence as the former: Which *Flaſh-Fired* the Steeple I cannot ſay, but a piece of Wood to which the Lead of the Windows was nailed was ſet on *Fire*, and kindled very faſt, and might have done a great deal of Miſchief, 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. At *Kettering* one of their Bells, as ſome ſay, received ſome dammage, and the Wires of the Chimes were twiſted one with another. The Wind was very bluſtering all the Night after. *At* Oundle; *by Mr.* W. R.

7. *Aug.* 13. 1693. about 3 a Clock in the Morning, it began to *Thunder* and *Lighten*, and Rain; about 4 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; an Alarm went preſently through the Ship, of *Fire! Fire!* the dreadfulleſt word that can happen on Board, and put us all into Confuſion. But 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. In the Gangway was one man Knock'd down, and lay ſometime 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 Touched; our Main Maſt Split from the top down to the very Deck. *On board the* Suffolk *in the* Bay *of* Biſcay; *Dr.* Oliver. n. 204. p. 911.

8. *Jul.* 24. 1696. We had an extraordinary pleaſant Forenoon, with continual Sunſhine till about about half an Hour after three in the Afternoon, when we had ſome Rain, after which happened two *Claps* of *Thunder*, though not very great, and then a great Shower of *Hail*, in which time happen'd a third *Clap* which made all our loſs. We were 16 in Number, none of us hapning to be out or abſent at the time. The moſt part of them were ſtanding *Near* Aberdeen *in* Scotland; *by* ..... n. 227. p. 311.

about

about me in the School, hard by my Chamber Door; The two forelaid Claps of *Thunder* being over, we thinking nothing of them; and now there being a great Shower of *Hail*, on a ſudden there happened ſuch a *Flaſh* of *Lightning* which I ſaw, and as I thought fill'd the whole Houſe, but of the *Clap* I mind nothing, but only I think that I heard as it were ſome ſharp Clink or Sound; but our Neighbours in the Town, ſuch as the Miniſter and his Wife, told, they never heard a Louder: But however, I think all our Loſs was by the *Fire*, which was over in an Inſtant, and after which we had Darkneſs in the School, by Reaſon of the *Smoak*, with a moſt violent *Sulphurous* Smell, and the Burning of ſome leaves of Books. There are five *Breaches* in the Walls, one in the Roof, exactly in Shape like a Cannon Ball; another under the Chimney; a third came through the back Wall, and quite through the other Wall oppoſite to it; and the Chimney was ſplit in pieces, and ſome that came to the School Door and made a Breach there, renting the Stones in pieces, and carrying them out. There were 4 Killed: And many of the reſt Hurt, having their Legs or Arms Ruined; but are all, I thank God, recovered. And as for my ſelf, I never was in greater Danger, for there was one Killed before me, another at my left Hand, and not half a Foot from me there was a Breach made in the middle Wall of my Chamber, and yet I thank God I received no Hurt, only I was Bled in the Mouth, but how I cannot tell. As to the Childrens Bodies that were Kill'd, I found none of their Bones broken; my Brother had a *Cut* in his Head; and all of them, where they received the Strokes, had their Cloaths *Cut*, as if it had been eat out with Rats; they all received their Strokes on their Vital Parts, as about their Shoulders, which were in Colour of a Browniſh Black. All the Children that were Killed were in different places, and as it were pick'd out.

At Smyrna; *by Mr.* Rob. Mawgridge. n. 235. p. 782.

9. *Nov.* 26. 1696. A ſad and Aſtoniſhing Accident, happened to the *Trumbull Galley* by *Lightning* and *Thunder*. For as we lay at Anchor at *Smyrna*, about one of the Clock in the Morning, ſhe was ſtaved in ſeveral Places; The Bulk Head of her Round Houſe was ſtaved all to pieces into the Captain's Cabbin, and hurt his Shoulder; Her Mizen Maſt was ſtaved all to Pieces; and the Spindle in the Head of the Maſt was *Melted* at both Ends with the *Lightning*; The Main Top Sail Yard was laſh'd in the Top, yet notwithſtanding, the Yard was thrown out, and ſtuck in our Awning right an End. The Quarter Maſter (one *John Page*) was on the Deck by the Mizen Maſt, and one *John Allen*, who were both Struck down flat thereon with the *Lightning*: *Page* had one ſide of him ſtupified for three Days, but under God I recovered him in ſix Days; *Allen* was very well the next Day, when his Fright was over. The *Lightning* did ſtrike the Plank for 6 Foot off of the outſide of the Galley all to pieces, and the Timber was like a Bruſh; and three Planks of the Ceiling was ſtarted, whereof 2 Foot and 7 Inches was ſtaved out from the Reſt within 10 Inches of my Head; My Velvet Cap was hanging on a Nail in the ſame piece of Ceiling, the inſide whereof, next unto the *Lightning*, had not one ſtitch amiſs, but the Outſide had all the Seams burſt to pieces; A great Weighty Nail was ſtarted out of the ſaid Ceiling, and fell over my Head, and lay upon my Pillow; and I thought my Head with the

Lightning

Lightning had been in a Flaſh of Fire. Whilſt I could but juſt ſhut my Eyes and open them again, the *Lightning* went down into the Hold, and ran out like a Train of *Wild-Fire*, and *Burſt* out through the Galley's ſide, and Rent 10 or 11 Foot of the Outſide Plank off, within a Foot of the Water's Edge. Some of the *Lightning* ſhot up between the Timbers and the Ceiling into the Gun-Room, and ſtaved a Beam, and ſet 3 or 4 Bundles of armed Match all on *Fire*. The Gunner, *George Hardy*, was lying in his Cabbin at the ſame Time, and the *Lightning* Bliſtered one of his Feet, and Sing'd the Hair of his Head. The Maſter's Cabbin was between the Gunner's and mine, but had no Dammage.

10. *Jul.* 27. 1691. in *Everdon* Field, near *Daventry* in *Northamptonſhire*, divers were at work reaping Corn. The Morning was Fair and Clear, but before Noon there came a Violent Storm of *Thunder*, *Lightning*, and *Rain*; which cauſed the Reapers, about 20 in all, to retreat for Shelter to a Quick-ſet-Hedge with a Ditch by the ſide of it. Of theſe Perſons 4 were *Kill'd*, *viz. Simon Marriot*, *Rob. Marriot*, *Rich. Wells*, and *Tho. Burroughs*, and 8 others Dangerouſly Hurt, of the reſt ſeveral were ſtruck down but not much Hurt. *In* Northamptonſhire; *by Dr.* Wallis. n. 236. p. 5.

Upon the firſt Tidings of this Accident, Mr. *Edwards* (the Miniſter of *Badby*) repaired to the Place: Where *Robert Marriot* lay on his Back out of the Ditch, having *Struggled* (as was ſaid by the By-ſtanders) after the ſtroak. Mr. *Edwards* ſays, he ſaw no Marks or Sign of Hurt on the Body: But the Woman who laid out him and the reſt ſays, there was a *Hole* about the Bigneſs of a Gooſe ſhot in the Pit of his Stomach, and many more about his Legs. There was in the Hedge a Pollard-Aſh, under which ſat *Simon Marriot* and *Richard Wells*; but *Thomas Burroughs* ſat at the diſtance of two or three Yards from thence. In this Tree were *Cut* or Raiſed four (or more) Grooves or Furrows, from the Top to near the Bottom, (deeper than the Bark, and about an Inch broad each of them) on that ſide of the Tree on which the Men ſat; but no Dammage appeared on the Tree elſewhere, there being a Knot on the oppoſite ſide, which is ſuppoſed to have diverted the Stream of the *Fiery* Matter. The Green Thorns were *Scorched*, and the Place ſmelt rank of *Sulphur*.

Simon Marriot had the Crown of his Hat *Cut* into the Shape as of a bearded Arrow, and at the Band-place cut ſmooth, almoſt round about from the Brim. His Cloaths on one Shoulder cut Jaggedly to the Skin; where was a Scar about 4 Inches in length, of a long Oval Figure; the Tranſverſe Diameter whereof was deepeſt, of a Darkiſh Red Colour, as hard as *Horn* all over. He had Snuſh on his Hand, as if juſt ready to take it.

Richard Wells had a little Dog on his Lap, or between his Legs, Dead. His Hand upon the Dog's Head; his Eyes Open, and with Bread and Cheeſe (or one of them) in his Hand, as if going to give the Dog a bit. His Shoulder (as his Relations ſay) was ſtruck down, and in a manner ſever'd from his Body.

Thomas Burroughs ſat as looking up to the Heavens, his Head turning toward one ſide as viewing the Clouds, his Eyes Open. He had in his Pocket a

Copper Tobacco-box, which had one little round *Hole* ſtruck quite through it; and a little of the Metal on one ſide, ſeemed to have *Run.* By theſe Poſtures, it is evident they Dyed in a *Moment.*

Mr. *Edwards* adds, that he took *Simon Marriot*'s Hat, and ſome of his Cloaths, and held them againſt the Light, and they appeared full of *Holes*, as a Skimmer or Cullender. But (at which he wondered moſt) the Woman who laid them out told him, their Buttocks which ſat upon the Ground were pitifully mangled, and their Privy-Members rent and Torn in pieces; and more eſpecially thoſe of *Thomas Burroughs*, as if ſmall Bars of red Hot Iron had been thruſt up into them in many Places.

The Hair of their Heads was *Burnt* very much. Some had no Harm that were hard by: But others were Wounded at a Diſtance, and their Wounds were Cured with more Difficulty than ordinary Burns.

It was (before the Storm) a pretty ſtill Day. But before each *Thunder-Clap*, was heard a great Whirling-Noiſe in the Trees, like Wind. The *Lightning* was Obſerved, by Perſons at a diſtance, as falling perpendicularly upon them. Thoſe who recovered had their Cloaths full of *Holes*, as if they had been Shot through. Not a Drop of Blood appeared upon any of them. Their Hurts like Dry, Scorched, Scarred or Healed Wounds.

Simon Marriot and *Robert Marriot* were ſtruk back: the other two (ſupported, as is ſuppoſed, by the Hedge at their back) continued in the Poſture wherein they were Kill'd, three or four Hours after, when Mr. *Richard Butler* of *Preſton* ſaw them.

Several of thoſe who were Hurt, were taken up for Dead, but ſoon came to themſelves without any Application: But ſome of them were fain to be carried home.

Will. Gregory's Wife had 4 little *Holes* in her Knee, like Shot-holes; which turned to *Sores*, and had *Cores* came out of them.

Mary Bird (a Woman with Child) had all over her Body, near an Hundred *Wounds*, ſome as large as a Man's Hand; on each Arm one, and one on each ſide of her Belly. Out of moſt of her *Wounds* came *Cores*, ſome bigger, ſome leſs; the biggeſt were bigger than a Walnut, Dry and Black like Leather. She had two *Sores* on the Soles of her Feet, but her Shoes and Stockings not touched. She ſate next to thoſe that were Kill'd; ſhe was taken out of the Ditch for Dead, and was ſuppos'd to be Kill'd. She was ſenſible of the ſtroke, and ſenſible that her Husband looked Pale, and then ſwooned away. She and her Husband were both Blooded; ſhe within an Hour after, and her Husband eight Hours after; and they Bled freely. Their Legs were mightily Swelled, before they were carried out of the Field. The Woman was very ſore and full of Pain, ſo that ſhe could hardly bear any Cloaths to touch her. She was three Weeks ill before ſhe could Riſe, and continued ill about a Quarter of a Year. No Medicines uſed for Burns did any Good, but occaſioned great Torment to her. The firſt that they perceived to do Good was *Oil* of St. *John's-wort*; and after the *Cores* were come out, the *Black-Salve.* She went out her full Time: The Child had no Marks or Blemiſh at all upon this Occaſion;

Occaſion; and is yet Living. About that time of the Year, ſhe hath been Blooded ever ſince. She finds a great Tingling, and hath little Pimples like Stinging of Nettles; and cannot be well till ſhe hath been Blooded.

The *Wounds* of all thoſe that were Hurt, were like thoſe of this Woman; but Slighter; and ſome of them had no *Cores* came out of them.

This is the beſt account I can give you out of the broken Remarks which I had in writing from Mr. *Edwards* and Mr. *Butler*, the two Gentlemen above mentioned.

11. *Dec.* 22. 1698. *Jeremiah Skelton*, at *Warley* in the Vicaridge of *Hallifax* in *Yorkſhire*, Obſerving a Storm coming upon him, ſtep'd aſide for Shelter within a Barn-Door, and while there, was ſtruck with a dreadful *Flaſh* of *Fire*; a Young Woman that lived with her Father, in the Houſe that belonged to this Farm, being ſadly affrighted with the *Thunder* and *Lightning* (for part of the Sulphurous Matter came down the Chimney, and fill'd the Houſe with a ſtrong *Scent*, like that of Gunpowder after Firing) ſhe leaves the Houſe, and not ſeeing the Young Man about the Barn, goes with ſpeed and tells the Family he was related to, that ſhe fear'd he was ſlain. They came to the Barn and found it even ſo: A ſad Spectacle; the Young Man caſt down and many Stones about him; he was laid upon his Face, wholly Naked, ſave a ſmall part of his Shirt about his Neck, and a very little of a Stocking upon one Foot, and ſo much of a Coat-Sleeve as covered the Wriſt of one Arm; his Cloggs driven from his Feet, one not to be found, and the other Cloven; his Hat not to be found after Search; and the reſt of his Garments Torn into ſmall Shreds, and caſt at conſiderable Diſtances one bit from another; the Hair of his Head and Beard Singed, as tho' it had been with a Candle, and a little Hole below his left Eye, which they ſuppoſed might be made with the Fall upon a Stone: for there was a great Breach made upon the Barn, the Door Tops, both of Stone, broken, and the Wall above them fallen, with the Slate and Water Tables.

In Yorkſhire, 1698. *by Mr.* Ralph Thoresby. n. 249. p. 51

12. *Apr.* 27. 1700. We had (at *Leeds* in *Yorkſhire*) a pretty ſevere Storm of *Thunder* and *Lightning*: One Clap particularly was very Loud, and ſeemed to me to be very low and near us. It fell upon a Cottage and broke down part of the Chamber Chimney, and thence made its way through a Chink or Nick in the Floor to the lower Room, whereby the Flame thus contracted was either more intenſly Hot, or at leaſt directed more immediately to a Shelf, where it Melted ſeveral Holes in two *Pewter* Diſhes; it *Melted* alſo, and Run into little Lumps, ſeveral Places in a *Pewter* Candleſtick, and of a *Braſs* Mortar: Yet Burnt not ſome bits of Fringe, and other Combuſtible Matters within it; it Burnt alſo ſome Holes in a *Tinn* Veſſel, and Smutted a white Stone Plate it ſtood upon, as if it had been with *Lamp-black*, and filled the Room with ſuch a *Bituminous Smell* (like fired Gunpowder) as almoſt ſtifled the poor Woman, who was all alone in the Houſe: But upon opening the Door received no further Damage. I bought the Candleſtick to preſerve as a Memorial of ſo uncommon an Accident:

In Yorkſhire, 1700. *by Mr.* R. Thoresby. n. 264. p. 577.

I have enquired of one in that Neighbourhood concerning a more Fatal Accident, of which the *Pariſh-Regiſter* has this Note. Sept. 2. 1672. *was Buried* Thomas, *the Son of* James Lambert *Junior, deceaſed, of* Holbeek, Slain *the Day before, being the Lords Day, by a* Thunderbolt. His Skin, (as I am informed) was perfectly *Burnt* Black, and was Shrunk up hard like Parchment or Leather burnt with Fire. There were other Children in Company, who were alſo caſt down by the Storm, amongſt whom the Party I ſpoke to had a Brother and Siſter: He had a pair of new Stockings Burnt off his Legs, and himſelf was ſo Scorched, that he never recovered his Natural Complexion; She having a Waſte-coat claſped before (as the Faſhion then was) was ſo Burnt betwixt her Breaſts, that the Scars thereof remains to this Day; Another had the ſtiffned Neck of his Doublet ſtruck off.

But all recovered, except *Lambert*'s Boy, who was found with his Face upward, whereas all the reſt had theirs to the Earth: Which reminds me of our Cole-Miners Practice, who, when any Swoon away by their *Sulphurous Damps*, Dig a Hole in the Earth, and lay 'em on their Bellies with their Mouths in it, which (if it prove not an abſolute *Suffocation*) recovers them.

The Direction *of Ship Compaſſes Changed with* Thunder *and* Lightning; *by* ..... n. 127. p. 647.

LX. 1. Mr. *Haward*, who has been Maſter of ſeveral Ships, and is a Man of good Credit, tells me, That in a Voyage to *Barbadoes* in company of another Ship commanded by one *Grofton* of *New-England*, they were, in the *Latitude* (as I remember) of *Bermuda*, ſuddenly alarmed with a terrible Clap of *Thunder*, which broke this *Grofton's* Fore-Maſt, tore his Sails, and did ſome dammage to his Rigging: But by that time the Noiſe, together with the danger of this frightful Accident was paſt, Mr. *Haward*, to whom this *Thunder* had been more favourable, was however no leſs ſurpriſed, to ſee his Companion's Ship ſteer directly homeward again. When they were almoſt out of Call, he Tack'd and ſtood after them, and found That Mr. *Grofton* did indeed ſteer, by the right Point of his *Compaſs*, but that the *Card* was *Turn'd* round, the *North* and *South* Points having *Changed Poſitions*; and though, with his Finger he brought the Flower de Lys to point directly North, it would immediately as ſoon as at Liberty return to this new unuſual Poſture; and upon Examination he found every *Compaſs* in the Ship of the ſame Humor: Which ſtrange and ſudden Accident he could impute to nothing elſe but to the operation of the *Lightning* or *Thunder* newly mentioned. He adds, that he lent *Grofton* one of his Compaſſes to finiſh the Voyage, and withal that thoſe *Thunder-Strucken* ones, did never to his knowledge recover their right *Poſitions* again.

By Sir R. S. n. 157. p. 520.

2. *July* 24. 1681. The Ship called the *Albemarle*, whereof Mr. *Edward Lad* was then Maſter, being a hundred Leagues from *Cape-Cod*, in *Lat.* 48°. about 3, h. *p. m.* met with a *Thunder Storm*; the *Lightning* burnt the Main-Top-Sail, Split the Main-Cap in pieces, Rent the Maſt all along; there was in ſpecial one Dreadful Clap of *Thunder*, in Report bigger than that of a great Gun, at which all the Ships Company were Amazed; then did there fall ſomething from the Clouds, upon the Stern of the Boat, which broak into many

many ſmall parts, Split one of the Pumps, the other Pump much hurt alſo; It was a Bituminous matter, *Smelling* much like Fired Gun Powder: it continued burning in the Stern of the Boat; they did with Sticks diſſipate it, and poured much Water on it, and yet they were not able by all that they could do, to extinguiſh it until ſuch time as all the matter was conſum'd.

When Night came, obſerving the Stars, they perceived that their *Compaſſes* were *Changed*; as for the *Compaſſes* in the *Bittakle*, the *North Point* was turned clear *South*. There were 2 other *Compaſſes* unhung in the Locker in the Cabbin, in one of which the *North* Point ſtood *South*, like that in the Bittakle; as for the other, the *North* Point ſtood *Weſt*; So that they ſailed 1000 Leagues by a Needle, whoſe *Polarity* was quite *Changed*. As for the *Compaſs* wherein the *Lightning* had made the Needle to Point *Weſtward*, ſince it was brought to *New-England*, the Glaſs being broken, it has, by means of the Air's coming to it, wholly loſt its Virtue.

Mr. *Edward Randolph* (who has been 4 times imployed to *New-England* in his Majeſties Service) being enjoyned by Mr. *Flamſteed* to make enquiry into this matter, at his return to *Boſton* in *Dec.* 1683. ſpoke with Mr. *Lad* himſelf. He affirmed the ſame thing, and dictated to him an account ſuitable to what you have. But that which you have, was in the hands of Mr. *Mather* a Miniſter, to whom Mr. *Lad* had alſo preſented one of the *Compaſſes*, as he had done the other to an *Engliſh Merchant* in *Amſterdam*, who gave it to the State-houſe.

A Fiery Exhalation or Damp by Mr. Maurice Jones. n. 208. p. 49.

LXI. 1. About *Chriſtmaſs* 1693. at *Harlech* in *Merionydh-ſhire*, 16 Ricks of Hay and 2 Barns, whereof one was full of Corn, the other of Hay, were ſet on Fire by a *Kindled Exhalation*, which was often ſeen to come from the Sea, and laſted at leaſt a Fortnight or three Weeks; and it annoyed the Country, as well by *Poyſoning* their Graſs, as *Firing* the Hay, for the ſpace of a Mile, or thereabouts. Such as have ſeen the Fire, ſay it was a blew weak Flame, eaſily extinguiſhed, and that it did not the leaſt harm to any of the Men, who interpoſed their Endeavours to ſave the Hay, though they ventured (perceiving it different from common Fire) not only cloſe to it, but ſometimes into it. All the Dammage ſuſtained happen'd conſtantly in the Night. *Dec.* 24. *Richard Griffith* of *Lechwedh-du*; *Humphrey Owen* of *Garreg-wenn*, and *Richard Davydh* of *Erw-wenn*, each of theſe loſt a Rick of Hay. 27. That Night was burnt one Rick of Hay of *John Philips* of *Ynyslanvihangel y Tralthau*, two Ricks of Hay of *Griffith John Owen* of *Cefn-Trevorbach*, and *Katherine William*, Widow, of *Cefn-Trevor fvawr*, loſt 2 *Ricks*. 29. That Night *Francis Evans* of *Glaſs-vryn* had one Rick burnt. *Richard Davydh* of *Erw-wenn* had a Barn full of Hay of 3 Bayles of Buildings, burnt down to the Ground.

There are 3 ſmall Tenements in the ſame Neighbourhood (call'd *Tydhin-Sion Wyn*) whereof the Graſs is ſo *Infected*, that it abſolutely kills all manner of Cattle that feed upon it. The Graſs has been *Infectious* theſe three Years, but not throughly Fatal till this laſt.

2. An

By Mr. Edw. Lhawyd. n. 213. p. 223.

2. An Intelligent Sober Perſon, that lives near *Harlech*, aſſures me that the *Fire* ſtill [*Aug.* 1694] continues there; that it is obſerved to come from a place call'd *Morva bychan* in *Caernarvonſhire*, about 8 or 9 Miles off [over part of the Sea.] That Cattle of all ſorts, as Sheep, Goats, Hogs, Cows, and Horſes, ſtill *Dye* apace; and that for certain any great Noiſe, as Winding of Horns, Drums, *&c.* does *Repel* it from any Houſe or Barn, or Stacks of Hay, upon account of which Remedy, they have had few or no Loſſes ſince *Chriſtmaſs*; That it happened, during this Summer, at leaſt one Night in a Week, and that commonly either *Saturday* or *Sunday*; but that now of late it appears ſomething oftner. The place from whence it proceeds is both Sandy and Marſhy.

Fairy-Circles; by Mr. Jeſſop. n. 117. p. 394.

LXII. I have often been puzled to give an Account of thoſe *Phænomena*, which are commonly called *Fairy-Circles*. I have ſeen many of them, and thoſe of two ſorts; one ſort *Bare*, of 7 or 8 Yards Diameter, making a Round path ſomething more than a Foot broad, with Green Graſs in the middle; the others like them, but of ſeveral bigneſſes, and encompaſſed with a Circumference of Graſs, about the ſame breadth, much *Freſher* and *Greener* than that in the middle. But my worthy Friend Mr. *Walker*, gave me full Satisfaction from his own Experience; it was his chance one Day, to walk out among ſome Mowing Graſs (in which he had been but a little while before,) after a great Storm of *Thunder* and *Lightning*; which ſeemed by the Noiſe and Flaſhes to have been very near him: He preſently obſerved a *Round-Circle*, of about 4 or 5 yards Diameter, the Rim whereof was about a Foot broad, newly *Burnt Bare*, as the colour and brittleneſs of the Graſs Roots did plainly Teſtifie. He knew not what to aſcribe it unto but the *Lightning*, which, beſides the odd *Capricios* remarkable in that Fire in particular, might without any wonder, like all other Fires, move Round, and Burn more in the Extremities than the Middle. After the Graſs was Mowed, the next Year it came up more *Freſh* and *Green* in the place Burnt, than in the Middle, and at Mowing-time was much Taller and Ranker.

The Cauſe *of* Lightning *and* Thunder *conſider'd*; *by Dr.* Liſter. n. 157. p. 517.

LXIII. 1. There are two ſorts of Inſtances (that often occur in Hiſtory) which very much favour my Opinion, That *Thunder* and *Lightning* owe their Matter from the ſole *Breach* of the *Pyrites*.

The firſt ſort of them are thoſe which tell us that in *Italy* it Rained Iron in ſuch a Year, and in *Germany* a great Body of Iron-Stone fell at ſuch a time; the like *Avicen* affirms. *Julius Scaliger* ſays that he had by him a piece of Iron which was Rained in *Savoy*, where it fell in divers places. *Cardan* reports 1200 Stones to have fallen from Heaven, and one of them Weighed 120 *l.* ſome of them 30 *l.* ſome 40 *l.* very Hard, and of the Colour of Iron. Now that which is very remarkable (ſays *Gilbert*, where thoſe Inſtances are reckon'd up,) and a very probable Argument for the Truth of ſuch like Inſtances, is that it is no where Recorded, that it ever Rained Gold or Silver Ore, or Tin, or Lead; but Copper hath been alſo ſaid to have fallen from the Clouds.

But

But wherever the *Pyrites* is mentioned by the Antients, it is always to be underſtood of the *Copper Pyrites*; they ſcarce having had any Knowledge of the *Iron Pyrites*. And therefore the Raining of Copper makes it yet more probable, becauſe of its great Affinity with Iron.

Now this *Ferrum* or *Æs Nubigenum*, if there was ever any ſuch, was concreted of the *Breath* of the *Pyrites*, which we have elſewhere ſhewn to be the *Pyrites, ex tota Subſtantia.*

The other Inſtance, (which is owing to our Regiſters) is of *Lightning* being *Magnetick*. This I am ſure of, I have a Petrified piece of Aſh, which is *Magnetick*; that is, the *Pyrites in Succo*; which makes it probable it may be *Magnetick* alſo in Vapour. *Vid. Sup.* §. LX.

2. *Thunder* and *Lightning* are ſo very like the Effects of Fired *Gun powder*, that we may reaſonably judge them to proceed from like *Cauſes*. Now the Principal Ingredients in Gun-powder are *Nitre* and *Sulphur* (the Admiſtion of Char-cole being chiefly to keep the parts ſeparate, for the better Kindling of it.) So that if we ſuppoſe in the Air, a convenient Mixture of *Nitrous* and *Sulphurous* Vapours, and thoſe by Accident to take Fire, ſuch *Exploſion* may well follow, with ſuch Noiſe and Light, as in the Firing of Gun-powder. And being once Kindled it will run from place to place, as the Vapour leads it, as in a Train of Gun-powder, with like Effects. *The* Cauſe *of* Hail, Lightning *and* Thunder *conſider'd; by Dr.* Wallis. n. 231. p. 655.

This *Exploſion*, if High in the Air, and far from us, will do no Miſchief, or not conſiderable; like a parcel of *Gun-powder* Fired in the open Air, where is nothing near to be Hurt by it: But if near to us (or amongſt us) it may Kill Men or Cattle, Tear Trees, Fire *Gun-powder*, Break Houſes, or the like; as *Gun-powder* would do in like Circumſtances. This Nearneſs or Farneſs may be eſtimated by the Diſtance of time between ſeeing the *Flaſh* of *Lightning*, and Hearing the Noiſe of the *Thunder*. For though in their Generation, they be Simultaneous; yet (*Light* moving faſter than *Sound*) they come to us ſucceſſively. I have obſerved that commonly, the Noiſe is about 7 or 8 *Seconds* after the *Flaſh* (that is, about half a Quarter of a Minute); but ſometimes much ſooner, in a *Second* or two, or leſs than ſo, and almoſt immediately upon the *Flaſh*. And at ſuch time, the *Exploſion* muſt needs be very near us, or even amongſt us. And, in ſuch Caſes, I have (more than once) Preſaged the Expectation of *Miſchief*, and it hath proved accordingly.

Now, That there is in *Lightning* a *Sulphurous Vapour*, is manifeſt from the *Sulphurous Smell* which attends it, and a Soultry Heat in the Air which is commonly a Fore-runner of *Lightning* ſoon after. And that there is alſo a *Nitrous Vapour* with it, we may reaſonably judge, becauſe we do not know of any Body ſo liable to a ſudden and Violent *Exploſion*.

As to the *Kindling* of theſe Materials, in order to ſuch *Exploſion*, I am told that a Mixture of *Sulphur* and *Filings* of *Steel*, with the Admiſtion of a *little Water*, will not only cauſe a great Effervescence, but will of it ſelf break forth into an Actual Fire. I ſay a *little Water*, becauſe too much will hinder the Operation, or quench the Fire; which I take to be the *Cauſe* of the *Bath Waters*. n. 233. p. 729.

Waters, and other *Hot Springs*, where *Steel* and *Sulphur* cauſe a great Effervescence, but no Flame.

n. 231. p. 657. So that there wants only ſome *Chalybeat* or *Vitriolick Vapour* (or ſomewhat *Equivalent*) to produce the whole Effect (there being no want of Aqueous Matter in the Clouds.) And there is no doubt, but that amongſt the various *Effluvia* from the Earth, there may be copious Supplies of Matter for ſuch Mixtions.

n. 233. p. 730. The ſame Account may be alſo given of *Ætna* (and other *Burning-Mountains*;) where the Mixture of *Steel* and *Sulphur* may give a *Flame*; which is oft attended with prodigious *Exploſions* (and *Earthquakes*) from great Quantities of *Nitre*, as in Springing a Mine.

n. 231. p. 657. This may alſo ſuggeſt ſomewhat as to the *Generation* of *Hail*, which is very oft an Attendant of *Thunder* and *Lightning*. 'Tis well known, in our Artificial *Congelations*, that a Mixture of *Snow* and *Nitre* (or even common Salt) will cauſe a preſent and very ſudden *Congelation* of *Water*. And the ſame in Clouds may Cauſe that of *Hail-ſtones*. And the rather, becauſe there ſeems ſomewhat like *Snow* rather than *Ice*, in the midſt of them. And as to thoſe in particular ſo very large (as to weigh Half a Pound, or three Quarters of a Pound) ſuppoſing them to fall from ſo great a Height, as 'tis manifeſt they did by the Violence of their Fall: 'Tis very poſſible, that, though their firſt Concretion, upon their ſudden *Congelation*, might be but moderately great, as in other *Hail*, yet in their long Deſcent, if the Medium through which they fall were alike inclined to *Congelation*, they might receive a great Acceſſion to their Bulk, and divers of them Incorporate into one. Like as in that ſtrange Shower of *Hail* in *December*, 1672. Wherein there did hang on the Trees a great deal in the Form of *Icicles* a Foot or more in Length.

Vid. Sup. §. XLIV.

Vid. Sup. §. LI.

n. 236. p. 9. These Conſiderations may alſo furniſh us with ſome account of the *Natural Cauſes* of thoſe particular Circumſtances, which attended the Accident at *Everdon* where 4 Perſons were Kill'd, and others Hurt with *Lightning*.

Vid. Sup. §. LIX. 10.

It ſeems to me that in and over the Ditch there was plenty of ſome *Cauſtick Vapour*, of a like Nature with the Ingredients of *Gun-powder*: And perhaps even under thoſe who were Killed or Wounded. And if this *Exploſive* Quality were attended with that of *Glaciation*, as *Thunder* is often accompanied with *Hail*, (*Nitre* being a proper Efficient of both,) there might be ſuch Concretions, in the Nature of *Hail*, as might (by ſuch *Exploſion*) be ſcattered like Hail-ſhot out of a Gun, and cauſe ſuch *Holes* as are ſaid to have been in the Cloaths and Fleſh of thoſe Perſons. And what is ſaid to have been Obſerved by others at a Diſtance, like a *Ball* of *Fire* falling down directly upon the Place, might be a Propagation of the *Flame* kindled above, and continued, as the *Vapour* directed it, to the Place (as would be in a Train of Gunpowder) and might there hurt ſome and ſpare others, according as it was here or there more Copious. For we are not to preſume that it was in all places equally mixed.

The *Cores* which came out of the Wounds, ſeem like *Eſcars* made by a Cauſtick

Cauſtick or other Burnings. And I take them to be Scorched Skin, Mortified, (beat into the Fleſh by that *Hail Shot*) and appearing like burnt Leather: Which muſt be worked out before the Wound could be healed; as is uſual, when other Heterogeneous Matter is forced into the Fleſh.

That ſome of the People not far off, might be thrown down, and not otherwiſe conſiderably Hurt, is not ſtrange; who might be within the *Blaſt*, though not within the reach of the *Fire*; as we ſee in the *Exploſion* of *Gunpowder*, (to which I take this to be very like) when Windows (and other things at a Diſtance) are ſhaken and ſhatter'd by the *Blaſt*, or great Concuſſion of the Air, though the *Flame* do not reach them.

LXIV. 1. *Dec.* 25. 1666. In the Evening here (*viz.* at *Madrid*) was a great *Halo* about the *Moon*; the Semidiameter whereof was about 23°. 30′. *Aldebaran* was juſt in the North-Eaſt part of the Circle, and the two *Horns* of *Aries* juſt encloſed by the South Weſt of the Circle, the *Moon* being in the Center. I note this the rather, becauſe 5 or 6 Years ago, *viz.* *Nov.* 21. 1661. an hour after Sun-ſet, I ſaw a great *Halo* about the *Moon*, of the ſame Diameter, at *Tangier*, the *Moon* being very near the ſame place, where ſhe was now.

Halo's, *At* Madrid; *by E. of* Sandwich. n. 22. p. 390.

2. *May* 12. 1667. An *Halo* or Circle about the *Sun*, was Obſerv'd by the *Philoſophical Society* at *Paris*. The Diameter of this *Circle*, was found to be of 44 *Degrees*, and the Breadth of the Limb thereof, about half a *Degree*. The upper and lower part were of a *Vivid Red* and *Yellow*, with a little *Purple* Colour, but eſpecially the upper, the *Red* was within the *Circle*. The other parts appeared but *Whitiſh* and of little Clearneſs. The Space within the *Halo* was a little Darker than that about it, eſpecially towards the parts that were *Coloured*. Beſides, there was ſeen the *Proportion* of another *Great Circle*, which touched the *Halo* above, and whoſe Extremities were bent downward, as is repreſented in the *Figure*. This *Portion* of a *Circle* had alſo its Colours like thoſe of the *Halo*, but fainter. The Height of the Sun at the Beginning of the Obſervation, was about 46. *Deg.* There were in the Air little White Clouds, which ſomewhat Tarniſh'd the Blew Colour of the Heavens, and leſſened the Brightneſs of the Sun, which ſhone as in an *Eclipſe*. The Weather was Cold, conſidering the Seaſon of the Year; and it was affirmed for certain, that it had *Frozen* the Night before. This *Halo* appear'd in the ſame Beauty and Splendor of Colours unchanged from 9 in the Morning, (when it began to be Obſerv'd) until about half an Hour paſt 10; after which time it became Fainter and Fainter till two of the Clock in the Afternoon, (when it ended,) after it had reſumed a little more Force ſometime before it diſappear'd.

At Paris; *by* M..... n. 60. p. 1065.

Fig. 26.

3. *Jan.* 1. *St. N.* 1676. H. 3. 46′. Durante *Eclipſi*, ingens *Halo Lunam* cinxerit.

At Dantzick; *by M.* Hevelius. n. 124. p. 589.

4. *Aug.* 21. 1676. At 12. h. 40′. At Night a *Halo* encompaſſed the *Moon*, in whoſe Circumference was *Saturn*, the *Pleiades*, *Capella*, and the *following* of the *Foot* of *Perſeus*.

At Oxford; *by Mr.* Halley. n. 129. p. 724.

Parhelia *Obſerv'd, in* France; *by* M..... n. 13. p. 219.

LXV. 1. *April* 9. 1666. About half an Hour paſt 9, there appeared three *Circles* in the Sky. *One* of them *SCHN*, was very great, a little interrupted, and *White* every where, without the Mixture of any other Colour. It paſſed through the midſt of the *Sun*'s Disk, and was Parallel to the *Horizon*. Its Diameter was above 100 *Degrees*, and its Center not far from the *Zenith A*.

Fig. 27.

The *Second DEBO*, was much leſs and Defective in ſome places, having the *Colours* of a *Rainbow*, eſpecially in that part which was within the great *Circle*. It had the true *Sun R*, for its Center.

The *Third HDN*, was leſs than the *Firſt*, but greater than the *Second*; it was not entire, but only an *Arch* or Portion of a *Circle*, whoſe Center was far diſtant from that of the *Sun*, and whoſe Circumference did by its Middle, joyn to that of the *Leaſt Circle*, with which it was confounded at *D*, and interſected the *Greateſt Circle*, by its two Extreams. In this Circle were diſcerned alſo the *Colours* of a *Rainbow*, but they were not ſo ſtrong, as thoſe of the *Second*.

At the Place, where the Circumference of this *Third Circle* did cloſe with that of the *Second*, there was a great Brightneſs of *Rainbow-Colours*, mixt together: And at the two Extremities, where this *Second Circle* interſected the *Firſt*, appeared two *Parhelia*'s or *Mockſuns*, *H*, *N*; which ſhone very bright, but not ſo Bright, or ſo well defined, as the *True Sun*. The Midſt of theſe two *Falſe Sun*'s was *White* and very Luminous: And their Extremities towards *DI*, were *Tinged* with the *Colours* of a *Rainbow*. The *Falſe-Sun H*, that was towards the South, was bigger, and far more Luminous, than that towards the Eaſt.

There was alſo upon the *Firſt* Great *Circle*, a *Third Mock-Sun*, *C*, Situated to the North, which was leſs, all *White*, and far leſs Shining than the Two others. There was a ſpace very Dark betwixt *R* and *D*.

This Appearance is look'd upon as one of the Notableſt that can be ſeen, by Reaſon of the Excentricity of the Circle *HDN*, and becauſe that the *Parhelia* were not in the Interſection of the Circle *DEBO* with the great Circle *SCHN*, as they appear'd at *Rome*, *March* 29. 1629. but in that of the Semicircle *HDN*.

Carteſii *Meteor.* c. 10.

In Hungary; *by Dr.* Edw. Brown. n 47. p. 953.

2. A Learned Jeſuit call'd Father *Michael*, who lives at *Presbury*, communicated to me an Account of two *Parhelia*'s, which were ſeen *Jan.* 30. 1669. *St. N.* about one of the Clock in the Afternoon, over the City of *Caſſovia* in *Hungary*.

There was one on each ſide of the *True Sun*, and they were ſo reſplendent, that the Naked Eye could not bear the Brightneſs thereof. *One* of them (the leſſer of the two) began to Decay before the *other*, and then the *other* grew Bigger, and continued well nigh two Hours, projecting very long Rays from it ſelf. They were *both*, on that part which was towards the *Sun*, *Tinged* with a pale *Yellow*, the other parts being ſomewhat Fuſcous. There were at the ſame time ſeen ſeveral *Rainbows*, together with the Segment of a great *White Circle*, of a long

long Duration, passing through the two *Parhelia*'s and the *Sun:* And all this at a time, when the Air was almost free from *Clouds*, though here and there were Scatter'd some very Thin ones.

3. *An.* 1670. *Oct.* 11. *St. N. H.* 7. 40′. Tres *Parhelii* apparuerunt. *At* Dantzick; *by M.* Hevelius. n. 66. p. 2026.

4. *Feb.* 5. 1674. *St. N.* Not far from *Marienburgh* in *Borussia*, I saw the *Sun* (in a Sky every where Serene enough) being yet some *Degrees* above the *Horizon*, and shining very bright, yet lancing out very long and *Reddish* Rays, 40 or 50 *Degrees* toward the *Zenith*. Under the *Sun*, towards the *Horizon*, there hung a somewhat dilute small Cloud, beneath which there appear'd a *Mock-Sun*, of the same bigness (to Sense) with the *True Sun*, and under the same Vertical, of a somewhat Red Colour. Soon after, the True-Sun more and more descending to the *Horizon* towards the said Cloud, the *Spurious Sun* beneath it grew Clearer and Clearer, so that the *Reddish* Colour in that *Apparent Solar* Disk Vanish'd, and put on the *Genuine* Solar Light, and that the more, the less the *Genuine* Disk of the *Sun* was distant from the *False Sun:* Till at length, the upper *True-Sun* passed into the lower *Counterfeit* one, and so remained alone. *At* Marienburgh *in* Borussia; *by M.* Hevelius. n. 102. p. 26. Fig. 28. Fig. 29. Fig. 30.

Upon this appearance there soon followed here an exceedingly Intense and bitter *Frost*, whereby the whole *Sinus Puzensis* was *Frozen* up, from this Town of *Dantzick*, as far as *Hela* in the *Baltique Sea*, which lasted unto the 25 of *March*, and the *Bay* was *Frozen* so hard, that with great safety People run out into it with Sleds and Horses, for several of our Miles.

5. *Aug.* 28. 1698. about 8 a Clock in the Morning, some Persons at *Sudbury* in *Suffolk* saw the Appearance of *Three Suns*; 'tis said, then the Apparition was most Full, or a little after. About $\frac{1}{2}$ an Hour after 8, I my self saw it; there was in the East, a Dark, Dusky, Watry Cloud, and below it towards the Middle, was the *True Sun*, shining with fierce and piercing Beams, that Persons could not look upon it; on each side were the *Reflections*, with the *True Sun* in the Middle. Elsewhere much of the Firmament was of an Azure, Light-Blew Colour. The *Circles* which I saw, was not of *Rainbow-Colours*, but *White*. There was also, higher in the Firmament, more over our Heads, and toward the South, at the same time, at a considerable Distance from the other, the Form of a Half *Moon*; but I think it was more than twice the Bigness of a Half Moon, with the Horns turned upward, and within of a fiery *Red* Colour, and more like a *Rainbow Colour*, These all Faded gradually; They continued in all, I suppose, two Hours. *In* Suffolk; *by Mr.* Petto. n. 250. p. 107.

6. *Feb.* 26. $169\frac{8}{9}$. about half an Hour after 3. in the Afternoon, chancing to look out of a Window that faced South-East, I saw not far from the South to the Westward, an Appearance of somewhat not much unlike the *Sun* when seen through Clouds, *viz.* with its Periphery not exactly defined: From which it likewise differed, in that one half of it was coloured Deep *Red* and *Yellow*, the other *White*. I went immediately into the Garden, and saw an Appearance exactly like the former, but on the Opposite side of the *Sun*. The Distance of this was 23°. from the *Sun*, to the Westward; but before I could take the Distance of the Eastern one, it Vanished, but soon after Re-appear'd, *At* Canterbury; *by Mr.* St. Gray. n. 251. p. 126.

and then I perceived manifeſtly, that they were both ſituate in the Extremities of a *Semicircle*, whoſe Center was the *Sun*, paſſing betwixt it and the *Zenith*. This Appearance continued about half an Hour.

At Canterbury; *by Mr.* St. Gray. n. 262. p. 535. Fig. 31.

7. *Apr.* 7. 1699. Between 4 and 5 a Clock, there appeared on each ſide the *Sun A*, a *Parhelion*, *B C*, connected by an *Halo B D C*, of the uſual Diameter, they had each of them a *Tail* of a *Whitiſh* Colour, extended oppoſite to the *Sun*, of about 15 or 20 *Degrees* in Length, the upper part of the *Halo* was touched at *D*, by the Arch of a *Circle*, whoſe Ends were turned towards the *Zenith Z*; it had the Colours of the *Iris*, but faintly; betwixt this and the *Zenith* was another Portion of a *Circle E*, which had the Colours of the *Iris* with greater Vivacity than the former.

Rainbows *Obſerv'd in* France; *by M.* Eſtienne. n. 13. p. 221. Fig. 32.

LXVI. 1. *An.* 1665. *Aug.* 10. About half an Hour paſt 6 in the Evening two odd *Rainbows* appeared at *Chartres* in *France*, croſſing one another almoſt at Right Angles. The *Rainbow*, which was oppoſite to the *Sun*, in the uſual manner, was more deeply *coloured*, than that which Croſs'd it: And its greateſt Height, was about 45 *Degrees*. The Feebler *Rainbow* loſt one of its Legs, by growing Fainter, about 20 *Degrees* above the ſtronger; and the Leg below appeared continued to the *Horizon*. This ſeem'd to be a Portion of a great Circle; and the Stronger was but a Portion of a ſmall Circle, as uſually.

The *Sun*, at their Appearance, was about 6 *Degrees* high above the *Horizon*. The River of *Chartres*, which runs very near from South to North, was betwixt M. *Eſtienne* (the Obſerver) and the *Rainbow*, and He ſtood Level with the River, whence he was diſtant not above 150 Paces.

At London; *by Mr.* Edm. Halley. n. 240. p. 195.

2. *Mar.* 11. 1696 It Rain'd pretty thick a ſmall Rain, and the *Sun*, about 2 of the Clock, ſhone directly down *Abchurch Lane*, as I was paſſing along it with my Back to him, when I perceived the Arch of the *Primary Rainbow* in the Drops of Rain, ſpanning the Street like an Arch of a Building under which I was to paſs, the Crown whereof was not much higher than my Head, and the Diameter thereof ſcarce ſo wide as the Street, which is but 5 Yards; and it moved along with me as faſt as I went; the *Colours* being very Vivid and Diſtinct, though the Arch it ſelf appear'd but narrow, and the Houſes were every where behind it. This, tho' very uncommon, will not appear ſtrange to thoſe who have well conſidered the Nature of the *Iris*.

At Cheſter; *by Mr.* Edm. Halley. n. 240. p. 193.

3. *Aug.* 6. 1698. Between 6 and 7 a Clock in the Evening, I Obſerved an *Iris*, exceedingly Vivid, as to its Colours, at firſt on the Southſide only, but in a little time with an entire Arch; and ſoon after, the Beams of the *Sun* being very ſtrong, there appear'd a *Secondary Iris*, whoſe Colours were more than Ordinary Bright, but inverted, as uſually: That is, the *Red* was inwards, which in the *Primary Iris* is outward, and *è contra* for the *Blews*. But what I took moſt notice of was, that with theſe two Concentrick Arches, there appear'd a third Arch, near upon as Bright as the *Secondary Iris*, but *Coloured* in the Order of the *Primary*, which took its Riſe from the Interſection of the *Horizon* and *Primary Iris*, and went croſs the Space between the two, and interſected the *Secondary*, as in the *Figure A F C G* Interſects the *Secondary Iris E F G D*

EFGD, dividing the Arch *ED*, into three equal Parts, as near as I could then gueſs: But at firſt the Arch *AF*, did not appear, which afterwards became as Bright as the former. I Obſerved the Points *F*, and *G*, to ariſe, and the Arch *FG*, gradually to contract, till at length the two Arches *FHG*, and *FG*, became coincident; when, for a great ſpace, the *Secondary Iris* loſt its *Colours*, and appeared like a *White* Arch at the Top. I obſerved alſo, that at the Points *F*, and *G*, the Interſection of the Interior *Red* of the *Secondary Iris*, and the Exterior *Red* of the Arch, was much more intenſly *Red* than the outward Limb of the *Primary Iris*; and that during the whole Appearance, the upper part of the *Third Iris* was not at all Viſible, beyond the Interſections, *F*, *G*. This uncommon Sight entertained me for about 20. *min.* when the Clouds blowing away, the whole Vaniſhed. I was at firſt amaz'd with the Sight, but afterwards, recollecting that the *Sun* ſhone along the River *Dee*, which from thence empties it ſelf into the *W. N. W.* where the *Sun* then was, I concluded this *Secondary Arch AFHGC*, was produced by the Beams of the *Sun Reflected* from that Water, which at that time was very Calm; and it had been much more Bright, had it been at that time about High, as it was Low-Water, when all the Sands were bare. I was ſoon confirmed that my Suppoſition was Right, and that it anſwered all the Appearance without any Scruple, and that the Arch *AFHGC*, was no other than that part of the Circle of the *Iris*, that would have been under the Earth, bent upwards by *Reflection*. Fig. 33.

I Remember not to have read of any ſuch *Iris* in any Author. *Des Cartes*, indeed ſpeaks of an *Inverted Iris* by *Reflection*, but it is not poſſible to be ſeen as he Deſcribes it: And I Quæry whether ever any ſuch has been really Obſerved.

LXVII. The Obſervation of the *Halo*, which appeared at *Paris*, *May* 12. 1667. engaged M. *Hugens* to propoſe to the *Academy* there, what he had Meditated ſome Years before, not only of theſe *Halo*'s but alſo of the *Parhelia*. As for *Halo*'s, he ſaid, that they were formed by ſmall round *Grains* made up of two Parts, one Tranſparent, the other Opaque; the latter being incloſed in the former, as a Cherry-ſtone is in a Cherry. Thus *AA*, repreſents one of theſe *Grains*, and *B*, the *Kernel* or Opaque part. *The Cauſes of* Halo's *and* Parhelia *Conſider'd by M.* Hugens. n. 60. p. 1066. *Vid. Sup.* §. LXIV.

He related the Obſervations of thoſe who have ſeen *Hail* formed after this manner, and explain'd how that ſome of theſe little *Grains*, which ſwim up and down in the Air betwixt us and the *Sun*, being leſs diſtant from the Axis, which extends it ſelf from the Sun to our Eye, than of a certain Angle, do neceſſarily hinder the Rays, which fall on them; from coming to our Eyes, in regard that the Opaque *Kernel* is the Cauſe that there is behind every ſuch *Grain* a ſpace of a Conical Figure, as *MNO*, in which the Eye of the Spectator being ſcituated cannot ſee the *Sun* through that *Grain*, though it may ſee him when poſted elſewhere, as ſome where in *P*. Fig. 34.

And to make the Company the more diſtinctly to underſtand the Effect which theſe *Grains* ſuſpended in the Air muſt produce, he drew the 35. *Fig.* in which *B*, is the place of the Eye; *BA*, the Axis which paſſeth from the Eye Fig. 35.

to.

to the Sun: *C*, *M*, *F*, ſome of the *Icy Grains* with their *Kernel*, making them half Opaque: Among which the *Grain C*, being in the Axis, *B A*, and the Lines *C K*, *L H*, repreſenting the Rays of the *Sun* neareſt to the Axis, the paſſage of which is not hindred by the Opacity of the *Kernel*, 'tis certain, not only that the *Grain C*, will not be able to tranſmit any Ray of the *Sun* towards *B*, but alſo that, imagining the Superficies of a Cone, whoſe Top is in the Eye, and its ſides *B D*, *B E*, Parallel to the Rays *C K*, *L H*; all the *Grains M M*, which this Superficies ſhall compriſe, will likewiſe not ſuffer any Ray to paſs to the Eye, becauſe it muſt needs be in their Cone of Obſcurity; but thoſe that ſhall be without this Superficies, as the *Grains F*, *F*, will let them paſs, becauſe the Eye is without their Cone of Obſcurity. Whence it follows, that the Angle of this Cone *B D E*, is that which Determines the Diameter of the *Halo*, which depends from the Proportion, the Opaque *Grain* hath to the Tranſparent, in which it is incloſed. For if this Diameter is of 44 *Degrees*, as is Obſerv'd in moſt *Halo*'s, the bigneſs of the Opaque *Grain* will be to the Tranſparent, as 40 to 19. But he ſaid, that this Proportion was not always the ſame, and that the Diverſity of it was the Cauſe, that ſometimes there were ſeen many *Halo*'s, one about the other, all having the *Sun* for their Center.

He added, that it was eaſy to know, why theſe *Halo*'s were always of a round Figure, whether the Sun be little or much raiſed above the Horizon; as alſo to give a Reaſon of their *Colours*, which is the ſame with that in the Triangular Glaſs *Priſmes*; as is evident by the Tangents *A C*, drawn to the *Grain A*, at the Points, where the Ray *D A*, enters or comes out.

Further he took notice, that it was alſo manifeſt, why the *Red* Colour is in the Interiour Circumference of the *Halo*: and why the ſpace, which it taketh in and chiefly near the moſt lively *Colour'd* parts, appears Obſcurer than the Air about; *viz.* becauſe it is there, where moſt *Grains* are, which tranſmit no Rays of the *Sun* to our Eyes, and ſo do nothing but darken the Air, as the Drops of Water when it Raineth.

As to the *Arch* of the *Circle*, which above touched the *Halo*, ſeen *May* 12. 1667. as alſo that the *Colours* were more Vivid in this place and in that below, than in the reſt of the *Circle*; he ſaid, that theſe Effects did not proceed from the *Grains*, he had been ſpeaking of, but from another Cauſe, which did alſo ſerve for the Production of the *Parhelia*, and the *Circles* which almoſt always accompany them. Touching which *Circles* and *Parhelia*'s he told the Company, that beſides the Round and half Dark *Grains*, there were alſo formed in the Air certain little *Cylinders* of the like Nature: Which being ſuppos'd to be *Oblong Icy Grains*, and Roundiſh at both Ends, having the inner *Kernel* of the ſame Shape, it was found, that from their different Diſpoſitions all the Appearances of the *Parhelia* and their *Circles* did neceſſarily follow.

Fig. 36.

And firſt, that ſome of theſe *Cylinders* being erect, in the Situation which probably they ought to have in being formed, there muſt appear in the Heavens a great *White Circle*, Parallel to the *Horizon*, paſſing through the *Sun*, and of near the ſame breadth withhim; as hath been obſerved in the Phænomenon of

Rome.

Rome. An. 1629. of which *Gaſſendus* and *Des Cartes* have written, and which is here Exhibited.

That this *Circle L K N M*, is cauſed by the *Reflection* of the Rays of the Sun upon the Surface of theſe *Cylinders*; it being eaſy to Demonſtrate, that there are none but thoſe which are raiſed at the ſame Angle above the *Horizon* with that of the Height of the *Sun*, that can *Reflect* his Rays to our Eye. Whence it manifeſtly follows, that it muſt appear *White*, and throughout of equal Altitude with the *Sun* it ſelf, and by Conſequence Parallel to the *Horizon*. That conſidering afterwards the Tranſparency of theſe Perpendicular *Cylinders*, and their Opaque *Kernels*, it is eaſily ſeen, that thoſe of the *White Circle*, which are diſtant from the *Sun* at a certain Angle, begin to give paſſage to his Rays to ſtrike our Eyes, in the ſame manner as hath been ſaid of the Round half Dark *Grains*. That theſe *Cylinders* are thoſe, which on each ſide of the *Sun* make us ſee a *Parhelion* in the great *White Circle*, as hath been noted in the Obſervation of *Rome* (where they are mark'd with *K* and *N*) and in many others. That theſe *Parhelia* have commonly luminous *Tails*, becauſe the *Cylinders*, which follow thoſe firſt ones that form the *Parhelia*, and which are yet further diſtant from the *Sun*, let alſo paſs his Rays to our Eye; ſo that theſe *Tails* may be 20 *Degrees* and more in length. That the ſame *Parhelia* are always *Colour'd*, becauſe they are made by *Refraction*, as the *Halo*. Fig. 37.

That beſides, there are two other *Images* of the *Sun*, generated by theſe Perpendicular *Cylinders*, and ſo diſpoſed in the great *White Circle*, that the Spectator, turning his Face towards the *True Sun*, hath them behind him; as in the *Roman* Obſervation are the *Parhelia L*, and *M*. That theſe are produced by two *Refractions* and one *Reflection* in theſe *Cylinders*, in the ſame manner as the Ordinary *Rainbow* in the Drops of Water, according as M. *Des Cartes* hath declared: So that the *Opaque Kernels* do nothing to the Production of theſe two *Suns*, but that they may be ſometimes ſo big, as to make them not appear. That according to the *Altitude* of the *Sun*, more or leſs, theſe two *Parhelia* are more or leſs nigh to one another. That they ſhould appear *Colour'd*, as the *Rainbow*, and that ſometimes they have been ſeen ſuch; but that when they are faint, they may alſo ſeem *White*, even as the *Halo*'s, when they are not very Bright.

That theſe ſame Perpendicular *Cylinders* can alſo produce an *Halo* about the *Sun*, by Reaſon of the Rounding of their two Ends; which maketh, that being diſtant from the *Sun* at a certain Angle, on what ſide ſoever it be, they begin from thence to give Paſſage to the Rays, tranſmitting them to the Eyes of the Spectator.

And that theſe *Halo*'s are probably thoſe, we ſee almoſt always paſs through the two *Parhelia* that are on the ſides of the *True-Sun*, as the *Halo G K N I*, in the Phænomenon of *Rome*.

That there is yet another Scituation of theſe *Cylinders* very conſiderable, which is of thoſe that are *Couchant*, ſo as their Axes are Parallel to the Plane of the *Horizon*, but turned divers ways, ſome one ſome another way, like Needles confuſedly thrown on the Ground: Which *Horizontal* Diſpoſition, is very Natural to thoſe *Cylindrick* Bodies ſupported by the Vapours, which riſe from

from the Earth, as may be made out Experimentally in Bodies thus Figur'd, being let fall in the Air.

That it is in theſe *Cylinders*, that the Arches which touch the *Halo*'s above or below, are formed; ſuch as there were in the *Phænomenon* obſerv'd at *Rome A.* 1630. which is deſcribed by *P. Schenir* in a Letter to M. *Gaſſendus*, as alſo in all thoſe which M. *Hevelius* had related at the End of his *Mercurius in Sole.*

And that the *Arch*, which appeared upon the laſt *Halo* at *Paris*, *A.* 1667. was of the ſame kind. That the Figure of theſe *Arches* is different according to the different Altitudes of the *Sun*, and the ſeveral Magnitudes of the Diameters of the *Halo*'s.

That when the *Sun* is very nigh the *Horizon*, ſuch an *Arch*, appearing upon ordinary *Halo* of 44 *Degrees*, muſt repreſent as 'twere two *Horns*, as in *Fig.* 38. *AB*, *AC*: But that the *Sun* Riſing higher, thoſe *Horns* become lower in Proportion, and make ſuch Arches as are repreſented in the ſame *Fig.* where each Height of the *Sun* is mark'd near the *Arch*, which it is to make.

Fig. 38.

That the place of the *Arches* where they touch the *Halo*'s, being more ſtrongly enlightned and coloured than the reſt, maketh us judge that there are *Parhelia* in thoſe Places. That the Reaſon, why theſe *Arches* do ordinarily touch a *Parhelion*, was, that the ſame *Cylinders Couchant*, which produce the *Arch*, produce alſo that *Parhelion*, by the means of their two round and Tranſparent Ends, in the ſame manner as hath been ſaid of the *Perpendicular Cylinders*. And that the *Parhelion* laſt ſeen at *Paris*, had been formed in theſe *Couchant Cylinders*. That that was alſo confirmed, by Reaſon that it was Brighter in the Superior and Inferior part, than any where elſe; which neceſſarily comes to paſs in a *Parhelion* cauſed by *Cylinders* thus diſpoſed, whereas when produced by the *Round Grains*, it muſt appear every where equally ſtrong.

That in theſe ſame *Cylinders Parallel* to the *Horizon*, there is alſo found the Cauſe of the *White Croſs*, obſerv'd together with the *Paraſelene*'s, or *Mock-moons*, by M. *Hevelius*, and exhibited at the End of his *Mercurius in Sole*: the Perpendicular Fillet of that *Croſs*, coming from the Reflection of the Rays of the *Moon* upon the Surface of theſe *Cylinders*; as the other Fillet, Parallel to the *Horizon*, is produced by the Reflection of the *Perpendicular Cylinders* which make the great White Circle, of which this Fillet is a part. That yet the *Moon* muſt not be very High above the *Horizon*, to the End that the *Couching Cylinders* may produce this Effect: And that it ſhould be well heeded, when the like *Meteor* ſhall appear, whether the Perpendicular Fillet be not narrower where it paſſeth through the *Moon*, than in other places, and eſpecially upwards, where it muſt grow larger and diſappear. That beſides the *Perpendicular Cylinders*, and thoſe that are *Couched Parallel* to the *Horizon*, there are often a great many, which move to and fro in the Air, in all ſorts of Poſitions; and that thoſe, by the ſame Reaſon that the *Round Grains* do, muſt produce an *Halo* about the *Sun*, and even a more Vivid one than that which is cauſed by the *Grains*, for as much as each *Cylinder* ſends many more Rays to the Eye, than each of theſe little *Spheres*. That the little *Halo DEF*, in the *Roman* Phænomenon (*Fig.* 37.) may very well have been cauſed by ſuch *Cylinders*.

Fig. 37.

As

As to those *Mock-suns*, which sometimes show themselves directly opposite to the *True-Sun*, (such an one as was published by M. *Hevelius*, and Obsery'd *Feb.* 23. 1661,) that he could find nothing, neither in the *Round Grains* nor in the *Cylinders*, which should make these *Suns* necessarily to meet in the great white *Circle*, Parallel to the *Horizon*, and that, if that should be always verified by future Observations, the Cause of it must be look'd for elsewhere: But that in the mean time he did believe, that that happened not but by Chance; which being so, a Reason might be given of these *Suns* by the same supposition, which served also for the *Anthelion*, Observed by M. *Hevelius*. *Sept.* 6. 1661; in which there were two *Coloured Arches* of a *Circle*, opposite to the *Sun*, which did intersect one another, their Intersection being the place of the *False Sun*. Which although it be represented in the Figure of *Hevelius* at the same Height with the *True Sun*, yet it was in truth higher by 15 *Degrees* or more; as he hath acknowleged himself afterwards: So that, if there had been a great *White Circle* in this *Phænomenon*, the *Parhelion* was not at all to have been in it.

That for the Generation of these *Suns*, he did suppose a Number of small *Cylinders* with *Opaque Kernels*, as the precedent; which were carried in the Air, neither Perpendicularly, nor Couching, but inclined to the Plane of the *Horizon* at a certain Angle, being near a half Right one; to which were particularly appropriated those *Cylinders*, which M. *Des Cartes* saw fall from the Heavens, having *Stars* at both Ends: As may be seen Experimentally, by forming *Cylinders* of that Fashion, which is represented in *Fig.* 39. and letting them Descend in the Air, or in Water. That in these *Cylinders* was found, following the *Calculus* to be given in another Treatise of *Parhelia*'s, not only the Cause of the *Anthelia* made by the Intersection of two *Arches*, as in *Fig.* 40. but also that of some other Extraordinary *Arches* and *Rods*, that are sometimes Observed near the *Sun*; of which notwithstanding there could nothing be as yet affirmed with certainty, for want of exact and faithful Observations.

Fig. 39.

Fig. 40.

To make all these different Effects of the *Cylinders* manifest to the Eye, M. *Hugens* produced one of Glass, a Foot long, of the Shape of that in *Fig.* 36. and for the *Kernel Opaque* in the middle a Cylinder of Wood, and the Ambient space filled with Water instead of transparent Ice: Which *Cylinder* being exposed to the *Sun*, and the Eye put in such places as was requisite, there were successively seen all those Reflections and Refractions, that have been discoursed of. Whence it might be concluded, that a great Number of the like *Cylinders*, although very small in Comparison to that, being found in the Air, and having the several Postures that have been supposed, all the Appearances of the *Parhelia* and their *Circles* must exactly follow.

Fig. 36.

It was wished, for an entire Confirmation of the truth of this *Hypothesis*, that some of those small *Cylinders* could be observed to fall to the Ground, at the time when any *Parhelia* do appear: Which yet he showed could not easily be done, because that the Vapours, which then Rise from the Earth upwards, and which are the Cause of their *Cylindrical* Figure, keep them also suspended in the Air. He added, that it was not to be thought strange, that such small *Grains* of *Hail* were thus kept in the Air by the Vapours, for as much

much as these, by being Rarified and Dilated upwards, might have Motion enough for this Effect; And that that was much more easy to conceive, than to imagine how these same Vapours could keep suspended a very great and weighty *Circle* of *Ice*, such as M. *Des Cartes* supposeth to explicate the Cause of *Parhelia*'s, and of the great *White Circle* of the *Roman Phænomenon*.

Optical Assertions concerning the Rainbow; *by M.* Fr. Linus. n. 117. p. 386.

LXVIII. 1. Minima quævis Pluviæ Guttula, Radiis *Solaribus* illustrata, mittit ex se *Iridem* perfectam, non solùm quoad ipsos *Colores*, sed etiam quoad eorum Ordinem, Situm, ac Figuram Circularem, ei quam in Cœlo videmus simillimam.

2. Radii enim *Solares* Guttulam subintrantes, indeque post duas Refractiones & unam Reflectionem, iterum versùs *Solem* redeuntes, erumpunt è Guttula *Colorati*, iisdemque plane *Coloribus*, quos in *Iride* videmus, *Rubro*, *Flavo*, *Viridi*, *Cæruleo* & *Purpureo* imbuti.

3. Hi Radii sic *Colorati*, dum Pluvioso Cœlo à variis Guttulis *Sole* illustratis in Oculum transmittuntur, Visionem, quam de *Iride* habemus, efficiunt.

4. Dantur autem inqualibet Guttula duo *Annuli*, Major & Minor distinctis *Coloribus Irialibus* imbuti; quorum Minor distat ab Axe seu Radio transeunte per Centrum Guttulæ, *Gradibus* circiter 21; Major autem ab eodem Axe distat *Gr.* 78. Radii autem Incidentes in Minorem *Annulum*, inde resiliunt in Majorem; è quo erumpentes in Aerem, dictis *Coloribus Irialibus* imbuuntur.

5. Oriuntur igitur hi *Colores* a Radiis *Solaribus*; sed non ab iis solis (uti hactenus existimatum) sed etiam à Radiis ipsius Aeris, Corpus *Solare* ambientis.

6. Sed neque oriuntur hi *Colores* ab omnibus iis Radiis, sive *Solaribus* sive Aëriis, qui Guttulam subintrant; sed ab iis solummodò, qui emittuntur ab ipso Limbo *Solari* Aereque ei vicino.

7. Quin & ii Radii, qui sic a Limbo *Solari Aereque* vicino in Guttulam transmittuntur, non omnes spectant ad dictos *Colores*, nec erumpunt *Colorati*; sed illi duntaxat, quorum Angulus Incidentiæ nec minor est *Gradibus* 45, nec major *Gradibus* 75.

8. A Limbo itaque *Solari*, vicinoque *Aere* procedunt *Colores Iriales*, non tamen omnes quinque immediatè inde fluunt; sed quatuor duntaxat, nempe *Ruber*, *Flavus*, *Cæruleus* & *Pupureus*: *Viridis* enim oritur ex Radiis *Flavis* & *Cæruleis* inter se permixtis.

9. Oriuntur igitur hi quatuor *Colores* à dicto Limbo; non tamen omnes ab una eademque ejus parte: Sed duo ex iis ab una parte Limbi, & alii duo ab alia ei directè opposita; *v. g.* à Limbo Superiore oriuntur *Cæruleus* & *Purpureus*, & ab Inferiore, *Ruber* & *Flavus*.

10. Causa autem, cur à Limbis adeo inter se similibus oriantur *Colores* tam Dissimiles, non alia hic apparet, quàm quod in uno Casu Limbus *Aerius* sit supra Limbum *Solarem*; & in alio Limbus *Solaris* sit supra *Aerium*. Hoc autem Discrimen videtur hîc sufficere, eò quòd Ratione illius Diversi Situs nunc

Radii

Radii *Solares* incurventur per Refractionem ſupra Radios *Aereos*; nunc è contra *Aerii* ſupra *Solares*.

11. Oriuntur itaque hi *Colores* per dictos Radios Refractos, ita tamen Refractos ut per eam Refractionem valdè inter ſe conſtipentur. Nam omnes Radii à *Gradu* 45. Uſque ad 60. ad Spatium unius *Gradus* in Minore *Annulo* contrahuntur: In quod etiam tam Anguſtum Spatium confluunt, per Retrogradationem, Radii omnes à *Gradu* 60. ad 75.

12. Quando plures Homines ſimul vident *Iridem*, tot videntur *Irides*, quot ſunt Homines videntes.

13. Qui intuetur *Iridem*, videt Singulis Momentis aliam & aliam.

The Colours and Diameter of the Rainbow, *from the given* Proportional *of* Refraction: *And the* Contrary; *by Mr.* Ed. Halley. n. 267. p. 714.

LXIX. *Iridis* Phænomena attentè reſpicientibus ſemper conſtabat, *Solis* Radios à Nube Aquoſa Reflexos, ſub certo quodam *Angulo* in oculum incurrere; unde forma ejus *Arcuata: Colorum* autem Cauſa, ut etiam magnitudinis *Anguli* iſtius, quo conſtanter ab oppoſito *Solis Iridem* diſtare deprehendimus, tam Modernos quam Veteres diu multumque torſit: Nec quicquam profecêre, uſque dum præclarus ille *Carteſius*, in auxilium collatis *Mathematicis* Diſciplinis, ſpeculationes has Phyſicas ſtrictiori argumentandi Methodo tractari poſſe ac debere, pluribus Exemplis edocuit; Inter alia vero *Iridis* Theoriam expoſuit. Ex *Hujus* Demonſtratis conſtat, *Iridem Primariam* à talibus *Solis* Radiis produci, ubi *Exceſſus* duorum *Angulorum Refractorum* ſupra unicum *Incidentiæ Angulum* omnium poſſibilium fuerit *Maximus*: *Secundariam* vero *Iridem* formari ab iis Radiis tantum, ubi exceſſus trium *Angulorum Refractorum* ſupra unum *Incidentiæ Angulum* ſimiliter ſit omnium *Maximus*. Ac pergere licet ad Tertiam, Quartamve, vel quamvis aliam *Iridem*, quæ fiunt ubi Radii, poſt Tres, Quatuorve, vel plures Reflectiones è Guttulis emergunt. In omnibus autem his Regula eſt Generalis, ut Exceſſus Quatuor vel Quinque vel plurium *Angulorum Refractorum* (numero: *Scil. Reflexionum* unitate aucto) ſupra unum *Incidentiæ Angulum* ſit omnium Maximus. Exceſſus autem iſte *Maximus* Duplicatus ubique eſt diſtantia *Iridis* ab Oppoſito *Solis*, ubi numerus *Reflectionum* impar eſt: Si vero par ſit iſte Numerus, duplum *Anguli* iſtius *Maximi* ſit diſtantia *Iridis* a *Sole* ipſo.

Ut autem habeantur Exceſſus iſti *Maximi*, data Liquoris alicujus *Refractione*, ſive Ratione Sinus *Anguli Incidentiæ* ad Sinum *Anguli Refracti*, obſervandum eſt, *Exceſſum* duorum *Angulorum Refractorum* ſupra unum *Incidentiæ Angulum*, *Maximum* fieri ubi Augmentum Momentaneum *Anguli Incidentiæ* præciſe duplum eſt Augmenti Momentanei *Anguli Refracti*: Trium vero *Angulorum Refractorum Exceſſum Maximum* eſſe, ubi Augmentum Momentaneum *Anguli Incidentiæ* Triplum eſt Momenti *Anguli Refracti*: & ſic de cæteris. Atque hoc per ſe ſatis evidens eſt: Angulos autem ipſos obtinebimus præmiſſo *Lemmate* ſequente, quod Demonſtrare oportet.

Lemma. *Manentibus Cruribus Trianguli cujuſvis Plani, ſi augeatur vel minuatur Augulus Verticalis Angulo quovis dato minore, erunt Momenta ſive Mutationes inſtantaneæ Angulorum ad Baſin inter ſe reciprocè ut Segmenta Baſis*

Fig. 41. Sit *ABC*, Triangulum cujus Vertex *A*, Crura *AB*, *AC*, & Baſis *BC*, in quam demittatur Perpendiculum *AD*: Dein augeatur Angulus *BAC*, Momento aliquo indiviſibili *CAc*, ac ducantur lineæ *Bcd*, *cD*, quæ non niſi intellectu differunt à lineis *BCD*, *CD*. Dico Momentum Anguli *ABC*, nempe *CBc*, eſſe ad Momentum Anguli *ACB*, vel *ACD*, ut *CD*, ad *BD*, hoc eſt reciprocè ut Segmenta Baſis. Cum enim Angulus *ACD*, ſit ſumma Angulorum *ABC*, *BAC*, Momentum ejus erit etiam ſumma Momentorum iſtorum Angulorum, ſive *CAc* + *CBc*; ſed *CAc*, æqualis eſt Angulo *CDc*, quoniam, ab Angulum Rectum ad *D*, puncta *A*, *D*, *C*, *c*, ſunt in Arcu Circuli cujus Diameter eſt *AC*: per *Euclid*: 3. 9. ac proinde ſumma Angulorum *CBc*, *CDc*, hoc eſt Angulus *Dcd*, erit Momentum Anguli *ACD*, vel *ACB*; Anguli autem iſti *CBc*, *Dcd*, cum Minimi ſint, ſunt inter ſe ut latera ſibi oppoſita, ſive ut *ccD* vel *CD*, ad *BD*, hoc eſt, ut Segmenta Baſis reciproce. *Q. E. D.* Quod ſi Angulus uterque *B*, & *C*, fuerit acutus, eodem modo demonſtrabitur *Lemma* mutatis mutandis.

Corol. Hinc conſequitur Momenta Angulorum ad Baſin eſſe inter ſe, ut ſunt Tangentes Angulorum ipſorum directè.

Hoc *Lemmate* muniti facili negotio cujuſvis *Iridis Diametrum*, vel Conſtructione Geometrica vel Calculo, obtinere licet. Expoſita enim Linea quavis rectâ *CA*, dividatur primum in *D*, ita ut *CA*, ſit ad *CD* in Ratione *Refractionis*, quæ in Aqua fit, ut 250 ad 187, ſive accuratius ut 529 ad 396. Deinde dividatur *CA*, in *E*, ita ut *CE*, ſit ad *AE*, ut Unitas ad Numerum *Reflexionum* quas patitur Radius *Solis*, ad *Iridem* propoſitam producendam idoneus; ac Diametro *AE*, deſcribatur Semicirculus *ABE*, ac Centro *C*, Radio *CD*, duc Arcum *BD*, Semicirculo *ABE*, in puncto *B*, occurrentem. Ductis denique Rectis *CB*, *AB*, demittatur in *AB* productam perpendicularis *CF*, eique parallela *EB*; Dico Angulum *CBF*, eſſe *Angulum Incidentiæ*, ac Angulum *CAB*, eſſe *Angulum Refractum*, quos quærimus, quique producent *Iridem* propoſitam.

Fig. 42.

Demonſtratio. Cum Triangula *ACF*, *AEB*, ſint ſimilia, erit *AF*, ad *BF*, ut *AC*, ad *EC*, hoc eſt ut Numerus *Reflexionum* Unitate auctus, ad Unitatem, per *Conſtructionem*; ac proinde Momentum Anguli *CBF*, erit ad Momentum Anguli *CAF*, in eadem ratione, per *Lemma præcedens*. Sed Sinus Anguli, *CBF*, eſt ad Sinum Anguli *CAF*, in ratione Laterum *CA*, *CB*, hoc eſt in ratione *Refractionis* datæ; etiam per *Conſtructionem*. Angulus itaque *incidentiæ CBF*, habet *Angulum Refractum*, ſibi reſpondentem *CAF*, eorumque Momenta ſunt in ratione propoſita, quocirca ſunt Anguli quæſiti. *Q. E. D.* Jamque Multiplicando Angulum *Refractum* per Numerum *Reflexionum* Unitate auctum, & è Facto Subducendo Angulum *Incidentiæ*, habebitur Semiſſis *Diſtantiæ Iridis* a *Sole*, ſi Numerus *Reflexionum* fuerit par, vel à *Solis Oppoſito* ſi fuerit impar; prout jam diximus.

Hinc Conſtructione ſatis concinnâ nec ineleganti, omnium ordine *Iridum* Incidentias Synopticè exhibere poſſumus, in quolibet Liquore cujus *Refractio* cognita eſt. Si enim Linea expoſita *AC*, dividatur Bifariam in *E*, Trifariam in *e*, Quadrifariam in ε, ac Quinquifariam in ϰ, *&c.* ac Diametris *AE*, *Ae*, *Aε*, *Aϰ*, deſcribantur Semicirculi *ABE*, *Abe*, *Aβε*, *Aγϰ*, Quibus omnibus

bus occurat Arcus Circularis $D\,B\,b\,\beta\,v$ Centro C, Radio $C\,D$, descriptus (qui sit ad $A\,C$, in ratione *Refractionis* data) in punctis B, b, β, v; dico quod ductæ lineæ $A\,B$, $A\,b$, $A\,\beta$, $A\,v$, constituent cum linea $A\,C$ Angulos $C\,A\,B$, $C\,A\,b$, $C\,A\,\beta$, $C\,A\,v$, æquales *Angulis Refractis*, ac cum Radiis $C\,B$, $C\,b$, $C\,\beta$, $C\,v$, respective, Angulos æquales *Angulis Incidentiæ* requisitis, nempe $A\,B\,C$, vel potius ejus complementum ad Semicirculum, pro *Primaria Iride*; $A\,b\,C$, pro *Secundaria*; $A\,\beta\,C$, pro *Tertia*, ac $A\,v\,C$, pro Quarta: & sic deinceps.

Quod si cui Calculo accurato hos Angulos investigare libeat, ex eodem fonte facile eruet Lector *Analysta*, *quod posito* Radio = 1, ac Ratione *Refractionis ut r*, ad *s*, Sinus *Incidentiæ* erit $\sqrt{\frac{4}{3}\frac{1}{3}\frac{rr}{ss}}$; Sinus vero *Anguli Refracti* $\sqrt{\frac{4}{3}\frac{ss}{rr}\frac{1}{3}}$ a quibus Angulis provenit *Iris Primaria*. Pro *Secundaria* vero $\sqrt{\frac{9}{8}\frac{1}{8}\frac{rr}{ss}}$ erit Sinus *Incidentiæ*, ac Sinus *Anguli Refracti* $\sqrt{\frac{9}{8}\frac{ss}{rr}\frac{1}{8}}$. Pro *Tertia*, Sinus *Incidentiæ* erit $\sqrt{\frac{16}{15}\frac{1}{15}\frac{rr}{ss}}$, Sinus *Refracti Anguli* $\sqrt{\frac{16}{15}\frac{ss}{rr}\frac{1}{15}}$ Radii autem Lucis in *Iridem Quartam* Emergentes in guttulas *Incidunt* cum *Angulo cujus* Sinus est $\sqrt{\frac{25}{24}\frac{1}{24}\frac{rr}{ss}}$: Angulus autem *Refractus* Sinum habet $\sqrt{\frac{25}{24}\frac{ss}{rr}\frac{1}{24}}$. & sic de cæteris. Invenies autem susceptо Calculo, admissâ Ratione *Cartesiana*, *Iridem Primariam* distare ab Opposito *Solis* 41°. 30′; *Secundariam* 51°. 55′. ab eodem Opposito; *Tertiam* vero 40°. 20′; ac *Quartam* 45°. 33′. ab ipso *Sole*; quas nescio an unquam aliquis videre possit ob Lumen *Solis* in singulis *Reflexionibus* ac *Refractionibus* magis magisq; attenuatum. Atq; hæc de *Magnitudine Iridum* in Guttulis perspicuis Fluidi, cujus Vires *Refractivæ* innotescant, dicta sunto. Restat ut nonnulla adjiciam de *Coloribus* quibus pinguntur *Irides* eorumque ordine in singulis, variatâ scilicet *Refractione* per omnes Gradus possibiles.

Sciendum autem in primis, *Lumen* omne generis *Cærulei* paulo plus *Refringi* quam Lumen quodvis *Rubens*, à quâ differentiâ oritur Latitudo *Iridum*, observatione quidem ægrè definienda, ob incertos *Colorum* in Nube limites. Quo autem majoris est inæqualitatis Ratio inter $C\,A$, & $C\,D$, sive quo major est *Refractio*, eo major provenit Distantia *Iridis* cujusvis a *Sole*, adeoque semper *Iridum* limites a *Sole* remotiores *Purpureo Colore* fulgent, propiores vero spissè *Rubent*: Uti semper videre est in *Iride Primaria*, quæ quidem evanescit in *Opposito Solis*, sic Sinus *Incidentiæ* fuerit ad Sinum *Anguli Refracti* sicut $C\,A$, ad $C\,E$, sive ut 2, ad 1. Quod si major fuerit Ratio illa, nulla omnino conspici potest *Iris Primaria*. *Vid. Sup.* Vol. I. *Cap.* III. §. I.

Secundariam autem *Iridem* notandum est in *Opposito Solis* in punctum abire, quoties Ratio *Refractionis* fuerit ut 1, ad 0, 847487... Inde vero ad *Solem* ipsum recurrere, ibique evanescere, si dicta Ratio fuerit ut 3 ad 1, sive ut $C\,A$, ad $C\,e$. Intermediis vero Rationibus (quales habentur in omnibus Fluidis notis, Aere excepto) quo major est Ratio eo plus distat *Iris* ab *Opposito Solis*, vel potius a *Sole* ipso, numerato ultra Semicirculum Arcu: ac proinde *Colores* diverso à *Primariâ* ordine reperiri videbuntur, in his recursibus, nisi hoc in sensu sumatur distantia *Iridum* à *Sole*: quod quidem ubique in cæteris observandum.

Tertia Iris in *Opposito Solis* confunditur, existente Ratione *Refractionis* ut 1 ad 0,91855... Indeque ad *Solem* recurrit in Ratione 1, ad 0,6825... Unde iterum,

iterum, reſtituto *Colorum* ordine, in Ratione 4, ad 1, ſive ut *C A*, ad *C e*, deſinit in *Solis Oppoſito*. *Iris* autem *Quarta* a *Sole* incipiens in Ratione æqualitatis, ad *Oppoſitum* ejus tranſit in Ratione 1, ad 0,94895... indeque ad *Solem* regreditur, ſi Ratio fuerit ut 5, ad 4. Hinc iterum ſpargitur ad *Solis Oppoſitum* in Ratione 1, ad 0,56337... : quo ſpatio clauduntur omnium Fluidorum *Refractiones* notæ. Denique Ratione exiſtente ut 5, ad 1, ſive ut *C A*, ad *C n* in ipſo *Sole* evaneſcit. *Coloribus* ubique quo ad viſum inverſis in regreſſu ad *Solem*, uti rectis in Egreſſu.

Hinc in Nimbis Aqueis, *Primaria* ac *Quarta Iris Coccineos Colores Soli* objiciunt, *Secundaria* vero ac *Tertia Purpureos*.

Unde autem oriatur diverſa Fluidorum *Vis Refractiva*, non levis momenti Problema eſt, interque Arcana Naturæ nondum ſenſibus nec Ratiociniis noſtris objecta meritò cenſendum: *Aqua* ebonim Pura, inter Fluida omnium minimè Radios Lucis *Refringit*; ac Salibus quibuſvis ſolutis imbuta, ſecundum quantitatem Salis Ponduſque ſuum, auget *Refractiones*: ac *Spiritus Corroſivi* Aqua multo graviores, etiam Radios Lucis multo plus *Detorquent*; nec mirum cum Corpora Denſiora ſint, eoque magis Luminis tranſitus obſtruere concipi poſſunt: Cur autem in *Spiritibus Ardentibus* aut *Oleis* quibuſvis reperiatnr tanta *Refractio*, preſertim in *Sp. Terebinthinæ* aut *Vini* cum Fluida ſint reſpectu *Aquæ* admodum Levia, ac particulis æthereis plurimum Conſtantia pari argumento non patet; Sed Luminis ac Materiæ ipſius interiorem cognitionem poſtulare videtur.

Ex data autem *Iridis* a *Sole* diſtantia *Refractionis* Rationem eruere, Curioſis Anſam præbet obſervandi accuratiſſime ac parvo negotio cujuſvis Fluidi *Refractionem*: Si enim ab inferiori parte exilis Cannulæ Vitreæ dependeat Guttula alicujus Fluidi perſpicui, ac *Sole* prope Horizontem conſtituto ſed fortiter ſplendente, obſervetur ſub quo Angulo cum *Oppoſito Solis* in Guttula conſpiciantur *Iridis Colores*, habebitur levi Calculo Ratio quæſita: *Cubica* autem eſt *æquatio*, unica Radice explicabilis, quâ ex datâ *Iride Primaria* ſupputatur Ratio: nempe $T^3 - 3TTt \ldots 4rrt = 0$, ubi T, eſt Tangens *Anguli Incidentiæ* requiſitæ; t autem, Tangens ſemiſſis diſtantiæ *Iridis* ab *Oppoſito Solis* ad Radium $r = 1$: Unde juxta *Cardani* Regulas, provenit *Theorema*. viz. *De Cubo ipſius t, Subducatur Productum ex* 2 t r *in exceſſum Secantis ejuſdem arcus ſupra Radium*: *Differentia erit Cubus minor. Eorundem autem ſumma, adjectis* 4 t r r *erit Cubus major. Summa Laterum utriuſque Cubi atque ipſius* t *æquabitur Tangenti Anguli* Incidentiæ, *ejuſque ſemis erit etiam Tangens* Anguli Refracti unde conſtat Ratio quam quærimus.

Hujus rei cape Exemplum. In Guttula *Olei Terebinthinæ* obſervatur diſtantia *Iridis Primariæ* ab *Oppoſito Solis*. 25°. 40′ quæritur Ratio *Refractionis*.

t = *Tang*. 12°. 50′. = 0,2278063
s = *Secant. ejuſdem* = 1,0256197

ttt = 0,01182217
$s - r$ in $2tr$ = 0,01167265

Diff.

Diff. Cubus minor. 0,00014952. $\sqrt[3]{}$ 0,0530773

Summa 0,02349482

$4trr$ 0,91122525

Cubus major 0,93472007 $\sqrt[3]{}$ 0,9777486

t 0,2278063

T = Tang. *Incid.* 51°. 32′ 1,2586322

$\frac{1}{2}T$ = Tang. *Refr.* 52. 11. 0,6293161

Denique ut $\sqrt{TT+4}$, ad $\sqrt{TT+1}$ :: ita r, ad s :: ita 1, ad 0,68026. Quæ quidem Ratio proxime accedit ad illam, quam in *Vitro* ac plurimis Solidis pellucidis Experimento ineſſe conſtat: *Adamas* autem non tantum Duritie ac pretio Diaphana omnia præcellit, ſed etiam hac *Vi Refractivâ*, cum ſit Ratio ejus ut 5, ad 2, proxime, vel rectius ut 100 ad 41. Sed de his fortaſſe ſuo loco uberius.

Dum in his ſcribendis occupatus tenerer, meo hortatu peritiſſimus Geometra, *Dominus de Moivre* ſimilem *æquationem* pro inveſtiganda Ratione è data *Iridis Secundariæ* Semidiametro inquiſivit: qua quidem paulo accuratius determinatur Ratio, ſed cum Biquadratica ſit, pari facilitate Calculus non abſolvitur: Hæc autem eſt $T^4 + \frac{2}{3}T^3t - 2TTrr - \frac{1}{3}r^4 = 0$. Ubi T, eſt Tangens *Anguli Refracti*; t, Tangens ſemiſſis diſtantiæ *Iridis* ab *Oppoſito Solis* ad Radium $r = i$. Hæc autem *Æquatio* ejus formæ eſt, ut ſemper Affirmativa unâ ac unâ Negativa Radice explicari poſſit, quarum altera ac Minor eſt Tangens *Anguli Refracti* in Regreſſu ad *Solem*, *viz.* cum *Purpurei Colores Soli* propiores ſunt. Major autem Radix eſt Tangens *Anguli Refracti*, in *Iride* à *Sole* egrediente, ut ſupra obſervavimus; nempe in Fluido minoris Rationis. In *Oleo Terebinthinæ* obſervatur diſtantia hujus *Iridis* ab *Oppoſito Solis* 81°. 30′; unde eruere poteſt Lector Curioſus Radices 0, 80822.. ac — 2, 98131.. Tangentes *Angulorum Refractorum*; hinc ſupputatur Ratio majoris inæqualitatis ut 1, ad 0,67995.. qualis eſt in *Oleo Terebinthinæ*: A Majori autem Radice provenit Ratio minor, ut *i*, ad 0,9540.. proxime, quanta daretur in Fluido *Iridem Secundariam* ejuſdem Diametri exhibente, ſed quæ *Rubentibus Coloribus* more *Primariæ Solem* reſpiceret.

LXX. *A.* 1679. in *Maio*, juxta Civitatem *Jounkoping* in colle quodam altiori, cui ad ſpatium quadrantis Milliaris ſubjacet Lacus aqua dulci *Wetter* dictus, in cujus Superficie tum placidiſſima, nulla Ventorum Vi agitata, repræſentabatur mihi Inſula *Wiſingsburg*, in eo Lacu ſita, tam vividè, ut à peritiſſimo Pictore melius vix depingi poſſet; Feneſtras enim & Homines, cujus eſſent Sexus, diſcerni potui; cum tamen ipſa Inſula in aſpectum meum nondum pervenerat, propter interjacentes Colles, & diſtabat à me per tria Milliaria cum Quadrante ad minimum, ubi decem Milliaria *Suecica* conficiunt fere unum *Gradum*. Erat tum temporis Sol primum Ortus, & Oculus meus inter locum iſtum in Lacu, ubi hæc repreſentabantur, & Solem: ab hoc loco dum digrederer, nihil

A Strange Appearance *near* Upſal; *by Dr.* And. Spole. *Ph. Col.* n. 5. p. 146.

nihil tale in Lacu visum est; sicut & altera Die cum ad eundem Locum me contuli eodem tempore, tale quid non comparuit, neque Lacûs tanta *Halcyonia erat.*

An Unusual Meteor; by Dr. Wallis. n. 135. p. 863.

LXXI. *Sept.* 20. 1676. about 7 of the Clock at Night, or soon after, there appeared a sudden *Light*, equal to that of Noon-day; so that the smallest Pin or Straw might be seen lying on the Ground. And above in the Air, was seen (at no great distance as was supposed) a long appearance as of *Fire*; like a long Arm (for so it was described to me) with a great Knob at the end of it; shooting along very swiftly: And at its disappearing, seem'd to break into small Sparks or Parcels of *Fire*, like as *Rockets* and such *Artificial Fire-works*, in the Air are wont to do. 'Twas so surprising, and of so short continuance, that it was scarce seen by any who did not then happen to be abroad. I am told, by some, that it scarce continued longer than while one might tell 15 or 20 at the most; which will be less than half a *Minute*. All this might happen well enough from some *Fiery Meteor* in our Air; as a *Draco Volans* (as some have been pleased to call this) or the like. But that which makes it to me the more surprising, is this; that I find the same to have been seen in most Parts of *England*, and at or near the same time: As, not only at *Oxford* and in *Oxfordshire*, but also in *Northamptonshire*, *Glouceſtershire*, *Worceſtershire*, *Somersetshire*, *Devonshire*, *Hampshire*, *Sussex*, *Surrey*, *Kent*, *Essex*, and (particularly) by the Watermen on the *Thames*, in their passage between *Graves-end* and *London*.

This is a great breadth of Ground, and too much for any Ordinary *Meteor* in our lower Region of the Air, to be seen in at once; Which Argues, that either it was *Higher* than it was imagined to be (though the *Light* of it reached the Earth,) or else, that it had a very *Swift Motion*. This made me then conjecture that it might be some small *Comet*, whose *Linea Trajectoria* passed very near our Earth, or upon it: And might, when further distant from us, appear as a *Comet*. And that *Comet* which hath since appeared in *April* and *May* confirms me in the same opinion; which I conjecture may be the very same which passed by us in *September* last. Why it was not sooner seen, I cannot tell; save what is the common fate of most *Comets*, that they are seldom observed till after their neareſt distance from us: And, perhaps, it may have been so near the *Sun* (as to its visible place) as not to be much above our *Horizon* save in the day time. And for the like reason it may be, that in *September* last, when it passed by us, it was not more seen abroad in other Parts; it might pass them in the day time, being but in the Twy-light with us; and, had it been one hour sooner, the Daylight would have hindred us from seeing it. Which way its motion was when near us, I cannot conclude, so as to satisfie my self. For most that saw it, being suddenly surprised, took little more notice of it, than that it suddenly appeared, and was suddenly gone, but saw it so little time as scarce to mark which way. By the account I had from one in *Northamptonshire* (between *Brackly* and *Banbury*) it should seem to have moved there towards the South-west. By the account I had from one who saw it in *Hampshire* (between *Winchester* and *Southampton*) it should seem to be

be towards the South-east; from others I have nothing of certainty, and therefore can conclude nothing. Its *Motion* might then seem to us the *Swifter*, if its proper *Motion* were then one way; and the *Earth*'s motion here, at the same time, contrary to it. And it is not impossible, that its dashing against the Earth might disturb its *Motion*; as when Clouds, in their passage, meet with *Mountains*.

The Compression *of* Air, *under Water; by Mr.*..... n. 73. p. 2192.

LXXII. 1 Some Members of the *R. Society* did, with two different Sorts of *Instruments*, make divers Experiments for finding the Proportions of the *Compression* of *Air* under *Water*, in the Month of *July*, at *Sheerness*, in the Mouth of the River of *Medway*, at the time of High-Water, where the Depth was then about 19 *Fathom*, and the Proportion of the Weight of the *Salt-water* to that of the same Quantity of *Fresh water*, taken out of the River *Thames*, was as 41 to 42.

One of the *Instruments* was a Glass-Bottle, that held a Quart of Water, having a Brass Ring fastened to the Mouth of it, with a *Valve*, or Flap, that opened inward, so well fitted, that the Bottle being filled more or less with Water, none dropped out though forcibly shaken. This, let down 33. *Foot* into the Water, the Mouth downwards, and after a little stay drawn up, was found to be so very near *Half* full of Water, at several Tryals, that it was thought fit to *State* the *Compression* of Air at that Depth to that Measure.

The Quantity of *Compression* was known by *Weighing* the Bottle with the Water in it, after that a forcible *Depression* of the *Flap* had made way for the Eruption of the *Compress Air* (which kept it up even when the Bottle was placed with the Mouth upwards,) and then filling the Bottle full of the same Water, and weighing it again; and lastly, by weighing the Bottle after the Water was all let forth; the *Weight* whereof being deducted, the first Quantity of *Water* weighed just *Half* as much as the Second, or so near it that the Fraction was not considerable. Whence it was concluded, that the Quantity of the *Air*, that filled the Bottle before it was immersed in the Water, was at the *Depth* of 33 *Feet*, *Compressed* into *Half* the space it took up before, and so proportionably at other *Depths*.

The other *Instrument* was a Cylinder of Glass, some two foot long, close at one end, and having the other end drawn small with a Lamp, and turn'd down a little way, after the manner expressed in the *Figure*. This Cylinder was Immersed perpendicularly with the crooked end uppermost; by which, as it sunk in the Water, the *Pressure* thereof did gradually force in so much Water, as *Compress* the *Air* proportionable to every *Depth*; till the Cylinder was so far immersed, that the Hole of the crooked part of it was just 33 *Feet* under *Water*; and then it being drawn up, by *Measuring* from the bottom of the Cylinder to the height of the Hole in the crooked part, by a pair of Compasses, the *Water* was found to fill the Cylinder so near the Half, that, the Motion of the Superfice of the Water, and the minuteness of the difference being consider'd, it was thought fit to *State* it to just Half. Fig. 43.

According to these Experiments confirmed by Tryals at other Depths, the ensuing Table was computed.

The Proportion of the *Weight* of *Salt-Water* to that of *Freſh*, was found by *Weighing* ſome *Ounces* of both in a Bottle, whereof the Weight was exactly known, and which was made with ſo ſmall a Neck, that the Addition or Diminution of one ſingle drop in it was diſcernable.

n. 75 p. 2240. The *Table* is on theſe Grounds computed, upon the ſuppoſed Depths, from the Surface of the *Water* to the bottom of the *Air* included in a *Cylinder* of 60 inches, cloſed at one End and having the open End downward.

Depths in *Water*.		*Air Compreſt*, to	
Feet.	*Fathoms.*	*parts.*	*inches.*
00	00	1	60
1	0	$\frac{33}{34}$	$58\frac{4}{17}$
2	0	$\frac{33}{35}$	$56\frac{4}{7}$
3	$\frac{1}{2}$	$\frac{33}{36}$	55
4	0	$\frac{33}{37}$	$53\frac{19}{37}$
5	0	$\frac{33}{38}$	$52\frac{2}{19}$
6	1	$\frac{33}{39}$	$50\frac{10}{13}$
7	0	$\frac{33}{40}$	$49\frac{1}{2}$
8	0	$\frac{33}{41}$	$48\frac{2}{41}$
$8\frac{1}{4}$	0	$\frac{4}{5}$	48
9	$1\frac{1}{2}$	$\frac{33}{42}$	$47\frac{1}{7}$
10	0	$\frac{33}{43}$	$46\frac{2}{43}$
11	0	$\frac{33}{44}$	45
12	2	$\frac{33}{45}$	44
13	0	$\frac{33}{46}$	$43\frac{1}{23}$
14	0	$\frac{33}{47}$	$42\frac{6}{47}$
15	$2\frac{1}{2}$	$\frac{33}{48}$	$41\frac{1}{5}$
16	0	$\frac{33}{49}$	$40\frac{20}{49}$
$16\frac{1}{2}$	0	$\frac{2}{3}$	40
17	0	$\frac{33}{50}$	$39\frac{3}{5}$
18	3	$\frac{33}{51}$	$38\frac{42}{51}$
19	0	$\frac{33}{52}$	$38\frac{1}{13}$
20	0	$\frac{33}{53}$	$37\frac{10}{53}$
21	$3\frac{1}{2}$	$\frac{33}{54}$	$36\frac{2}{3}$
22	0	$\frac{33}{55}$	36
23	0	$\frac{33}{56}$	$35\frac{5}{14}$
24	4	$\frac{33}{57}$	$34\frac{42}{57}$
25	0	$\frac{33}{58}$	$34\frac{4}{29}$
26	0	$\frac{33}{59}$	$33\frac{33}{59}$
27	$4\frac{1}{2}$	$\frac{33}{60}$	33
28	0	$\frac{33}{61}$	$32\frac{28}{61}$
29	0	$\frac{33}{62}$	$31\frac{26}{31}$
30	5	$\frac{33}{63}$	$31\frac{3}{21}$
31	0	$\frac{33}{64}$	$30\frac{15}{16}$

Depths in *Water*.		*Air Compreſt*, to	
Feet.	*Fathoms*	*parts.*	*inches.*
32	0	$\frac{33}{65}$	$30\frac{30}{65}$
33	$5\frac{1}{2}$	$\frac{1}{2}$	30
66	11	$\frac{1}{3}$	20
99	$16\frac{1}{2}$	$\frac{1}{4}$	15
132	22	$\frac{1}{5}$	12
165	$27\frac{1}{2}$	$\frac{1}{6}$	10
198	33	$\frac{1}{7}$	$8\frac{4}{7}$
231	$38\frac{1}{2}$	$\frac{1}{8}$	$7\frac{1}{2}$
264	44	$\frac{1}{9}$	$6\frac{4}{9}$
297	$49\frac{1}{2}$	$\frac{1}{10}$	6
330	55	$\frac{1}{11}$	$5\frac{8}{11}$
363	$60\frac{1}{2}$	$\frac{1}{12}$	5
396	66	$\frac{1}{13}$	$4\frac{8}{13}$
429	$71\frac{1}{2}$	$\frac{1}{14}$	$4\frac{2}{7}$
462	77	$\frac{1}{15}$	4
495	$82\frac{1}{2}$	$\frac{1}{16}$	$3\frac{3}{4}$
528	88	$\frac{1}{17}$	$3\frac{9}{17}$
561	$93\frac{1}{2}$	$\frac{1}{18}$	$3\frac{1}{3}$
594	99	$\frac{1}{19}$	$3\frac{3}{19}$
627	$104\frac{1}{2}$	$\frac{1}{20}$	3
660	110	$\frac{1}{21}$	$2\frac{6}{7}$
693	$115\frac{1}{2}$	$\frac{1}{22}$	$2\frac{8}{11}$
726	121	$\frac{1}{23}$	$2\frac{14}{23}$
759	$126\frac{1}{2}$	$\frac{1}{24}$	$2\frac{1}{2}$
792	132	$\frac{1}{25}$	$2\frac{2}{25}$
825	$137\frac{1}{2}$	$\frac{1}{26}$	$2\frac{4}{13}$
858	143	$\frac{1}{27}$	$2\frac{2}{9}$
891	$148\frac{1}{2}$	$\frac{1}{28}$	$2\frac{1}{7}$
924	154	$\frac{1}{29}$	$2\frac{2}{29}$
957	$159\frac{1}{2}$	$\frac{1}{30}$	2
990	165	$\frac{1}{31}$	$1\frac{29}{31}$
1023	$170\frac{1}{2}$	$\frac{1}{32}$	$1\frac{9}{16}$
1056	176	$\frac{1}{33}$	$1\frac{9}{11}$
1089	$181\frac{1}{2}$	$\frac{1}{34}$	$1\frac{13}{17}$

Depths in Water.		*Air Compreſt*, to	
Feet.	*Fathoms.*	*parts.*	*inches.*
1122	187	$\frac{1}{35}$	$1\frac{5}{7}$
1155	$192\frac{1}{2}$	$\frac{1}{36}$	$1\frac{2}{3}$
1188	198	$\frac{1}{37}$	$1\frac{23}{37}$
1221	$203\frac{1}{2}$	$\frac{1}{38}$	$1\frac{11}{19}$
1254	209	$\frac{1}{39}$	$1\frac{7}{13}$
1287	$214\frac{1}{2}$	$\frac{1}{40}$	$1\frac{1}{2}$
1320	220	$\frac{1}{41}$	$1\frac{19}{41}$
1353	$225\frac{1}{2}$	$\frac{1}{42}$	$1\frac{9}{7}$
1386	231	$\frac{1}{43}$	$1\frac{7}{43}$
1419	$236\frac{1}{2}$	$\frac{1}{44}$	$1\frac{4}{11}$
1452	242	$\frac{1}{45}$	$1\frac{1}{5}$
1485	$247\frac{1}{2}$	$\frac{1}{46}$	$1\frac{7}{23}$
1518	253	$\frac{1}{47}$	$1\frac{13}{47}$

Depths in Water.		*Air Compreſt*, to	
Feet	*Fathoms*	*parts*	*inches*
1551	$258\frac{1}{2}$	$\frac{1}{48}$	$1\frac{1}{4}$
1584	264	$\frac{1}{49}$	$1\frac{11}{49}$
1617	$269\frac{1}{2}$	$\frac{1}{50}$	$1\frac{1}{5}$
1650	275	$\frac{1}{51}$	$1\frac{9}{51}$
1683	$28\frac{1}{2}$	$\frac{1}{52}$	$1\frac{2}{13}$
1716	286	$\frac{1}{53}$	$1\frac{7}{53}$
1749	$291\frac{1}{2}$	$\frac{1}{54}$	$1\frac{1}{9}$
1782	297	$\frac{1}{55}$	$1\frac{1}{11}$
1815	$302\frac{1}{2}$	$\frac{1}{56}$	$1\frac{1}{14}$
1848	308	$\frac{1}{57}$	$1\frac{1}{19}$
1881	$313\frac{1}{2}$	$\frac{1}{58}$	$1\frac{4}{29}$
1914	319	$\frac{1}{59}$	$1\frac{1}{59}$
1947	$324\frac{1}{2}$	$\frac{1}{60}$	1

2. Let *E D*, repreſent the *Tube*. $=x$.

A B, the Diſtance of the upper part of the *Tube* from the Surface of the *Water*, above or under it $=b$.

The Calculation by M..... n. 75. p. 2239. Fig. 44.

F C, the *Depth* of the *Water* from its Surface to the Bottom of the *Air* within the *Tube* $=a$.

B C, that part of it, which remains fill'd with *Air*, within the *Water*.

C D, the reſt thereof which is full of *Water*.

And any two of the three firſt, x, b, and a, being given, the other is known; and conſequently the reſt alſo.

For, if by the Incumbent *Weight* of 33. *Feet Depth* in *Water*, the *Air* in the *Tube* is *Compreſt* into *Half* the ſpace it filled before, then the ſaid 33 *Feet Depth* of *Water* equals the *Weight*, or *Preſſure*, of the *Incumbent Air* on the Surface of the *Water*. Now, as the *Weight*, or *Preſſure*, of the *Air* on the Surface of the *Water*; is to the *Depth* of the *Water*, from the Surface thereof to the Bottom of the *Air* within the *Tube*: So is the *Length* of the *Tube* fill'd with *Air*, to the *Length* thereof fill'd with *Water*. That is, according to the ſaid *Experiments*, putting z for 33, or whatever, at other times or places, ſhall be found to be the *Weight*, or *Preſſure*, of the *Incumbent Air* on the Surface of the *Water*, (for it is not always the ſame exactly;) $z : a :: a \pm b : \frac{a^2 \pm ab}{z} = CD$.

And therefore $\frac{a^2 \pm ab + za \pm zb}{z} = x$.

Wherefore $\frac{z}{z+a} x - a = b$.

And $bb \mp zb + zz + zx \mp b - z = a$.

Therefore *a*, and *b*, being given, *x* is known by the *First Equation*; And *a* and *x*, being given, *b* is known by the *Second*; and *b* and *x* being given, *a* is known by the *third*.

The Horizontal Line *BFBAF*, is ſubſtituted for *GABEFb*, when the *Cloſe* end of the *Tube* is not even with the Surface of the *Water*, to avoid the Breach $cC = bB = \frac{1}{4r} b^2$, in the Length of the *Tube*.

Effects of the Varying Weight *of the* Atmoſphere *upon Bodies under* Water; *by Mr.* Rob. Boyle. n. 91. p. 5156.

LXXIII. I cauſed to be blown at the Flame of a Lamp three ſmall round *Glaſs-Bubbles*, about the bigneſs of Hazel-nuts, and furniſhed each of them with a ſhort and Slender *Stem*, by whoſe means they were ſo nicely *Poiſed* in *Water*, that a very ſmall *Change* of Weight would make them either Emerge, if they but lightly leaned on the Bottom of the Veſſel, or Sink, if they floated on the Top of the Water. This being done at a time when the *Atmoſphere* was of a convenient *Weight*, I put them in a wide-mouth'd Glaſs furniſh'd with common *Water*, and leaving them in a quiet place, where yet they were frequently in my Eye, and were ſuffer'd to continue many Weeks (or ſome Months,) I obſerved, as I expected, that ſometimes they would be at the *Top* of the *Water*, and remain there for divers Days, or perhaps Weeks; and ſometimes would fall to the *Bottom*, and after having continued there for ſome time (longer or ſhorter) they would again Emerge. And though ſometimes (eſpecially if I removed the Veſſel that contain'd them to a Southern Window,) they would riſe to the *Top* or fall to the *Bottom* of the *Water*, according as the *Air* was *Hot* or *Cold*; yet 'twas not difficult to diſtinguiſh theſe Motions from thoſe produced by the *Varying Gravity* of the *Atmoſphere*. For when the Beams of the Sun, or *Heat* of the Ambient *Air*, by raryfying the *Air* included in the *Bubbles*, made that *Air* drive out ſome of the *Water*, and conſequently made the whole *Bubble* (conſiſting of *Glaſs*, *Air* and *Water*) ſomewhat *Lighter* than a Bulk of *Water* equal to it, though the *Bubble* did neceſſarily Swim as long as the included *Air* was thus *Rarified*, yet when the Abſence of the Sun, or any other Cauſe made the *Air* loſe its Adventitious *Warmth*, there would enſue a *Condenſation* of the *Air* again, and thereupon an Intruſion of more *Water* (to ſucceed the *Air*) into the Glaſs, and conſequently a Sinking of the Bubble, and this would commonly happen at Night, if it did not happen ſooner. But when it was upon the account of the Varying *Weight* of the *Atmoſphere* that the Bubbles either Roſe or fell, it appeared by the *Baroſcope*, that the *Atmoſphere* was ſo *Heavie* or ſo *Light*, that they ought to do ſo. Inſomuch that I divers times predicted; whether I ſhould find the *Mercury* in the *Baroſcope* high or low, by obſerving the Situation and Poſture of the Bubbles; and conſulting that Inſtrument, it verified my Conjectures And though whilſt the *Atmoſphere* was not too conſiderably either *Light* or *Heavy*, the Changes of the *Air* as to *Heat* or *Cold*, would (as I was ſaying) place the Bubbles ſometimes at the Top and ſometimes at the Bottom of the Water, within the Compaſs of a Day; yet if the *Atmoſphere* were either very *Heavy* or very *Light*, the Bubbles would continue at the Bottom or at the Top of the *Water* for many Days together, in Caſe the *Atmoſphere* did not in all that time Change its *Gravity*. And I remember, that I did for Curioſity s ſake, when the *Quickſilver*

was

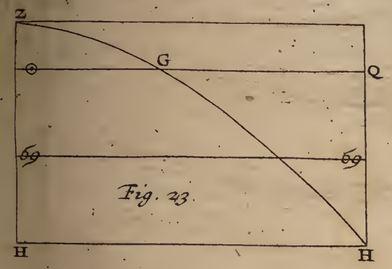
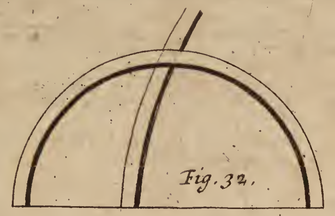


Fig. 23.


Fig. 26.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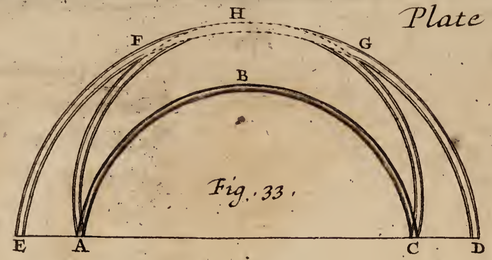

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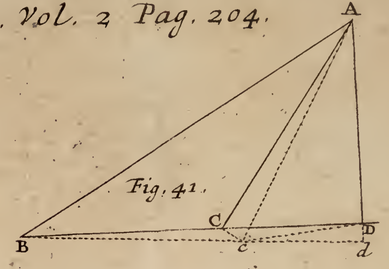


Fig. 41.

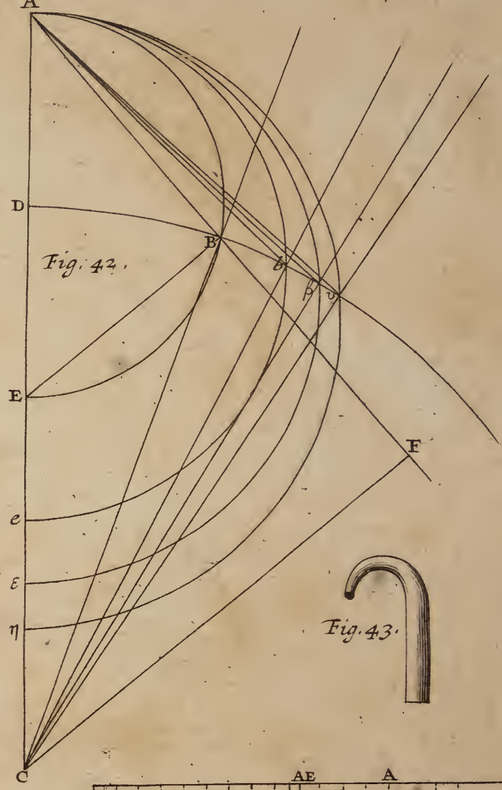
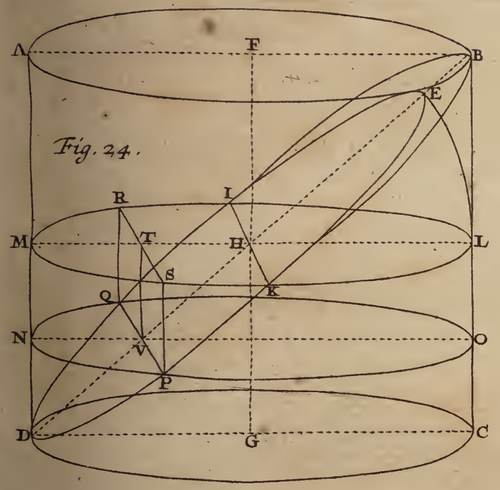


Fig. 42.

Fig. 43.



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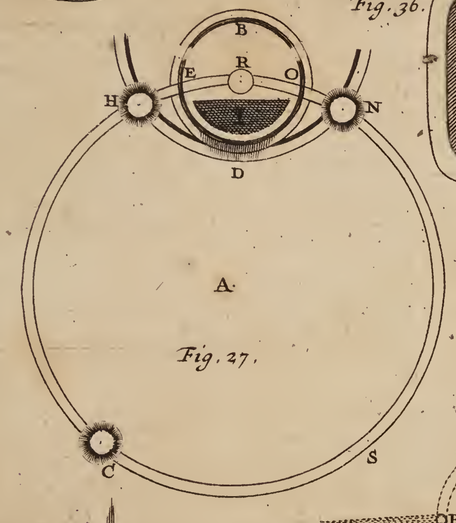


Fig. 27.

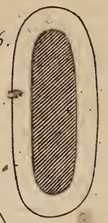


Fig. 36.

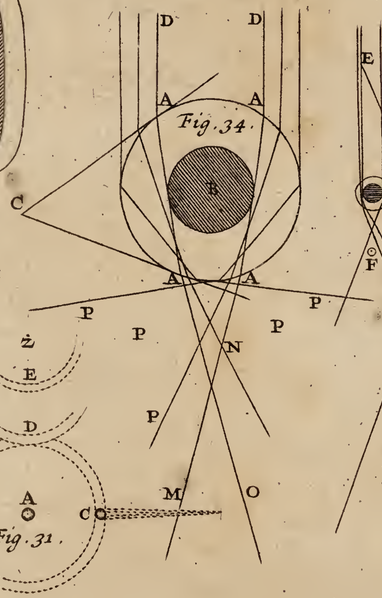
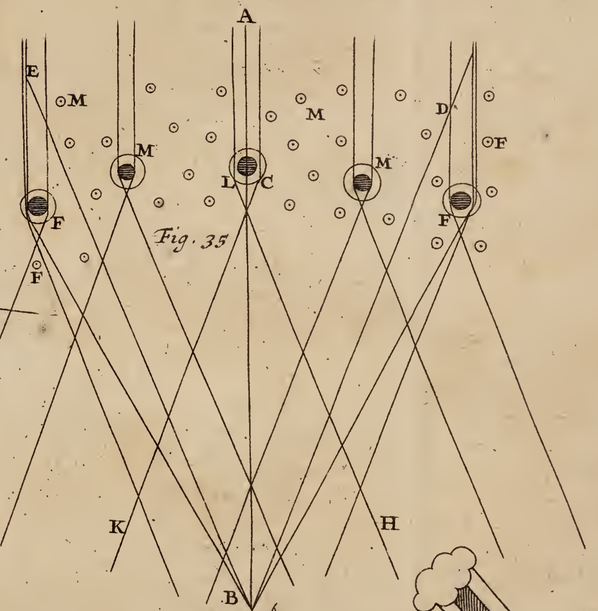


Fig. 31.

Fig. 34.



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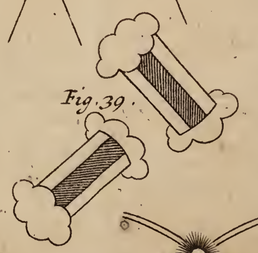
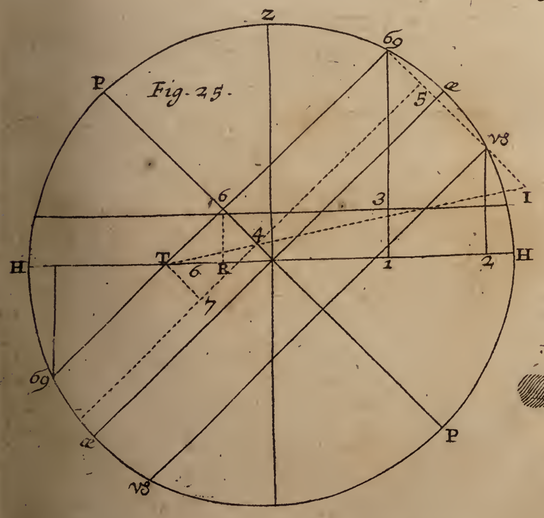


Fig. 39.

Fig. 44.



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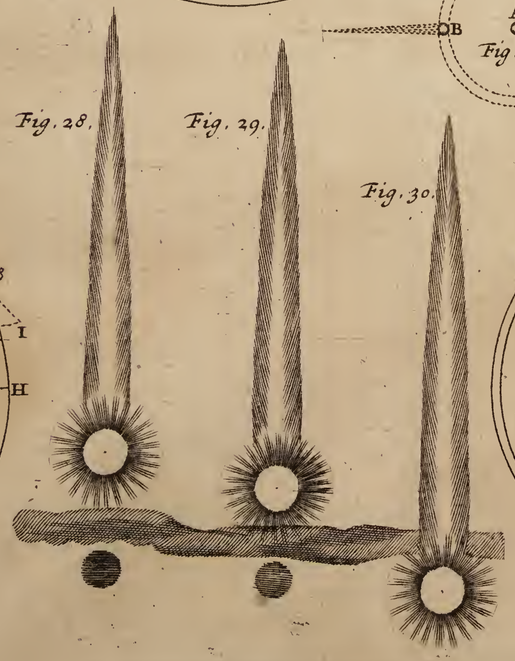
Fig. 28.

Fig. 29.

Fig. 30.

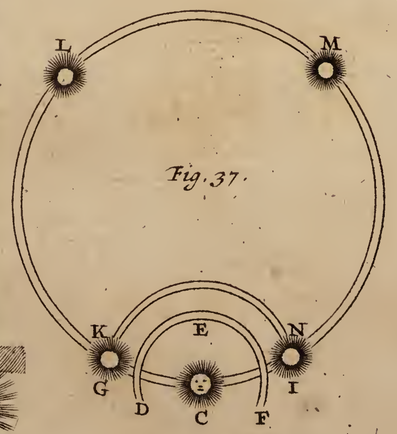

Fig. 37.

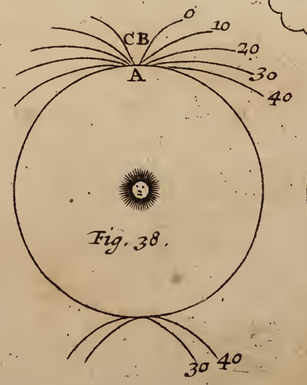

Fig. 38.

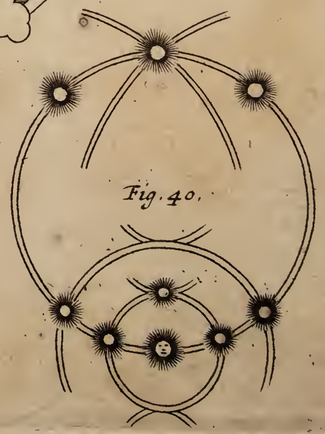
Fig. 40.

was high in the *Baroſcope*, put the Glaſs two or three Days in a South-Window about Noon (and for a good while after) and that in Sunſhining *Weather*, and yet even then the Bubbles did not Emerge, though it appeared by a good *Seal'd Weather-Glaſs*, which I kept in the ſame Window, that the Ambient *Air* was much *Warmer* than at other times, when I had Obſerved the Bubbles to keep at the Top of the Water.

N. B. 1. It being very difficult to *Poiſe* ſeveral Bubbles preciſely, as well one as another, I thought it not ſtrange, that all the three Bubbles did not conſtantly (though for the moſt part they did) Riſe and Fall together, but ſometimes two of them, and now and then (though ſeldom) one alone, would Sink or Emerge, when the Change of the *Weight* of the *Atmoſphere* was not conſiderable enough to Operate ſenſibly upon the reſt. And therefore 'tis not amiſs to *Poiſe* a great Number of Bubbles together, that after tryal made of all, the fitteſt may be choſen. For I have obſerved it ſometimes to happen, that a Bubble that Floated when 'twas firſt *Poiſed*, would after a while Subſide, without any manifeſt cauſe, or if it were made to Sink by ſuch a Cauſe, it would continue at the Bottom of the Water, though that Cauſe were removed; Which difficult *Phænomenon* ſeeming to depend upon a kind of Imbibition made of certain particles of an Aereal Nature by the *Water*, the Conſideration of it belongs to another place, not to this; where it may ſuffice, that the *Experiment* did ſometimes actually anſwer Expectation, as that above related did; wherein my main Drift was to ſhew, that ſince, as the *Atmoſphere* is *Heavier* or *Lighter*, 'tis capable to work upon Bodies under *Water*, ſo as to procure their Sinking, or their Emerſion; the *Air* (though a Fluid a thouſand times Lighter) muſt lean or preſs upon the *Water* it ſelf, by whoſe Intervention it produces theſe Effects; which confirms what I elſewhere Teach, that the *Atmoſphere* is Incumbent, as a Heavy Body, upon the *Terraqueous Globe*.

LXXIV. I cauſed the Edges of my *Recipient* to be well Ground, ſo as that being apply'd, it every where touched a Glaſs Plate, which had alſo been very ſmoothly Ground to ſerve for a *Cover* to the ſame; and I ſpread a piece of *Lamb-Skin* wetted, over the ſaid Plate, and having thus applyed it to the *Engine*, I put my *Recipient* over it: But in one place there was a Hail-ſhot of Lead, which kept the *Receiver* from being exactly applyed to its *Cover*, that ſo the Air might more freely get out. And having afterwards whelmed another great *Receiver* over all, I cauſed the *Pump* to be plyed. All being well *Evacuated*, I ſhook the Engine ſo as that the little *Receiver* fell off from the Hail ſhot, and ſtood every where cloſe to the *Skin*, expanded over the *Cover* of the Glaſs plate. Then I had no more to do but to ſuffer the *Air* to re-enter into the great *Receiver*, and this Air Preſſing upon the little one, kept it ſo cloſely faſtened to its *Cover*, that it was impoſſible for me to ſever them. And I am aſſured, that the *Air* enters not into the ſmall *Receiver*, when 'tis thus applyed upon the *Skin*; for I have often put *Gages* in them, which always kept at the ſame Height, altho' the *Air* was permitted to repaſs into the great *Receiver*. You might alſo let alone the putting under of the Hail-ſhot to keep up the little *Recipient*,

To take Exhauſted Receivers *away from the* Air-Pump; *by* M. Papin. n. 120. p. 477.

n. 121. p. 544.

Recipient, becauſe the *Air* by its *Spring* would lift it up ſufficiently; but then the *Vacuum* would not be ſo perfectly made.

When I firſt began to keep *Receivers* thus *Void* of *Air*, I apply'd *Eels-Skins* to the *Cover*. But I found them not proper for things that are intended to be conſerved a long time, becauſe by Drying they grow *Springy*, and this *Spring* is capable to raiſe the whole Pillar of *Air* that preſſes the *Receiver* againſt its *Cover*; and ſo the *Air* gets in between, and fills the place *Exhauſted*.

Afterwards I employed *Mutton-Skins*; but that ſticks yet leſs cloſe than an *Eel Skin*: For, as ſoon as the *External Air* comes to preſs upon it, it makes all the *Water*, which Wetteth the *Skin*, that ſtands over without, enter into the emptied *Receiver*; and you may ſee little Drops of Water coming out of the Pores of the *Skin* that is under the *Receiver*; and after the Water is all entered, the *Air* quickly gets in, the ſame way.

At Length I took a *Lamb-Skin*, and by means thereof I have kept *Receivers* empty 8 Days together, and never perceived it fail. Yet, for greater ſecurity, I do put *Turpentine* round about ſuch *Receivers* as I mean to keep ſtaunch a long time. Mean while, this Difference betwixt the *Skins* of *Mutton* and *Lambs* is ſomewhat remarkable, and confirms what *Phyſitians* ſay of the different Conſtitution of Bodies in *Youth* and *Old-Age*. I afterwards found that *Paper* Wetted ſerves as well as a *Lamb Skin*; but you muſt put *Turpentine* about it before it be Dry.

Seeds *Sown in the* Exhauſted Receiver; *by* ....: n. 23. p. 425.

LXXV. Some *Lettice Seed* being Sown upon ſome Earth in the *Open Air*, and ſome of the *ſame Seed* at the ſame time upon other Earth in a *Glaſs Receiver* of the *Pneumatick Engine*, afterwards *Exhauſted* of *Air*, the Seed expoſed to the *Air* was grown up an Inch and a half high, within 8 Days: But that in the *Exhauſted Receiver*, not at all. And, *Air* being again admitted into the ſaid *Emptied Receiver*, to ſee whether any of the Seed would then come up, it was found, that in the ſpace of one Week it was grown up to the Height of two or three Inches.

Experiments concerning the Relation between Light *and* Air (*in* Shining Wood *and* Fiſh); *by Mr.* Rob. Boyl. n. 31. p. 581.

LXXVI. *Exp.* I. *Oct.* 29. 1667. Having procured a piece of *Shining Wood*, about the bigneſs of a Groat or leſs, that gave a Vivid Light (for *Rotten Wood*) we put it into a middle-ſized *Receiver*, ſo as it was kept from touching the Cement; and the *Pump* being ſet a-work, we obſerved not, during the 5 or 6 firſt *Exſuctions* of the *Air*, that the *Splendour* of the included Wood was manifeſtly leſſened (though it was never at all increaſed); but about the 7th *Suck*, it ſeem'd to grow a little more Dim, and afterwards anſwered our Expectation, by loſing of its Light more and more, as the *Air* was ſtill further Pumped out; till at length about the 10th *Exſuction* (though by the removal of the Candles out of the Room, and by black Cloaths and Hats we made the place as dark as we could, yet) we could not perceive any *Light* at all to proceed from the *Wood*.

Exp. II. Wherefore we let in the outward *Air* by Degrees, and had the pleaſure

pleaſure to ſee the ſeemingly Extinguiſht *Light* revive ſo faſt and perfectly, that it looked to us all, almoſt like a little *Flaſh* of *Lightning*, and the *Splendour* of the *Wood* ſeemed rather greater than at all leſs, than before it was put into the *Receiver*.

But partly for greater certainty, and partly to enjoy ſo Delightful a Spectacle, we repeated the Experiment with the like Succeſs as at firſt. Wherefore being deſirous to ſee how ſoon theſe Changes might be produced, we included the *Wood* into a very ſmall Receiver of clear Glaſs, and found, That in this the Light would begin to grow *faint* at the Second, or at leaſt at the 3d. *Exſuction* of the *Air*, and at the 6th or 7th would quite diſappear. And we found by a *Minute-Watch*, that the ſending the Candles out of the Room, the *Pumping* out the *Air* 'till the *Wood* would *Shine* no more, the Readmitting of the *Air* (upon which it would in a trice Recover its *Light*) and the ſending in for the Candles to conſult the Watch, did in all take up but 6 *Minutes*.

Exp. III. Having *Exhauſted* this new *Receiver*, 'till the *Wood* quite diſappeared; we ſtayed ſomewhat above a quarter of an Hour in the Dark, without perceiving that the *Wood* had Regained any thing of *Light*, though about the end of this time, we made the place about it as Dark as we could; and then it (being too late at Night to protract the *Experiment*,) we let in the *Air*, upon whoſe Admiſſion the *Wood* preſently Recovered *Light* enough to be conſpicuous at a diſtance, though it ſeemed to me ſomewhat leſs Vivid than before; which yet may be either a Weakneſs in my Sight, or an Effect of the Steams of the Cements, unfriendly perhaps to the *Luminouſneſs* of the *Wood*.

The Night following we put in a piece of *Wood* bigger than the former (this being above an Inch long) and that *ſhone* very vigorouſly; And having by a few *Sucks* quite Deprived it of *Light*, we left it in the *Exhauſted Receiver* for full half an Hour, and then coming into the Dark Room again, we found all had not continued ſo ſtanch, but that ſome ſmall Portion of *Air* had inſinuated it ſelf into the *Receiver*. This we concluded to be but a ſmall Portion of *Air*, becauſe the *Wood* was but Viſible to an Attentive Eye: And yet, that it was really ſome *Air*, which was got in, that cauſed the little *Glimmering Light* which we perceived, may appear by this, that it did preſently (as we expected) Vaniſh at the firſt or ſecond *Suck*; and then the *Air* being let into the Dark *Receiver*, the included *Wood* preſently *Shone* again as before; though I ſuſpected that I diſcerned ſome little Diminution of its brightneſs; which yet, 'till further Trials of the like kind, and for a longer time, have been made, I dare not affirm.

Exp. IV. Having obſerved, on another Occaſion, That ſometimes the Operation, which the Withdrawing the *Air* hath upon a Body included in the *Receiver*, proves more conſiderable ſome *Minutes* after we have ceaſed *Pumping*, than immediately after the Exerciſe is left off, I imagined, that even in ſuch caſes, where the *Light* is not made wholly to diſappear (though it be made almoſt quite to do ſo) by the emptying of the *Pneumatical Glaſs*, the ſuffering the Body to remain a while there, though without any *Pumping* (unleſs now

and

and then a very little to remove the *Air*, that might have ſtolen in in the mean time) the remaining *Light* of the Body might probably be further impaired, if not reduced quite to Vaniſh. To examine this Conjecture, we put in a Body that was not *Wood*, which had ſome parts much more *Luminous* than the reſt; and having drawn out the *Air*, all the others diſappeared, and even the formerly brighter ones Shone but faintly, when the *Pneumatical Glaſs* ſeemed to be Exhauſted. But keeping the included Body a while in that unfriendly place, we perceived the parts that had retained *Light*, to grow more and more Dim, ſome of them diſappearing, and that which was formerly the moſt conſpicuous, being now but juſt Viſible to an Attentive Eye, and that ſcarce without diſpute; for if we had not known beforehand, that a *Shining* matter had been included in the *Receiver*, perhaps we ſhould not have found it out. (And he that had the youngeſt Eyes in the Company could not at all diſcern it;) But the *Air* being let in, the Body began to *Shine* again.

Exp. V. The *Rarefaction* or *Expanſion* of the *Air*, having ſo notable an Operation upon our *Shining Wood*, I thought it would not be amiſs to try, what the *Compreſſion* of the *Air* would do to it: For which purpoſe we included a piece of it in ſuch a little Inſtrument to *Compreſs* as hath been deviſed and propoſed by Mr. *Hook*. But though we impell'd the *Air* Forcibly enough into the Glaſs, yet by reaſon of the thickneſs requiſite in ſuch Glaſſes, and the Opacity thence Ariſing, we were not able then to determine, whether or no any change was made in the *Luminouſneſs* of the *Wood*. Which I thought the leſs ſtrange, becauſe by ſome *Experiments* purpoſely deviſed I had long ſince obſerved, That even a great *Preſſure* from a Fluid Body, which Preſſeth more uniformly againſt all the parts it toucheth of the conſiſtent Body, does Work a far leſs manifeſt *Change* even on ſoft or tender Subſtances, than one would expect from the Force wherewith it *Compreſſeth*.

Exp. VI. Thinking fit to try, Whether a ſmall Quantity of *Air*, without being ventilated or renewed, might not ſuffice to maintain this *Cold Fire*, though it will not that of a *Live Coal*, or a piece of Match, we cauſed a piece of *Shining Wood* to be *Hermetically Sealed* up in a Pipe of clear and thin Glaſs; but though Carrying it into the Dark we found it had quite loſt its *Light*, yet imagining that that might proceed from its having been over-heated (being *Sealed* up in a Pipe not long enough to afford it a due Diſtance from the Flame of the Lamp we employ'd to Seal it) we cauſed 2 or 3 pieces of Freſh *Wood*, amounting all of them, to the length of about 2 Inches, to be *Seal'd* up in a ſlender Pipe between 4 or 5 Inches in length; which being warily done, the *Wood* retained its *Light* very well, when the Operation was over; and afterwards laying it by my Bed-ſide, when the Candles were carried away out of the Room, I conſidered it a while before I went to ſleep, and found it to *Shine* Vividly.

The next Morning when I awaked, though the Sun was Riſen, yet forbearing to draw open the Curtains of my Bed 'till I had look'd upon the Seal'd Glaſs, which I had fenced with a piece of Cloath held between it and the Window, my Eyes having not yet been expoſed to the Day-light ſince the Darkneſs they had been accuſtomed to during the Night, made me think the

Wood

Wood Shined brighter than ever. And at Night, after 10 of the Clock, looking on it in a Dark place, it appeared *Luminous* all its length, though not so much as in the Morning.

The Morning after, and the Night after that, the same *Wood* did likewise manifestly, though not vigorously *Shine*, especially one piece, whose *Light* was much more Vivid than the rest; And, for ought I know, I might have observed them to *shine* longer, if one of the Sealed Ends of the Glass had not been accidentally broken.

Exp. VII. I caused a piece of *Iron* to be Forged, whose top was of the bigness of a Nutmeg; the rest being a Stem, of an Inch, or an Inch and a half long, for which we provided a little Candlestick of Tabacco-Pipe-Clay, which would not yield any Smoak to fill and darken the *Receiver*. Then having heated the *Iron* Red-hot, and placed it in this Clay, so that the round part was clearly protuberant, we conveyed it into a *Receiver* of White Glass, which was so placed, as to keep the sides at as good a distance as we could from the *Iron*, least the excessive *Heat* should (as we much feared it would) break the Glass. Then sending away the Candles, and making the Room dark, we hastily *Pumped* out the *Air*, but could not perceive the withdrawing of it had any Operation on the *Glowing Iron*. And though it continued *shining* long enough to give us an opportunity to Pump out and let in the *Air* three several times, yet we could not observe, that the *Air* had any manifest Operation one way or other. For though upon the withdrawing of the *Air* the *Iron* grew Dimmer and Dimmer, yet that I attributed to the *Cooling* of it; and the rather because having (to examine the Conjecture) let in two or three times the *Air*, when the *Receiver* had been *Exhausted*, there appeared no manifest Increase of *Light* upon the sudden admission of it.

Exp. VIII. Some Curious persons would perhaps, if they had been present, have desired to see a Tryal made, whether or no a small piece of *Shining Wood*, being so included in the *Receiver* as that the *Pumping* out of the *Air* should have no Injurious Operation upon the Body of it, its *Light* would, upon the Withdrawing of the *Air*, be manifestly diminished; This was I was the less backward to try, because it did not readily occur to my Memory, that by any manifest Experiment it appeared, that a Body more thin than *Air* will or can transmit *Light*, as well as other Diaphanous Mediums. Wherefore having *Hermetically Sealed* up a piece of *Shining Wood* in a slender Pipe, and placed it in a small *Receiver* that was likewise made of clear Glass, we *Exhausted* it of *Air*, and afterwards let in again that which we had Excluded. But by neither of the Operations could we perceive any sensible Decrement or Increase of the *Light* of the *Wood*, though by that very Observation it appeared, that the Glass had been well *Sealed*, since otherwise the included *Air* would have got out of the Pipe into the *Receiver*, and have left the *Wood* without *Light*.

Exp. IX. I took an old but thin Glass, *Sealed* at one end, whose shape was pretty Cylindrical, and whose Bore was about the bigness of a Man's little Finger, and whose length was about a Foot or more. Into this Pipe, near the *Sealed* end, we put a piece of *Shining Wood*, wedged in with a piece of Cork to keep it from falling; and having inverted the Nose of it into another Slen-

der Glaſs; but not Cylindrical, wherein was pretty ſtore of *Quickſilver*, we put them both into a long *Receiver*, ſhaped almoſt like a Glaſs Churn, and having *Pumped* a while, that the *Air* Included in the Pipe expanding it ſelf, might depreſs the *Quickſilver*, and ſo make eſcapes into the *Receiver* as long as we thought fit; we then let in the Outward *Air*, that the *Stagnant Quickſilver* might be impelled into the Cavity of the Pipe now freed from much of the *Air*, to the Height requiſite for our purpoſe.

This done, we plied the *Pump* again, and obſerved, That as the *Air* in the Pipe did by its own *Spring* expand it ſelf more and more, and grow Thinner and Thinner, the *Shining Wood* grew Dimmer and Dimmer, till at length it ceaſed to *Shine*, the Internal *Air* being then got a good way lower than the Surface of the external *Quickſilver*; whereupon opening the Commerce between the Cavity of the *Receiver*, and the *Atmoſphere*, the *Quickſilver* was driven up again, and conſequently the *Air* above it was reſtored to its former Denſity; upon which the *Rotten Wood* alſo recovered its *Light*. What the greateſt Expanſion of this *Air* was, we could not certainly determine, becauſe the Expanſion raiſed the external *Quickſilver* ſo high, as to hinder us to ſee and meaſure it: But we gueſſed, that the *Air* reached to about a foot or more from the top of the Pipe to the Surface of the *Quickſilver* near the bottom of it. But when that *Rarified Air* was impell'd into its former Dimenſions, we meaſured it, and found, that the upper part of the Tube, unpoſſeſt by the *Quickſilver*, was about 3 Inches; and the *Wood* being about an Inch long, there remained two Inches or ſomewhat better for the *Air*. But this Experiment ought to be repeated, when exacter Inſtruments can be procured.

Exp. X. Thinking it fit to try, as well, Whether *Stinking Fiſh* that *Shines* be of the ſame Nature; as to *Luminouſneſs*, with *Rotten Wood* that *Shines* too; as, whether the withdrawing of the *Air* will Extinguiſh or Eclipſe the *Light* of a conſiderable Bulk of *Luminous Matter*, as in the Experiments hitherto made, we found it would do to a ſmall one: We took a *Fiſh* that we had kept, and cauſed to be watched till it was almoſt all over *Luminous*, though much more in the Belly, and ſome parts of the Head than elſewhere: And having ſuſpended him in a conveniently ſhaped *Receiver*, we found him to give ſo great a *Light*, that we ſuſpected before-hand that the withdrawing of the *Air*, would hardly have its full Operation upon a Body, whoſe Bulk was conſiderable as well as its *Light* very Vivid, and which had many *Luminous* parts retired to a pretty diſtance from the *Air*. Accordingly having *Exhauſted* the *Receiver* as much as we were wont, it appeared indeed, eſpecially towards the latter end of the Operation, that the abſence of the *Air* did conſiderably Leſſen, and in ſome places Eclipſe the *Light* of thoſe parts that *Shone* leſs Strongly: But the Belly appeared not much leſs *Luminous* than before. Wherefore ſuppoſing, that upon the turning of the *Sto-cock*, the *Air* coming in much more haſtily than it could be drawn out, we ſhould have the beſt advantage to diſcern, what Intereſt it had in the *Luminouſneſs* of the *Fiſh*, we readmitted it: And upon its Ruſhing in, perceived the *Light* to be as it were Revived and Encreaſed; thoſe parts of the *Fiſh* that were ſcarce

Viſible

Viſible before, or *Shone* but Dimly, receiving preſently their former *Splendour.*

And not to leave unproſecuted the remaining part of the Experiment, which was to try, Whether it was the *Kind* of the *Luminous Body*, or only the Greatneſs of the *Bulk*, and the *Vividneſs* of *Light*, and, if I may ſo ſpeak, the Tenacity of the Subſtance it reſided in, that made the difference between the *Fiſh* and the *Wood*: we put part of the *Fiſh* of another Kind, that *Shone* much more faintly than that hitherto ſpoken of, and but in ſome places; and by the withdrawing the *Air*, we made ſome of the *Luminous* parts diſappear, and the others ſo Dim, as ſcarce to be diſcerned, and yet both the one and the other Regained their former *Light* upon the return of the *Air*.

And to purſue the *Experiment* a little further, we put in ſuch a piece of the firſt *Fiſh*, as though it were *Bright*, was yet but Thin, and not conſiderably great, and upon Pumping out the *Air*, we found it, according to our expectation, quite *Eclipſed*, though it recovered its *Light* upon the *Air*'s reentry.

'Tis probable that ſome will make uſe of this Diſcourſe to countenance their Opinion, That notwithſtanding the *Coldneſs* (at leaſt as to ſenſe) of *Fiſhes* and other *Animals*, there may be in the *Heart* and *Blood* a Vital kind of *Fire* which needs *Air*, as well as thoſe *Fires* which are ſenſibly *Hot*: Which may leſſen the wonder, that *Animals* ſhould not be able to *Live* when robb'd of *Air*.

Exp. XI. To examine the Conjecture mentioned in the laſt *Experiment*, That the durableneſs of the *Light* in the *Shining Fiſh*, in ſpight of the withdrawing the *Air*, might proceed in great part from the *Vividneſs* of it, and the beauty of the matter it reſided in, rather than from the Extent of the *Luminous Body*, in compariſon of the ſmall pieces of *Shining Wood*, I hitherto had made my Tryals with; In *Dec.* 1667. I got a large piece of *Wood*, whoſe *Luminous* Superficies might be perhaps 10 or 12 times as great as that which the Eye ſaw at once of the Surface of ſuch Fragments of *Shining Wood* as I was wont to employ: And though ſome parts of this large Superficies *Shined* Vividly enough (for *Rotten-Wood*, for the *Light* was uſually inferiour to that of our *Fiſh*) yet this great piece being put into a convenient *Receiver*, was, upon the *withdrawing* of the *Air*, deprived of *Light*, as the ſmaller ones had been formerly; the *Returning Air* Reſtoring its *Light* to the one, as it had done to the other.

Exp XII. I took ſome ſmall pieces of *Rotten-Fiſh*; that ſhone ſome of them more faintly, and ſome of them more Vividly, in reference to one another, but none as ſtrongly as ſome that I could have employed; and having in a very ſmall and clear *Receiver* ſo far drawn off the Air, as to make the included Body *Diſappear*, we ſo ordered the Matter, that we kept out the *Air* for about 24 *Hours*; and then allowing the *Air* to re-enter, in a dark place and late at Night, upon its firſt admittance the *Fiſh* regained its *Light.*

Exp. XIII. This, compared with ſome of my former Obſervations about Putrefaction, put me upon a Tryal, which, though it miſcarried, I ſhall here

make mention of, that in caſe you, who are better furniſhed with Glaſſes, think it worth while, you may get reiterated by the Society's Operator; Conſidering how great an Intereſt *Putrefaction* hath in the *Shining* of *Fiſhes*, and *Air* in the *Phænomena* of *Putrefaction*, I thought it might be ſomewhat to the Purpoſe, to take a *Fiſh* that was, according to the common courſe I had obſerved in Animals, not far from the State, at which it would begin to *Shine*; and having cut out a piece of it, I cauſed the reſt to be hung up again in a Cellar, and the exſected piece to be put into a ſmall and tranſparent *Receiver*, that we might obſerve, if a day or two, or more, after the *Fiſh* in the Cellar ſhould begin to *Shine*, that in the *Exhauſted Receiver* would either alſo *Shine* or (becauſe that ſeem'd not likely) would, notwithſtanding the Check which the Abſence of the *Air* might be preſumed to give the *Putrefaction*, be found to *Shine* too, either immediately upon the Admiſſion of the *Air*, or not long after it.

But this *Experiment*, was only deſigned and attempted, not compleated; the *Receiver* being ſo thin, that upon the *Exhauſtion* of the internal *Air*, the Weight of theExternal broke it; and we could ill ſpare another of that kind from Trials, we were more concern'd to make: Notwithſtanding which, we made one Trial more, which ſucceeded no better than the former, but miſcarried upon a quite differing account, *viz.* Becauſe neither the included piece of *Fiſh*, nor the remaining, though it were of the ſame ſort with the *Fiſhes* I uſually employed, would *Shine* at all, though kept a pretty while beyond the uſual time, at which ſuch *Fiſhes* were wont to grow *Luminous*. But that this Paragraph may not be uſeleſs to you, I'le take this Occaſion to give you a couple of *Advertiſements*, that may relate not only to this Experiment, but alſo more generally to thoſe whether precedent or ſubſequent, where *Shining Fiſh* are employed.

Advertiſement I. In the firſt place then, I will not undertake, that all the Experiments you ſhall make with *Rotten Fiſh*, ſhall have juſt the ſame Succeſs with theſe I have related. For, as I elſewhere obſerved, that the Event of divers other Experiments is not always certain, ſo I have had occaſion to obſerve the like about *Shining* of *Fiſhes*. And I remember, that having once deſigned to make Obſervations about the *Light* of *Rotten Fiſhes*, and having in order thereunto cauſed a competent Number of them to be bought, not one of them all would *Shine*; though they were bought by the ſame Perſon I was won't to employ, and hung up in the ſame place where I uſe to have them put, and kept not only 'till they began to *Putrifie*, but beyond the time that others uſed to continue to *Shine*; although a Parcel of the ſame kind of *Fiſhes*, bought the Week before, and another of the ſame kind, bought not many days after, *Shined* according to Expectation. What the reaſon of this Diſappointment was, I could not determine, only I remember, that at the time it happen'd, the Weather was variable, and not without ſome days of *Froſt* and *Snow*.

Adver. II. Notice muſt alſo be taken in making Experiments with *Shining Fiſh*, that their *Luminouſneſs* is not wont to continue very many days. Which *Advertiſement* may be therefore uſeful, becauſe without it we may be apt ſometimes

times to make Trials, that cannot be ſoon enough brought to an Iſſue; and ſo we may miſtake the loſs of *Light* in the *Fiſh* to be a Deprivation of it cauſed by the *Experiment*, which indeed is but a Ceſſation according the uſual Courſe of Nature.

Exp. XIV. We put a piece of *Shining Fiſh* into a wide mouthed Glaſs, about half filled with fair Water, and having placed this Glaſs in a *Receiver*, we *Exhauſted* the *Air* for a good while, to obſerve, Whether, when the *Preſſure* of the *Air* was removed, and yet (by reaſon of the Water that did before keep the Air from immediately touching the *Fiſh*) the *Exhauſtion* of the *Receiver* did not deprive the *Fiſh* of that Contact of *Air*, which it had loſt before: Whether, I ſay, in this caſe the abſence of the *Air* would have the ſame Influence on the *Shining Body*, as in the former *Experiments*.

And here, as far as the numerous Bubbles excited in the Water would give us leave to diſcern it, we could not perceive, that either the abſence or return of the *Air* had any great Operation upon the *Light* of the *Immerſed* Body.

I ſhall here inform you, that though, when I formerly put together ſome Notes about *Luminous* Bodies, I confined not my Obſervations to one or two ſorts of *Fiſhes*, yet theſe *Experiments* were all of them (except a Collateral one or two) made with *Whitings*, which, among the *Fiſhes*, I have had occaſion to take Notice of, is (except one ſort that I cannot procure) the fitteſt for ſuch Trials.

Exp. XV. To proſecute the I. and IX. *Experiments* in one Trial, we took ſomewhat late at Night a piece of *Rotten Fiſh*, which we judged to *Shine* too ſtrongly to be quickly deprived of all its *Light*, and having put it into a ſmall and clear *Receiver*, we found (as we had foreſeen) that the *Light* was much impaired, but nothing near ſuppreſſed by the withdrawing of the *Air*. Wherefore having removed the *Receiver* into a convenient place, I cauſed it to be brought to me about Midnight, and having made the place pretty dark, I perceived the included Body to continue to *Shine* more vividly than one would have expected, (and, if I miſtake not, I ſaw it ſhining in the Morning whilſt it was dark;) but the Night after, coming to look upon it again, its *Light* appeared no more: Notwithſtanding which, I made a ſhift to keep out the Air about 24 *Hours* longer, and ſo after 48 *Hours* in all, we opened the *Receiver* in a dark place, and preſently upon the *Ingreſs* of the *Air* were pleaſingly ſaluted with ſo Vivid an Apparition of *Light*, that the included Body continued to *Shine*, when carried into a Room, where there was both Fire and Candle, if it were but by a Hat ſcreen'd from the Beams.

Being encouraged, as well as pleaſed with this Succeſs, we forthwith *Exhauſted* the *Air* once more out of the ſame *Receiver*, and having kept it about 4 *Hours* longer, we lookt upon it again in a dark place, and finding no appearance of *Light*, let the *Air* in upon it, whereby it was made to *Shine* again and that vigorouſly enough.

The ſuddenneſs, with which the included Body appeared to be, as 'twere, *rekindled* upon the firſt contact of the *Air*, revived in me ſome ſuſpicions I have had about the poſſible Cauſes of theſe *Short liv'd Apparitions* of *Light* (for I ſpeak not now of real Lamps found in Tombs, for a Reaſon to be told

you

you another time) which diſcloſing themſelves upon Mens coming in, and conſequently letting in Freſh *Air* into *Vaults*, that had been very long cloſe, did ſoon after Vaniſh.

Theſe thoughts, as *I* was ſaying, occurred to me upon what I had been relating by reaſon of the *Sudden Operation* of the *Freſh Air* upon a Body, that but a Minute before diſcloſed no *Light*. For though the *Lights* reported to have been ſeen in *Caves*, quickly Diſappeared, which that of our *Fiſh* did not; yet that difference might poſſibly proceed from the Tenacity, or ſome other diſpoſition of the matter, wherein the *Luminouſneſs* of the *Fiſh* reſides: For I remembred that *I* had more than once obſerved a certain Glimmering and ſmall *Light* to be produced in a ſort of Bodies, upon putting them out of their former Reſt, and taking them into the *Air*; which ſparks would vaniſh themſelves, ſometimes within one *Minute*, ſometimes within a few *Minutes*. But as theſe thoughts were but tranſient Conjectures, ſo *I* ſhall not entertain you any longer about them, but rather contenting my ſelf with the hint already given, take notice of what may be more certainly deduced from our Experiment, which is, That the *Air* may have a much greater intereſt in divers odd *Phænomena* of Nature, than we are hitherto aware of.

And for Confirmation of our *Experiment*, *I* ſhall add, that having in another *Receiver* Eclipſed a piece of *Fiſh*, that *Shone* when 'twas put in more *languidly* than divers others that we had tried, *I* kept it about 3 *days* and 3 *Nights* in a *Receiver*; after which *I* opened it in the dark, and upon letting in the *Air* upon this Body, that *Shined* but *faintly* at firſt, it immediately recovered its ſo long ſuppreſſed *Light*. And having included another piece that was yet more faint than this, when it was put into the *Receiver*, and having kept this piece alſo 3 days and 3 Nights in the *Exhauſted* Glaſs, I let in the *Air* upon it, and notwithſtanding the darkneſs of the place, nothing of *Life* was thereupon Revived. But this being little other than I expected from a Body that *Shined* ſo *faintly*, when 'twas put into the *Receiver*, and had been kept there ſo long, *I* reſolved to try, Whether the Appulſe and Contact of the *Air* would have that Operation after ſome time, that it had not at firſt; and accordingly, after having waited a while, *I* obſerved the *Fiſh* to diſcloſe a *Light*, which though but dim, was yet manifeſt enough.

I ſhall only add, That having included in ſmall *Receivers* two pieces of *Rotten Whitings*, whereof the one, before it was put in, ſcarce *Shone* ſo Vividly as did the other after the *Receiver* was *Exhauſted*; and having ordered the matter ſo, that we were able to keep out the *Air* for ſome days, at the end of about 48 *Hours*, we found, that the more *ſtrongly Shining* Body retained yet a deal of *Light*; but afterwards looking upon them both in a dark place, we could not perceive in either any ſhow of *Light*. Wherefore having let in the *Air* into that *Receiver*, whereinto the Body that at firſt *Shined* the *faintlier* had been put, there did not enſue any *Glimmering* of *Light* for a pretty while: Nay, upon the ruſhing in of the *Air* into the other Glaſs, the Body that at firſt *Shone* ſo *Strongly*, and that continued to *Shine* ſo long, ſhewed no *Glimmering* of *Light*. But within leſs than a quarter of an *Hour* we ſaw a manifeſt *Light* in the Body laſt named, and a while after the other alſo became *Viſible*, but by

a *Light* very dim. The more *Luminous* of these Bodies *I* observed to retain some *Light* 24 *Hours* after; and the hitherto recited *Experiment* had this peculiar instance in it, That the 2 *Receivers* were uninterruptedly kept *Exhausted* no less than 4 *Days*, and as many *Nights*.

Pneumatical *Experiments*; *by Mr.* Boyle. n. 62. p. 2011.

Upon Ducks.

LXXVII. I. 1. We put a full grown *Duck* into a *Receiver*, whereof she fill'd, by our Guess, a third part or somewhat more, but was not able to stand in any easie Posture in it; then *Pumping* out the *Air*, within the short space of one *Minute* she appeared much discomposed, and between that and the second *Minute*, her Strugling and *Convulsive* Motions increased so much, that, her Head also hanging carelessly down, she seemed to be just at the point of *Death*: So that, it did not appear, that, notwithstanding the peculiar structure of some Vessels about the *Heart*, which enables these and other *Water Birds* to continue without *Respiration* for some time under the Water, this *Duck* was able to hold out considerably longer than a *Hen*, or other *Bird not Aquatick*, might have done.

This *Duck*, being revived upon the admission of Fresh *Air*, and again shut up in the same *Receiver* with the *Air* in it, continued five times as long as before, without appearing any ways discomposed.

2. We conveyed a *Duckling*, that was not yet Callow, into the same *Receiver*, and Observ'd, that before the first *Minute* was quite ended, she gave manifest tokens of being much disordered, and before a Second *Minute* was expired, several *Convulsive Motions* obliged us to let the *Air* in upon her, whereby she quickly recover'd.

N. B. When the *Receiver* was pretty well *Exhausted*, she appeared manifestly bigger, than before the *Air* was with withdrawn, especially about the Crop, though that was very Turgid before. We kept the same *Duckling* in the same *Receiver* very close, to keep out all *External Air*, and to keep in the *Excrementitious* Steams of her Body for above 6. *Min.* without perceiving her to grow Sick upon her *Imprisonment*.

Vipers.

II. 1. *Jan.* 2. $166\frac{2}{3}$. We included a *Viper* in a small *Receiver*, and as we drew out the *Air*; she began to *Swell*, and afforded us these *Phænomena*.

1. It was a good while after we had left *Pumping*, e're the *Viper* began to *Swell* so much as to be forced to Gape, which afterwards she did.

2. That she continued, by our Estimate, above $2\frac{1}{2}$ *Hours* in the *Exhausted Receiver*, without giving clear Proof of her being *Kill'd*.

3. That after she was once so *Swelled*, as to be compelled to open her Jaws, she appeared slender and lank again, and yet very soon after appear'd *Swell'd* again, and had her Jaws disjoyned as before.

2. We took a *Viper*, and including her in the greatest sort of small *Receivers*, we emptied the Glass very carefully, and the *Viper* mov'd up and down within, as it were to seek for *Air*, and after a while foamed a little at the Mouth, and left of that Foam sticking to the inside of the Glass. Her Body *Swelled* not considerably, and her Neck less, till a pretty while after we had left *Pumping*; but afterwards the Body and Neck grew prodigiously Tumid, and a Blister appeared upon the Back. An *Hour* and an *half* after the *Exhaustion* of

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the *Receiver* (which we then by Trial found to be pretty ſtaunch) the diſtended *Viper* did give by Motion manifeſt Signs of *Life*; but we obſerved none afterwards. The Tumor reached to the Neck, but did not ſeem much to *Swell* the under Chap. Both the Neck and a great part of the Throat, being held betwixt the Eye and the Candle, were tranſparent enough, where the Scales did not darken them. The jaws remained mightily opened, and ſomewhat diſtorted; the *Epiglottis* with the *Rimula Laryngis* (which remained gaping) was protruded almoſt to the further end of the nether-Chap. As it were from beneath this *Epiglottis* came the black Tongue, and reached beyond it, but ſeemed by its poſture not to have any *Life*, and the Mouth alſo was grown blackiſh within. But the *Air* being readmitted after 23 *Hours* in all, the *Viper's* Mouth was preſently clos'd, though ſoon after it was open'd again, and continued long ſo; and ſcorching or pinching the Tail made a Motion in the whole Body, that argued ſome *Life*.

3. *April* 25. We included an Ordinary harmleſs *Snake*, together with a Gage, in a pretty portable *Receiver*, which, being *Exhauſted* and well ſecur'd againſt the *Ingreſs* of the *Air*, was laid aſide in a quiet place, where it continued from 10. or 11. a Clock in the Forenoon, till about 9. the next Morning; and then, though he ſeem'd to be dead, and gave no Signs of *Life* upon the Shaking of the *Receiver*, yet upon holding the Glaſs at a convenient Diſtance from a moderate Fire, he did in a ſhort time manifeſt himſelf to be *Alive* by ſeveral tokens, and even by putting forth his *Forked Tongue*. In that Condition I left him, till the next Day early in the Afternoon; at which time he was grown paſt recovery, and his Jaws, which were formerly ſhut, gaped exceeding wide, as if they had been ſtretched open by ſome External force.

Frogs. III. 1. *Sept.* 9. 1662. We took a large luſty *Frog*, and having included her in a ſmall *Receiver*, we drew out the *Air*, and left her not very much *Swell'd*, and able to move her Throat from time to time, though not ſo faſt as when ſhe freely breathed before the *Exſuction* of the *Air*. She continued *alive* about 2 *Hours* that we took notice of, ſometimes removing from the one ſide of the *Receiver* to the other; but ſhe *Swell'd* more than before, and did not appear by any Motion of her Throat or Thorax to exerciſe *Reſpiration*, but her Head was not very much *Swell'd*, nor her Mouth forced open. After ſhe had remained there ſomewhat above 3 *Hours* (for it was not $3\frac{1}{2}$ *Hours*) perceiving no *Sign* of *Life* in her, we let in the *Air* upon her, with which the formerly Tumid Body ſhrunk very much, but ſeem'd not to have any other Change wrought in it; and though we took her out of the *Receiver*, yet in the *Free Air* it ſelf, ſhe continued to appear ſtark *Dead*. Nevertheleſs to ſee the utmoſt of the *Experiment*, having cauſed her to be laid upon the Graſs in a Garden all Night, the next Morning we found her perfectly *Alive* again.

2. *Jun.* 29. 1660. About 11. of the Clock in the Forenoon, we put a *Frog* into a ſmall *Receiver*, containing about $15\frac{1}{4}$ *Ounce Troy* Weight of *Water*, out of which we had tollerably well drawn the *Air*, (ſo that when we turned the Cock under Water, it ſucked in about $13\frac{1}{4}$ *Ounce* of *Water*:) The *Frog* continued in it (the *Receiver* all the while under Water) *lively* enough till about

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5 of the Clock in the Afternoon, when it expir'd. The *Frog* at the firſt ſeem'd not to be much altered by the *Exſuction* of the *Air*, but continued *Breathing* both with her Throat and Lungs.

3. *Sept.* 6. 1662. We included into a large *Receiver* a couple of *Frogs* newly taken, the one not above an *Inch* long, and proportionally Slender; the other, very large and luſty. Whilſt the *Air* was *Drawing* out, the leſſer *Frog* Skipt up and down very lively, and ſomewhat to our wonder, clambered up ſeveral times to the ſides of the *Receiver*, in ſo much that he ſometimes reſted himſelf againſt the ſide of the Glaſs; when his Body ſeem'd to be Perpendicular to the *Horizon*, if not in a Reclining Poſture. He continued to Skip up and down a while after the *Exſuction* of the *Air*, but within a *Quarter* of an *Hour* (meaſured by a Minute Watch) we perceived him to lye ſtark *Dead*, with his Belly upwards. The other *Frog*, that was very large and ſtrong, though he began to *Swell* much upon the *withdrawing* of the *Air*, and ſeem'd to be Diſtreſſed, by his frequently leaping up, after the *Air* was *drawn out*, which he did not before, yet being as we ſaid very luſty, he held out *half* an *Hour*; at which time the Weight of the *outward Air* broke the *Receiver* and thereby brought him a *Reprieve*.

4. *Sept.* 11. We took a ſmall *Frog*, and having conveyed her into a very ſmall Portable *Receiver*, we began to Pump out the *Air*. At firſt She was *Lively* enough, but when the *Air* began to be conſiderably withdrawn, ſhe appeared to be very much Diſquieted (leaping ſometimes after an odd manner, as it were to get out of the uneaſie Priſon,) but yet not ſo, but that, after the Operation was ended and the *Receiver* taken off, the *Frog* was perfectly *alive*, and continued to appear ſo (if I am not miſtaken) near an Hour, though the *Abdomen* was very much, and the Throat ſomewhat extended; this latter part having alſo left that wonted panting Motion, that is ſuppoſed to argue and accompany the *Reſpiration* of *Frogs*. At the End of about $3\frac{1}{4}$ *Hours*, after the Removal of the *Receiver* from the *Pump*, the *Air* was let in; whereupon the *Abdomen*, which by that time was ſtrangely *Swell'd*, did not only ſubſide, but ſeem'd to have a great Cavity in it, as the Throat alſo proportionably had; which Cavities continued, the *Frog* being gone paſt all *Recovery*.

5. *Apr.* 14. A large *Frog* was conveyed into a plated *Receiver*, and the *Air* being *withdrawn*, her Body by Degrees was Diſtended. The *Receiver* with the *Gage* were kept under Water near 7 *Hours*; at the End of which I found the *Receiver* ſtaunch, but the *Frog Dead*, and exceedingly *Swelled*: upon the *letting in* of the *Air* ſhe became more hollow and *Lank* than ever.

IV. Being deſirous to try, whether Animals, that had lately been accuſtomed to *Live* either without any, or without a full *Reſpiration*, would not be more difficultly, or ſlowly kill'd by the *Want* of the *Air*, than others, which had been longer uſed to a free *Reſpiration*; we took a *Kitling* that had been kitten'd the Day before, and put it into a very ſmall *Receiver* (that we gueſſed to hold about a *Pint* or leſs) that it might be the ſooner *Exhauſted*. Within one *Minute*, or a little more, after the *Air* firſt began to be *withdrawn*, the little Animal, who in the mean time had gaſped for *Life*, and had ſome violent Kitlings;

Convulsions, lay as *Dead*, with his Head downwards, and his Tongue out; but upon letting in of the *Air*, he did in a Trice shew Signs of *Life*, and being taken out of the *Receiver*, quickly recovered.

Another of the same Litter, being put into the same *Receiver*, quickly began, like the other, to have *Convulsions*, after which he lay as *Dead*. But, though we continued *Pumping*, and could not perceive that the Engine *leaked* more than in the former Experiments; the *Kitling* began to stir again, and after a while had stronger and more general *Convulsions* than before; till at the end of full 6 *Minutes* after the *Exsuction* of the *Air* was begun, the Animal seeming quite *Dead*, was taken out of the Vessel, and lay with its Mouth open, and his Tongue lolling out without any sensible *Breathing*; and *Pulsation*; till having ordered him to be pinched, the Pain, or some Internal Motion produced by the External Violence done to him, made him immediately give manifest Signs of *Life*, though there was yet no sensible Motion of the *Heart* or the *Lungs*; but afterwards gaping and fetching his Breath in an odd manner, and with much straining, as I have seen some *Fœtus*'s do when Cut out of the *Womb*, he by little and little, within about a *Quarter* of an *Hour* recover'd.

Inclosing another *Kitling* kitten'd at the same time, in the same *Receiver*, we Observ'd, that divers violent *Convulsions*, as it were gasping for Breath, into which he began to fall at the second or third *Suck*, ended in a seeming *Death*, within about a *Minute* and a *half*. A while after, notwithstanding our continuing to *Pump*, the *Kitling* gave manifest Signs of *Life*, which was not till it had endured divers *Convulsions*, as great as those of the first *Fit*, if not greater. When 7. *Min.* from the beginning of the *Exhaustion* were compleated, we *Let in* the *Air*; upon which the little Creature, that seemed stark *Dead* before, made us expect that he might recover; but though we took him out of the *Receiver*, and put *Aqua vitæ* into his Mouth, yet he irrecoverably *Died* in our Hands.

By what has been related it appears, that those Animals continued 3 times longer in the *Exhausted Receiver*, than other Animals of that bigness would probably have done.

The Air *Conceal'd in the* Pores *of* Liquors.

V. 1. We put some *Water* in an open Tube, and suffer'd the *Air Latitant* in it, to escape in an *Exhausted Receiver*, without any Artifice to catch it; by which Trial the *Water* did not part with any thing of its bulk, that made a Diminution sensible to the Eye.

2. A Chymical Pipe, seal'd at one End, and 36 *Inches* (or somewhat less) in length, was fill'd with *Water*, and inverted into a Glass Vessel, not two *Inches* in Diameter, and but $\frac{1}{4}$ of an *Inch* or little more in Depth. These Glasses being conveyed into a fit *Receiver*, and the *Air* being leisurely *Pump'd* out, and somewhat slowly *Readmitted*, the numerous *Bubbles*, that had Ascended during the Operation, constituted at the Top an *Aerial Aggregate*, mounting to $\frac{5}{100}$ wanting about 100 part of an *Inch*.

3. Presently after another Tube was fill'd again with the same *Water*, and inverted, and the *Water* being drawn down to the Surface of the vessel'd Water,

ter, and the *Air* let in again, the *Water* was impell'd up to the very Top within a 10*th* and *half* a 10*th* of an *Inch*.

4 The Tube for meaſuring the *Air* latitant in the *Water*, was $43\frac{1}{2}$ *Inches* above the Surface of the Stagnant Water: The *Air* collected out of the *Bubbles* at the top of the *Water*, was the *firſt* time $\frac{3}{4}$ of an *Inch*, and ſomewhat better; the *Second* time we eſtimated it but $\frac{1}{8}$ and $\frac{1}{16}$. The *Firſt* time the *Water* in the *Pipe* was made to ſubſide full as low as the Surface of the Reſtagnant Water: The *Second* time, the loweſt we made it ſubſide ſeem'd to be 4 or 5 *Inches* above the Surface of the Water in the open Veſſel.

I muſt here *Advertiſe* that the *Air* at the Top of the *Tube* did poſſeſs more room than it's Bulk did abſolutely require, becauſe it was ſomewhat defended from the Preſſure of the *Atmoſphere* by the Weight of the Subjacent Cylinder of *Water*, wuich might be about three or four *Foot* long.

5. We provided a clear *round* Glaſs, furniſhed with a Pipe or *Stem* of about 9 *Inches* in length, the *Globulous* part of the Glaſs being on the outſide about $3\frac{1}{2}$ *Inches* in Diameter; the *Pipe* of this Glaſs was within an *Inch* of the Top, melted at the Flame of a *Lamp*, and drawn out for two or three *Inches* as ſlender as a Crow's Quill, that the Decrement of the *Water* upon the Receſs of the *Air* harboured in its Pores, might, if any ſhould happen, be the more eaſily Obſerved and eſtimated. Above this *Slender* part of the *Pipe*, the Glaſs was of the ſame largeneſs (or near it) with the reſt of the *Pipe*, that the *Aerial Bubbles*, aſcending through the *Slender* part, might there find room to break, and ſo prevent the overflowing, or loſs of any part of the *Water*.

This Veſſel being not without Difficulty and ſome Induſtry fill'd, till the *Liquor* reached to the Top of the *Slender* part, where not being uniformly enough drawn out, it was ſomewhat broader than elſewhere; we conveyed the Glaſs, together with a Pedeſtal for it to reſt upon, into a tall *Receiver*, and *Pumping* out the *Air*, there diſcloſed themſelves numerous *Bubbles* Aſcending nimbly to the upper part of the Glaſs, where they made a kind of Froath or Foam; but, by Reaſon of the above mentioned Figuration of the Veſſel, they broke at the Top of the ſlender part, and ſo never came to overflow. This done, the *Pump* was ſuffered to reſt a while, to give the *Aerial* Particles, lodged in the *Water*, time to ſeparate themſelves and Emerge, which when they had done a pretty while, the *Pump* was plyed again, for fear ſome *Air* ſhould have ſtolen into ſo large a *Receiver*.

Theſe Viciſſitudes of *Pumping* and Reſting laſted for a conſiderable Time, till at length the *Bubbles* began to be very rare, and we weary of waiting any longer, ſoon after which the *External Air* was let in to the *Receiver*, and it appear'd ſomewhat ſtrange to the Spectators, that notwithſtanding ſo great a Multitude of *Bubbles*, as had eſcaped out of the *Water*, I could not by attentively comparing the Place where the Surface of the *Water* reſted at firſt (to which a Mark had been affix'd) with that where it now ſtood, I could not, I ſay, diſcern the Difference to amount to above, if ſo much, as an Hair's breadth; and the Chief Operator in the Experiment profeſſed that for his part, he could not perceive any difference at all.

6. Filling a Glaſs of the ſame *Shape*, and much of the ſame bigneſs, with *Claret Wine*, and placing it upon a convenient Pedeſtal, in a tall *Receiver*, we cauſed ſome of the *Air* to be *Pumped* out; whereupon in a ſhort time there Emerg'd, through the *Slender Pipe*, ſo very great a Multitude of *Bubbles*, that were darted as it were upwards, as did not a little both pleaſe and ſurpriſe the Beholders: But it forced us to go warily to work, for fear the Glaſs ſhould break, or the *Wine* overflow. Wherefore we ſeaſonably left off *Pumping*, before the *Receiver* was any thing near *Exhauſted*, and ſuffered the *Bubbles* to get away as they could, till the preſent Danger was over paſſed, and then from time to time we *Pumped* a little more *Air* out of the *Receiver*, till we were weary, the withdrawing of a moderate Quantity of *Air* at a time ſufficing, even at the latter end, to make the *Bubbles* not only copiouſly, but very ſwiftly Aſcend, (by a *Minute* Watch) for above a *Quarter* of an *Hour* together.

Shell-Fiſhes. VI. 1. An *Oyſter* being put into a very ſmall *Receiver*, and kept in long enough to have ſucceſſively *Kill'd* three or four *Birds* or *Beaſts*, *&c.* Was not thereby *Kill'd*, nor, for ought we could perceive, conſiderably diſturb'd; only at each *Suck* we perceived, that the *Air* contain'd between the two Shells broke out at their Commiſſure; as we concluded from the Foam which at thoſe times came forth all round that Commiſſure. About 24 *Hours* after, I found that both this and another, that had been put into the *Receiver* at the ſame time, were *Alive*.

2. We put a pretty large *Craw-Fiſh* into a pretty large *Receiver*, and found, that though he had been injur'd by a Fall before he was brought thither, yet he ſeem'd not to be much *incommoded* by being included, till the *Air* was in great Meaſure *Pump'd* out, and then its former Motion, preſently ceaſed, and he lay as *Dead*; till upon the letting in a little *Air* into the *Receiver*, he began forthwith to move a freſh; and upon the withdrawing the *Air* again, he preſently, as before, became moveleſs. Having repeated this Trial two or three times, we took him out of the *Receiver*, where he appear'd not to have ſuffer'd any *Harm*.

3. Having put an *Oyſter* into a Viol full of Water, before we included it in the *Receiver*, it prov'd ſo ſtrong as to keep it ſelf cloſe ſhut, and repreſs'd the *Eruption* of the *Bubbles*, that in the other did force open the Shells from time to time; and kept in its own *Air* as long as we had Occaſion to continue the Trials.

4. Moreover a *Craw Fiſh*, that was thought more vigorous, being ſubſtituted in the place of the former *Craw-Fiſh*, though once he ſeem'd to loſe his Motion together with the *Air*, yet afterwards he continued moving in the *Receiver*, in ſpight of our Pumping.

A Scale Fiſh. VII. We took a *Receiver* ſhap'd almoſt like a *Bolthead*, containing by Eſtimation near a *Pint*, and the *Globulous* part of it being almoſt half full of *Water*, we put into it, at the Oriſice (which was pretty large) a ſmall *Gudgeon*, about 3 *Inches* long, which when it was in the *Water* ſwam nimbly up and down therein. Then having drawn out the *Air* ſo well, that we gueſſed by a Gage,

that

that about 19 parts of 20 or more might be *Exhauſted*, we ſecured our ſelves that the Regreſs of the *Air* ſhould not injure our Experiment; about which we Obſerv'd that,

1. The Neck of the Glaſs being very Long, though there appear'd great ſtore of *Bubbles* all about the *Fiſh*; yet the reſt of the *Water*, notwithſtanding the withdrawing of ſo much *Air* as had been mention'd, emitted no *Froth*, and but few *Bubbles*.

2. The *Fiſh* both at his Mouth and Gills did, for a great while, diſcharge ſuch a Quantity of *Bubbles* as appear'd ſtrange, and for about half an *Hour* or more (for much longer I had not Opportunity to watch it;) whenever he reſted a while, new *Bubbles* would adhere to many Parts of his Body (as if they were generated there) eſpecially his *Fins* and *Tail:* So that he would appear almoſt beſet with *Bubbles*; and if, being excited to *Swim*, he was made to ſhake them off, he would quickly, upon a little Reſt, be beſet with new ones as before.

3 Almoſt all the while, he would gape and move his *Gills*, as before he was included; though towards the end of the time that I watch'd, it often happened, that he neither took in, nor Emitted any *Aerial* Particles that I could perceive.

4 After a while, he lay almoſt conſtantly with his Belly upwards, and yet would in that Poſture *Swim* briskly as before.

5. Nay, after a while, he ſeem'd to be more *Lively* than at firſt putting in; whether by Reaſon, that by Diſcharge of ſo many *Bubbles*, which by their Diſſenſion, perhaps, put him to Pain, he found himſelf relieved, or for ſome other Cauſe, I examine not.

6 About an *Hour* and an *Half* after he had been Seal'd up, I found him almoſt free from *Bubbles*, and with his Belly upwards, and ſeeming ſomewhat Tumid, but yet Lively as before. But an *Hour* and a *Quarter* after that, he ſeem'd to be moveleſs and ſomewhat ſtiff; yet upon ſhaking the Glaſs, obſerving ſome faint Signs of *Life* in him by ſome Languid Motions, he attempted to make when excited to them, I opened the *Receiver* under *Water*, to try if that Liquor and *Air* would recover him; and the External *Water* ruſhing in, till it had fill'd the vacant part of the Ball, and the greateſt part of the Stem too, the *Fiſh* Sunk at the Bottom of it, with a greater appearance than ever of being *Alive*; in which State after he had continued a pretty while, I made a Shift, by the help of the *Water* he ſwam in, to get him through the Pipe into a Baſon of Water, where he gave more manifeſt Signs of *Life:* But yet for ſome *Hours* lay on one ſide or other, without being able to ſwim or lye on his Belly, which appeared very much Shrunk in, as if ſomething, during the time of its being *Seal'd* up, had been broken in his Body, or his Belly had been exceedingly diſtended, beyond Reſtitution of its former Tone.

All the while he continued in the Baſon of *Water*, though he moved his *Gills* as before he had been *Seal'd* up; yet I could not perceive, that he did, even in his new Water, Emit, as formerly, any *Bubbles*, though two or three times I held him by the Tail in the *Air*, and put him into the *Water* again, where at length he grew able to lye conſtantly upon his Belly, which

yet

yet retained much of its former Lankneſs. He lived in the Baſon, 8 or 10 Days, though divers other *Gudgeons* dy'd there in much fewer Days.

Wounded Animals.

VIII. 1. *Sept.* 12. A ſmall *Bird*, having the *Abdomen* open'd almoſt from Flank to Flank, without injuring the *Guts*, was put into a ſmall *Receiver*, and the *Pump* being ſet a-work, continued for ſome time without giving any Signs of Diſtreſs: But at the end of about a *Minute* and a *half* from the Beginning of the *Exhauſtion*, ſhe began to have *Convulſive* Motions in the Wings; and though the *Convulſions* were not Univerſal, or did appear Violent, as is uſual in other *Birds* from whom the *Air* is withdrawn by the *Engine*, yet at the end of two full *Minutes*, letting in the *Air*, and then taking off the *Receiver*, we found the *Bird* irrecoverable; notwithſtanding which we did not find any notable Alteration in the *Lungs*, and found the *Heart* (or at leaſt the *Auricles* of it) to be yet beating, and ſo it continued for a while after.

2. We took alſo a pretty large *Frog*, and having, without violating the *Lungs* or the *Guts*, made two ſuch Inciſions in the *Abdomen*, that the two curl'd *Bladders* or *Lobes* of *Lungs* came out almoſt totally at them, we ſuſpended the *Frog* by the Legs in a ſmall *Receiver*, and after we had *Pump'd* out a good part of the *Air*, the Animal Strugled very much, and ſeem'd to be much diſorder'd, and when the *Receiver* was well *Exhauſted*, ſhe lay ſtill for a while as if ſhe had been *Dead*, the *Abdomen* and Thigh very much Swell'd, as if ſome *Rarified Air* or Vapour forcibly diſtended them. But as, when the *Frog* was put in, one of the *Lobes* was almoſt Full, and the other almoſt ſhrunk up, ſo they continued to appear, after the *Receiver* had been *Exhauſted*; but upon letting in of the *Air*, not only the Body ceaſed to be Tumid, but the *Plump Bladder* appear'd for a while Shrunk up as the other, and the *Receiver* being remov'd, the *Frog* preſently *Reviv'd*, and quickly began to fill the *Lobe* again with *Air*.

The ſeparated Hearts of Cold Animals.

IX. 1. The *Heart* of an *Eel* being taken out and laid upon a Plate of Tin in a a ſmall *Receiver* when we perceived it to *Beat* there as it had done in the open *Air*, we *Exhauſted* the Veſſel, and ſaw, that though the *Heart* grew very Tumid, and here and there ſent forth litttle *Bubbles*, yet it continued to beat as manifeſtly as before, and ſeem'd to do ſo more ſwiftly; as we tryed by numbring the *Pulſations* it made in a *Minute*, whilſt it was in the *Exhauſted Receiver*, and when he had readmitted the *Air*, and alſo when we took it out of the Glaſs and ſuffered it to continue its Motion in the open *Air*.

2. The *Heart* of another *Eel*, after having been included in a *Receiver*, firſt *Exhauſted* and then accurately ſecur'd from leaking, though it appear'd very Tumid, continued to *Beat* there an *Hour*; after which looking upon it, and finding its Motion very Languid, and almoſt ceas'd, by *breathing* a little upon that part of the Glaſs where the *Heart* was, it quickly regained Motion, which I obſerv'd a while, and an *Hour* after, finding it to ſeem almoſt quite Gone, I was able to renew it by the Application of a little more Warmth.

At the End of the 3*d Hour*, I could no more excite it by *Warmth*: Wherefore I ſuffer'd the outward *Air* to ruſh in, but could not diſcern, that thereby the *Heart* regained any ſenſible Motion, though aſſiſted with the *Warmth* of my *Breath* and *Hands*.

X. A

X. A ſufficient Number of Inſtances of *Animals* kill'd in the *Exhauſted Receiver*, is to be met with in our other *Experiments*: And therefore I ſhall now ſubjoyn ſome *Trials*, about the *Times* wherein Animals may be kill'd by that want of *Reſpiration*, which, in thoſe that are *Drowned*, is cauſed by the *Water* that Suffocates them. *Animals Drowned and Deprived of Air.*

1. *Sept.* 10. A *Green Finch*, having his Legs and Wings tyed to a Weight, was gently let down into a *Glaſs body* fill'd with *Water*; and at the end of *half* a *Minute* he was found quite *Dead*.

2. A *Sparrow*, that was luſty and quarrelſome, was let down after the ſame manner; but though he ſeem'd to be under *Water* more vigorous than the other Bird, and continued ſtrugling almoſt to the very end of *half* a *Minute* from the time of his being totally *Immerſed* (during which ſtay under *Water* there Aſcended from time to time, pretty large *Bubbles* from his Mouth.) yet notwithſtanding that as ſoon as ever the *half* a *Minute* was compleated he was drawn up, we found him, to our Wonder, *irrecoverably gone*.

3. A ſmall *Mouſe*, being held under *Water* by the Tail, Emitted from time to time divers *Aerial Bubbles* out of his Mouth, and at laſt, as one of the Spectators affirmed he ſaw, at one of his Eyes; being taken out at the end of *half* a *Minute* and ſome few *Seconds*, he yet retained ſome Motions: But they proved but *Convulſive* ones, which at laſt ended in *Death*.

4. We took the *Duck* (mentioned above) and ſo tyed a conſiderable Weight of Lead to her Body, as it did not hinder her *Reſpiration*, and yet would be ſure to keep her down under *Water*. With this Clog ſhe was put into a Tub full of clear *Water*, under whoſe Surface ſhe continued about a *Minute* by my Watch quietly enough, but afterwards began to appear for a while much diſturbed; which fit being over our not perceiving any Motion in her made us, at the end of the *Second Minute*, take her out of the *Water*, to ſee in what Condition ſhe was, and finding her in a good one, after we had allow'd her ſome Breathing time to recruit her ſelf with *Freſh Air*, we let her down again into the Tub, which in the mean time had been fill'd with *Freſh Water*. After a while, ſhe begun, and from time to time continued, to Emit divers *Bubbles* at her Beak. There alſo came out at her Noſtrils divers real *Bubbles* from time to time; and when the Animal had continued about *two Minutes* or better under *Water*, ſhe began to Struggle very much, and to endeavour either to Emerge, or change Poſtures; the latter of which ſhe had liberty to do, but not the former. After *Four Minutes* the *Bubbles* came much more ſparingly from her: Then alſo ſhe began to *Gape* from time to time, (which we had not Obſerv'd her to do before,) but without Emitting *Bubbles*; and ſo ſhe continued *gaping* till near the end of the *6th Minute*, at which time all her Motions, ſome of which were judg'd *Convulſive*, and others that had been excited by our rouzing her with a Forceps, appear'd to ceaſe, and her Head to hang careleſly down as if ſhe were quite *Dead*. Notwithſtanding which, we thought fit for greater ſecurity to continue her under *Water* a full *Minute* longer, and then finding no Signs of *Life* we took her out; and being hung by the Heels, and gently preſs'd in convenient places, ſhe was made to void a pretty Quantity of *Water*. But all the Means that were uſed, to recover the *Vid. Sup.* 8. *Exp.* 1.

Bird

Bird to *Life*, proving Ineffectual, we concluded, she had been *Dead* a full *Minute* before we remov'd her out of the *Water*: So that to Sum up the Event of our *Experiment*, even this *Water-Bird* was not able to *Live* in *Cold Water*, without taking in *Fresh Air*, above 6 *Minutes*.

Vid. Sup. I. Exp. 2.

5. The *Duckling*, (mentioned above,) having a Competent Weight ty'd to her Legs, was let down into a *Tub* of *Water*. There came out store of *Bubbles* at her Nostrils, but there seem'd to come out more and greater from a certain place in her Head almost equidistant from her Eyes, but somewhat less remote from her Neck than they. After much strugling and frequent gaping, she had divers *Convulsive* Motions, and then let her Head fall down backward, with her Throat upwards. To which moveless Posture she was reduced at the End of the *third Minute*, if not a little sooner; but a while after there appear'd a manifest but tremulous Motion in the two parts of her Bill, which continued for some time, but afforded no Circumstances, whereby we could be sure, that they were not *Convulsive* Motions; but these also ceasing upon the end of the *fourth Minute*, the Bird was taken out and found *irrecoverable*.

From these two Experiments it appears, that tho' *Water Foul* (at least *Ducks*) could not in our *Receivers* endure the want of *Air* much longer than other *Birds*; Yet by that Contrivance of Nature mention'd about the *Heart*, they are enabled to continue much longer under *Water*.

6. A *Viper*, that was kept so many *Hours* in an *Exhausted Receiver* till it was concluded to be stark *Dead*, and to have been so for a good while, was kept all Night in a Glass-body upon a warm Digestive Furnace: Whereupon the *Viper* was found, the next Morning, to be very *lively*. We then put her into a tall Glass Body, fitted with a Cork to the Orifice of it, and depressed with Weight, so that she could come at no *Air*. And after she had been *ducked* a while, she lay with a very little Motion for a considerable space of time. At an *Hour* and a *Quarter* she often put out her black Tongue; At near 4 *Hours* she appear'd much *alive*, and, as I remember, about that time also put out her Tongue, *Swimming* all this while, as far as we Observ'd, above the Water. At the end of about 7 *Hours* or more, she seem'd yet to have some *Life* in her, her Posture being manifestly changed in the Glass from what it was a while before, unless that might proceed from some difference made in her Body as to Gravity and Levity. Not long after she appear'd quite *Dead*. Her Head and Tail hanging down movelessly, and directly towards the Bottom of the Vessel, whilst the middle of the Body floated as much as the above mentioned Cork would permit it.

I must here take Notice, that though some of the above mentioned Animals seem by the Relations we have given of them, to have been a little sooner destroy'd by *Drowning*, than any we have mention'd were by our *Engine*, yet that is no sure proof, that *Suffocation* does kill Animals faster than the *Deprivation* of *Air*, they are exposed to in our *Engine*. For in *Drowning*, that which destroys is applyed to its full Vigour at the very first, and all at once: Whereas our *Receivers*, being made for several Purposes, the *Deprivation* of the *Air*, that they make cannot be made all at once, but the *Air* must be *Pump't* out by

by Degrees; ſo that till the laſt the *Receiver* will be but partly emptied. For Confirmation of which I have this to alledge, that, having in the preſence of ſome *Virtuoſi*, provided for the Nonce a very ſmall *Receiver*, wherein yet a *Mouſe* could Live ſome time if the *Air* were left in it, we were able to evacuate it at *one Suck*, and by that Advantage we were enabled, to the Wonder of the Beholders, to kill the Animal in leſs than *half* a *Minute*.

Animals in Rarify'd Air. n. 63. p. 2036.

XI. 1. *Aug.* 16. A *Linnet* being put into a *Receiver*, capable to hold about $4\frac{1}{2}$ *Pints* of Water, the Glaſs was well clos'd with Cement and a Cover; but none of the *Air* was drawn out with the *Engine* or otherwiſe. And though no new *Air* was let in, nor any change made in the impriſon'd *Air*, yet the *Bird* continu'd there 3 *Hours* without any apparent approach to *Death*; And though it ſeem'd ſomewhat *Sick*, yet being afterwards taken out it recovered, and Liv'd ſeveral *Hours*.

2. *Aug.* 18. From the above mention'd *Receiver* about *half* the *Air* was drawn out, a *Linnet* being then in the Glaſs, and in that *Rarified Air* (which appear'd by a *Gage* to continue in that State) the *Bird* lived an *Hour* and near a *Quarter* before it ſeemed in danger of *Death*; after which the *Air* being let in without taking off the *Receiver*, ſhe manifeſtly recover'd, and leaped againſt the ſide of the Glaſs; being taken out into the *open Air* ſhe flew out of my Hand to a pretty Diſtance.

3. *Sept.* 9. We convey'd into a *Receiver*, capable to hold about $4\frac{1}{2}$ *Pints* of Water, a *Lark*, together with the *Gage*, by the Help whereof we Pump'd out of the *Receiver* $\frac{3}{4}$ of the *Air* that was in it before; then heedfully obſerving the *Bird*, we perceived it to pant very much, ſo that a Learned Phyſitian (from whom I yet diſſented,) judged thoſe Beatings to be *Convulſive*: Having continued thus for a little above a *Minute* and a half; the Bird fell into a true *Convulſive* Motion, that caſt it upon the Back. And although we made great Haſt to let in the *Air*; yet before the Expiration of the *Second Minute*, and conſequently in leſs than *half* a *Minute* from the time immediately preceeding the *Convulſion*, the *Lark* was gone paſt all Recovery.

4. Preſently after we put into the ſame *Receiver* a *Greenfinch*, and having withdrawn the *Air*, till it appeared by the *Gage* there remained but *half*, we took Notice, that, within a *Minute* after, ſhe appeared to be very *Sick*, and ſhaking her Head, threw againſt the inſide of the Glaſs a certain Subſtance, which I took to be Vomit, and which afterwards appear'd ſo; upon this *Evacuation* the *Bird* ſeemed to recover, and continue pretty well (but not without panting) till about the end of the 4*th Minute*, at which growing very *Sick*, ſhe vomited again (ſhaking her Head as at firſt,) but much more unqueſtionably than before, and ſoon after eat up again a little of her Vomit; at which time (whether that contributed to her Recovery or no) ſhe very much recovered. And though ſhe had, in all, three fits of Vomiting, yet for the laſt 7 or 8 *Minutes* that we kept her in the *Receiver*, ſhe ſeem'd to be much more *lively* than was expected: Which may in part be attributed to a little *Air* that by an Accident got in, tho' it were immediately *Pump'd* out again. At the end of a full

Quarter of an *Hour* from the first *Exhauſtion* of the *Receiver*, the Bird appearing not likely to *Dye* in a great while, we took her out.

5. *Apr.* 12. A *Viper* was included, together with a *Gage*, in a Portable *Receiver*, capable to hold $3\frac{1}{2}$ *Pints* of Water. This Veſſel being *Exhauſted*, and ſecured againſt the Regreſs of the *Air*, the Impriſoned Animal was obſerv'd not only to be *alive*, but nimbly to put out and to draw back its Tongue, about 36 *Hours* after it was firſt ſhut up. At the end of 60 *Hours* as I was going to Bed ſhe appear'd very dull and *faint*, and not likely to *live* much longer; the next Day after *Dinner*, I found her Stark *dead*, with her Mouth open'd to a ſtrange wideneſs: Wherefore ſuffering *Water* to be impelled by the outward *Air* into the Cavity of the *Receiver*, we found that 4 parts of 5, or rather 5 of 6 of the Veſſelled *Air* had been *Pumped* out.

Difficult Reſpiration at the Tops of Mountains.

6. I ſhall here add, that, an Eccleſiaſtical Perſon, who had viſited thoſe *high Mountains* of *Armenia*, (on one of which, becauſe of their *Height*, the Tradition of the Natives will needs have the *Ark* to have reſted;) told me, that thoſe *Mountains* were really exceeding *high*, and that he could not come to the *Top*, (becauſe of the unpaſſable Snows. And that whilſt he was in the upper part of the *Mountain*, he plainly perceived, that he was reduced to fetch his Breath much oftener than he was wont, and than he did before he Aſcended the Hill and after he came down from it; And that, having expreſt ſome wonder to find himſelf ſo ſhort winded, the People told him, that it was no more than happen'd to them when they were ſo high above the plain; it being a Common Obſervation among them. He alſo told me, that he made the like Obſervation upon the *Top* of a Mountain in the Country of *Sevennes*, in or near the Province of *Languedock*.

A Learned Travailer, who was a Perſon very Curious and Intelligent, told me, that being invited, about the Beginning of *September* to viſit a Neighbouring Mountain, that is at leaſt one of the *Higheſt* of the *Pyreneans*, which is commonly call'd *Pic de Midi*, they found the *Air* there not ſo fit for *Reſpiration* as common *Air*, and were fain to breath *ſhorter* and *oftner*, than uſual; and becauſe I ſuſpected, that might come from their Motion, I ask'd, whether they obſerv'd it to ceaſe when they came down to the *Bottom* of the *Hill*, which he told me they plainly did; beſides that, they ſtayed many *Hours* at the *Top*, too long to continue out of *Breath*.

It is worth further Inquiry, whether the Sickneſs, if not alſo the Difficulty of Breathing, that ſome have been obnoxious to in the uppermoſt parts of *Pariacacha*, and perhaps ſome other *high Mountains*, may not be imputed, not ſo preciſely to the *Thinneſs* and *Rarity* of the *Air* in places ſo remote from the lowermoſt part of the *Atmoſphere*, as to exclude certain *Steams* of a peculiar Nature, which in ſome places the *Air* may be Imbued with? For an Intelligent Perſon Informed me, that he had attempted to go up to the *Top* of the *Pic* of *Teneriffe*: But that, though ſome of the Company were able to do ſo, he and ſome others, before they had reached near ſo *high*, grew ſo *Sick* upon the Operation they felt of the ſharp *Air*, and *Sulphurous Exhalations* which infected it, that they were fain to ſtay behind their Companions, he having already found

found this Effect of thoſe *piercing Steams* upon his Face, that the Skin began to be of a pale-Yellow, and even his Hair to be diſcoloured.

XII. We included a *Mouſe* in a fine limber and clear *Bladder*, made more Tranſparent by being anointed with *Oyl*, on the Outſide that the ſmell of it might leſs offend him. *Animals in the ſame* Air, *Vary'd as to* Denſity.

Then, to make up ſo large an Orifice without Wrinkles, (at which the *Rarify'd Air* may eſcape) we provided a round ſtick, ſomewhat leſs than the Orifice, which we laid over with a cloſe and yielding Cement, (for Pitch, or the like common Stuff, will not alwayes ſerve the turn) and ty'd the *Bladder* faſt and cloſe enough upon it, leaving in the *Bladder* as much *Air* as we thought might ſuffice him for as long a time as the *Experiment* was to laſt. Then putting this Limber or *Extenſible Receiver*, if I may ſo call it, into an ordinary one of Glaſs, and placing this *Engine* near a Window, that we might ſee through both of them; the *Air* was by Degrees Pumped out of the *External Receiver*, (as for Diſtinctions ſake I ſhall call it, and thereupon the *Air* included in the *Bladder* did proportionally expand it ſelf, and ſo diſtend the *Internal Receiver*, till being arrived at a Degree of *Rarefaction*, which rendred it unfit for the included *Mouſe's Reſpiration*, I perceived, though with ſome Difficulty, in this Animal the Signs of his being in great Danger of *Sudden Death*. Whereupon the outward *Air*, being haſtily let into the *External Receiver*, compreſſed the ſwelled *Bladder* to its formed Dimenſions, and thereby the *Included Air* to its former *Denſity*, by which means the *Fainting Mouſe* was quickly *revived*. Having given him ſome convenient time of Reſpite, the *Experiment* was reiterated with the like Succeſs; and we doubted not but the *third Trial* we made, would have ended as the two former did: But that, whilſt we were conſidering of the Sickneſs of the *Mouſe*, which, by Reaſon of ſome Opacity that could ſcarce be avoided in the Wrinkled Bladder, was not, as to its Degree, ſo eaſily taken notice of, it grew *irrecoverable* by the ſubſequent *Condenſation* of the *Air*.

XIII. 1. We took a good Company of *Tadpoles*, and put them with a convenient *Quantity* of *Water* into a Portable *Receiver* of a round Figure, and Obſerv'd, that at the firſt *Exſuction* of the *Air*, they did riſe to the top of the Water though moſt of them ſubſided again, till the next *Exſuction* raiſed them. They ſeem'd by their Active and Wrigling Motion to be very diſcompoſed. The *Receiver* being *Exhauſted* they continued reſtleſs, moving all of them in the top of the Water, and tho' ſome of them ſeem'd to endeavour to go to the Bottom, and dived ſome part of the way, eſpecially with their Heads, yet they were immediately buoyed up again. Within an Hour or a little more they were all moveleſs, and lay floating on the Water; wherefore I opened the *Receiver*, upon which the *Air* ruſhed in, and almoſt all of them (which were many) preſently ſunk to the Bottom, but none of them recovered to *Life*. *The* Production *and* Growth *of Animals, in an* Exhauſted Receiver.

2. A little after theſe, we included a leſſer Number of *Tadpoles* in a ſmaller Glaſs, which was alſo *Exhauſted* with the like Circumſtances with the former. And when I found the other *Tadpoles* to be *dead*, I haſted to theſe which did not, except perhaps one, give any Sign of *Life*, but upon letting in the *Air*, theſe having not been long kept from it, ſome few of them did *recover*, and

ſwam up and down lively enough for ſome time; though after a while they alſo *Dy'd*.

3 Some years after, I repeated the ſame *Experiment*: And though after the *Exhauſtion* was perfected, the *Tadpoles* did for a while move briskly enough on the top of the Water, (none of them appearing able to Dive or Swim under Water) yet coming to look on them after the end of an *Hour*, they ſeem'd to be all of them quite *Dead*, yet continued floating. And though within *half* an *Hour* after that, I let in the *Air* upon them, yet all the Effect of it was, that the moſt of them immediately ſunk to the Bottom, as the reſt of them did a very little while after; none of them, that I could Obſerve, recovering any *Vital Motion*.

4. Having, after much watching and with much ado, got 4 or 5 of thoſe odd *Aquatick Inſects*, whereof *Gnats* are generated, about the end of *Auguſt*, after a Shower of *Rain* which dropt from a Houſe into a Veſſel laid on purpoſe for it, we included them with ſome of their *Water* into a ſmall Glaſs *Receiver*, which being very exactly cloſed we kept in a South-Window, where thoſe little Creatures continued to Swim up and down for ſome few *Days*, without ſeeming to be much incommodated by ſo unuſual an Habitation; and at the end of that time, and much about the ſame Day, they Diveſted the Habit they had whilſt they lived as Fiſhes, and appear'd with their *Exuviæ*, or caſt Coats, under their Feet, ſhewing themſelves to be perfect *Gnats*, that ſtood without ſinking upon the Surface of the *Water*, and diſcovered themſelves to be *alive* by their Motion, when they were excited to it: But I could not perceive them to *fly* in that *Thin Medium*, to which Inability, whether the *Viſcoſity* of the *Water* might contribute, I know not; though they *lived* a pretty while, till Hunger or Cold deſtroy'd them.

The Expanſion of Blood *and other* Animal Juices, *and of the* Soft Parts *of the Body.*

1. The warm *Blood* of a *Lamb*, or a *Sheep*, being taken as it were haſtily brought from the Butchers, where the Fibres had been broken to hinder the *Coagulation*, was in a wide Mouth'd Glaſs put into a *Receiver*, made ready for it; and the *Pump* being early ſet on Work, the *Air* was diligently drawn out. After a long Expectation, the more ſubtile parts of the *Blood* would begin to force their way through the more Clammy ones, and ſeem to boyle in large Cluſters, ſome as big as great Beans or Nutmeggs; and ſometimes, to the wonder of the by-ſtanding Phyſitians, the *Blood* was ſo Volatile, and the Expanſion ſo Vehement, that it boyled over the containing Glaſs; of which, when it was put in, it did not, by our Eſtimate, fill above a Quarter.

Having alſo included ſome *Milk*, warm from the Cow, in a Cylindrical Veſſel of about 4 or 5 Inches high, when the *External Air* was *fully* withdrawn, the white Liquor began to boyle in a way that was not ſo eaſy to deſcribe, as pleaſant to behold: And this it did for a pretty while, with ſo much Impetuoſity, that it threw up ſeveral parts of it ſelf out of the wide mouthed Glaſs that contained it (and could have contained as much more) though there were not above two or three *Ounces* of the Liquor.

A yet greater Diſpoſition to the *Intumeſcence* we thought we obſerv'd in the *Gall*, which was but ſuitable to the *Viſcoſity* of the Texture.

Note,

Note, that the two foregoing Experiments were made with an Eye caſt upon the Inquiry, that I thought might be made, Whether, and how far, the Deſtructive Operation of our *Engine* upon the *Included Animal*, might be imputed to this, that upon the *withdrawing* of the *Air*, beſides the removal of what the *Air*'s preſence contributes to *Life*, the little *Bubbles* generated upon the abſence of the *Air* in the *Blood*, *Juices*, and *Soft Parts* of the Body, may by their vaſt Number and their conſpiring Diſtenſion, variouſly Streighten in ſome places, and ſtretch in others, the Veſſels, eſpecially the ſmaller ones, that convey the *Blood* and *Nouriſhment*; and ſo by choaking up ſome Paſſages and vitiating the Figure of others, diſturb or hinder the due *Circulation* of the *Blood*? Not to mention the Pains that ſuch *Diſtenſions* may cauſe in ſome *Nerves*, and *Membranous Parts*, which by irritating ſome of them into *Convulſions*, may haſten the *Death* of Animals, and deſtroy them ſooner by Occaſion of that Irritation, than they would be deſtroyed by the bare abſence, or loſs, of what the *Air* is neceſſary to ſupply them with. And to ſhew, how this Production of *Bubbles* reaches even to very minute Parts of the Body, I ſhall add on this Occaſion, (hoping that I have not prevented my ſelf on any other,) what may ſeem ſomewhat ſtrange, what I once obſerved in a *Viper*, furiouſly tortured in our *Exhauſted Receiver*, namely, that it had manifeſtly a conſpicuous *Bubble* moving to and fro in the Wateriſh Humor of one of its Eyes.

2. And to ſhew, that not only the *Blood* and *Liquors*, but alſo the other *Soft Parts*, even in *cold* Animals, have *Aerial* Particles latitant in them; we took the *Livers* and *Heart* of an *Eel*, as alſo the *Head* and *Body* of another *Fiſh* of the ſame kind, cut aſunder croſs ways ſomewhat beneath the *Heart*, and putting them into a *Receiver*, upon the *withdrawing* of the *Air* we perceived, that the *Liver* did manifeſtly *Swell* every way, and that both the upper and lower Parts did ſo likewiſe; and at the place where the Diviſion had been made there came out, in each portion of the *Fiſh*, divers *Bubbles*, ſeveral of which ſeemed to come from the *Medulla Spinalis*, or the Cavity of the *Back-bone*, or the adjoyning Parts, and the *External Air* being let in, both the Portions of the *Eel* preſently ſhrunk, ſome of the Skin ſeeming to be grown Empty or Flaccid in each of them.

Aſſuefaction to *Rarify'd Air*.

XIV. 1. We included in a round Viol with a wide Neck, (the whole Glaſs being capable of containing about 8 *Ounces* of Water) a Young and ſmall *Mouſe*, and then tyed ſtrongly upon the upper part of the Glaſſes Neck a fine thin *Bladder*, out of which the *Air* had been carefully expreſſed, and then conveyed this Phantaſtical Veſſel into a middle ſized *Receiver*, in which we alſo placed a *Mercurial Gage*. The *Air* was by Degrees pumped out, till it appeared by the *Gage*, that there remained but a 4*th* part in the *External Receiver* (as for Diſtinctions ſake I call it;) whereupon the *Air* in the *External Receiver* Expanding it ſelf, appear'd for to have blown the *Bladder* almoſt half full, and the *Mouſe* ſeeming very ill at eaſe by his Leaping, and otherwiſe endeavouring to paſs out, at the Neck of his uneaſy Priſon; we did, for fear the over-*Thin Air* would diſpatch him, let the *Air* flow into the *External Receiver*, whereby

whereby the *Bladder* being compreſs'd, and the *Air* in the Viol reduced to its former *Denſity*, the little Animal quickly *recover'd*.

2. A while after, without removing the *Bladder*, the *Experiment* was repeated, and the *Air* by the help of the *Gage*, was reduced to its former Degree of *Rarefaction*; and the *Mouſe* was kept in that *Thin Air* for full 4 *Minutes*; at the end of which he appeared ſo *Sick*, that, to prevent his *Dying* immediately, we remov'd the *External*, and took out the *Internal Receiver*. Whereupon, though he recovered, yet 'twas not without much Difficulty; being unable to ſtand any longer upon his Feet, and for a great while after continued manifeſtly *Trembling*.

3. But having ſuffered him to reſt a reaſonable ſpace of time, preſuming that *Aſſuefaction* had accuſtomed him to greater Hardſhips, we convey'd him again into the *External Receiver*, and having brought the *Air* to the former Degree of *Expanſion*, we were able to keep him there for a full *Quarter* of an Hour. And 'tis worth Noting, That, till near the latter end of the *Quarter* of an *Hour*, not only the Animal did ſcarce at all appear *diſtreſſed*, remaining ſtill very quiet; but, which is more, whereas when he was put in, the Tremblings formerly mention'd were yet upon him and continued ſo for ſome time, yet afterwards, in ſpight of the *Expanſion* of the *Air* he was then in, they left him early enough. And when the *Internal Receiver* was taken out, he did not only recover from his *Fainting Fit* ſooner than before, but eſcaped thoſe ſubſequent *Tremblings*.

4. After we had allow'd him ſome time to recollect his Strength, we reconveyed him into the *Receiver*, and *Pump'd* out the *Air*, till the *Mercury* in the *Gage* was not only drawn down as *low* as formerly, but near half an *Inch* lower. And though this did at firſt ſeem to diſcompoſe our little Beaſt, yet after a while he grew very quiet, and continued ſo for a full *Quarter* of an *Hour*; when we cauſed 3 *Exſactions* more to be made by the *Pump*, before we diſcovered him to be in manifeſt Danger (at which time the *Bladder* appeared much fuller than before:) But then we were oblig'd to let the *Air* into the *outward Receiver*; whereupon the *Mouſe* was more ſpeedily revived than one would have ſuſpected.

And theſe *Trials* of the Power of *Aſſuefaction* ſeem'd the more conſiderable, becauſe the *Air*, in which the *Mouſe* had all this while *lived*, had been clogged and infected with the *Excrementitious Effluviums* of his Body; for 'twas the ſame all along, we having purpoſely forborn to take off the *Bladder*.

Unfit for Reſpiration, *yet retaining its* Denſity.

XV. 1. We took a *Mouſe* of an ordinary Size, and having (not without ſome Difficulty) conveyed him into an Oval Glaſs fitted with a ſomewhat long and conſiderably broad Neck, we conveyed in after him a *Mercurial Gage*, in which we had diligently Obſerv'd and marked the Station of the *Mercury*, and which was ſo faſtened to a Wire reaching to the Bottom of the Oval Glaſs, that the *Gage*, remaining in the Neck, was not in danger to be broken by the Motions of the *Mouſe* in the Oval part: The upper part of the long Neck of the Glaſs was, notwithſtanding the wideneſs of it, *Hermetically Seal'd*: And though by Reaſon of the largeneſs of the Veſſel in Compariſon of ſo ſmall an Animal,

Animal, he ſeem'd to me rather drooping than very near *Death* at the end of the *Second Hour*; yet coming to look upon him about *half* an *Hour* after, he was judged by the Spectators quite *Dead*, notwithſtanding our ſhaking of the Veſſel to rouze him up. This made me caſt my Eyes upon the *Gage*, wherein I could not perceive any ſenſible Change of the *Mercuries* Station. But having cauſed the *Seal'd* part of the Glaſs to be broken off, and *freſh Air* to be blown in by a pair of *Bellows*, the gaſping Animal *revived*, tho' but ſlowly.

2. Such an Experiment as the former we made with like Succeſs upon a ſmall *Bird* included with a *Gage* in a *Receiver* holding about a *Quart* of Water. The *Bird* in about *half* an *Hour* appeared to be *Sick* and drooping, and the Faintneſs and Difficulty of Breathing increaſed for about *two Hours* and an *half* after that, at which time the Animal *Dyed*, the *Gage* being not ſenſibly altered.

3. In a *Glaſs Viol*, capacious enough to hold about 3 *quarts* of Water, we *Hermetically Seal'd* up a ſmall *Bird*, and found, that in a few *Minutes* he began to be *Sick* and *Pant*; which *Symptoms* I ſuffered to continue and increaſe againſt the Mind of a Learned Byſtander, (who thought the Animal would not hold out ſo long) till they had laſted juſt *half* an *Hour*; at which time having provided a Veſſel of *Water*, made exceeding *Cold* with *Sal Armoniack*, newly put into it, the Viol with the *Sick Bird* was immers'd in it, and kept there in that Condition for 6 *Minutes*; and yet it did not appear, that this great *Refrigeration* did ſenſibly *Refreſh* the *drooping Animal*. So that this Remedy proving ineffectual, the *Viol* was removed out of the *Water*, and the *Bird* ſometime after did, as I foretold, make many ſtrains to *Vomit* (though ſhe brought up little) followed by *Evacuations* downward, before ſhe quite *Expired*, which ſhe did within a *Minute* or *two* of a juſt *Hour*, after the beginning of her *Impriſonment*.

XVI. We made by *Diſtillation* a Blood-Red Liquor, which I have with very little variation communicated in the *Hiſtory* of *Colours*, and which chiefly conſiſts of ſuch *Saline* and *Spirituous* Particles, as may be Obtained from the *Maſs* of *Blood* in Humane Bodies; this Liquor is of ſuch a Nature, that if a Glaſs Viol, about half fill'd with it, be kept well *ſtopp'd*, the Red Liquor will reſt as quietly as any ordinary one, without ſending up any *Smoak* or viſible *Exhalation*; But if the Viol be Unſtopped, ſo that the *External Air* be permitted to come in, and touch the Surface of the Liquor, within a *Quarter* of a *Minute* or leſs, there will upon this Contact be elevated a copious white *Smoak*, which will not only fill the upper part of the Glaſs, but plentifully paſs out into the open *Air*, till the Viol be again ſtopped. This Experiment may ſerve to illuſtrate the Office of the *Air* to carry off in *Expiration* the *Fuliginous Steams* of the *Lungs*. For, in our Experiment we manifeſtly ſee, that the very *Contact* of the *Air* may give the *Corpuſcles* of moiſt Bodies a peculiar Volatility, or Facility to Emerge in the form of *Steams*. It may here ſuffice to take Notice of theſe two things: The one is, That when the Viol has lain *Stopped* and Quiet a competent time, the upper half of it will appear deſtitute of *Fumes*, of which the *Air*, it ſeems, will imbibe, and conſtantly retain but a certain moderate Quantity, which may give ſome Light towards the Reaſon,

The uſe of Air in Reſpiration.

Why

Why the ſame *Air*, which will be quite Clogged with *Steams*, will not long ſerve for *Reſpiration*, which requires frequent Supplies of *freſh Air*: The other is, That if the *unſtopped* Viol were placed in our *Vacuum*, it would not Emit any viſible *Steams* at all, nor ſo much as to appear in the upper part of the Glaſs it ſelf that held the Liquor; whereas, when the *Air* was by Degrees reſtored at the Stopcock, without moving the *Receiver* it ſelf, to avoid injuring its cloſeneſs, the returning *Air* would preſently raiſe the *Fumes*, firſt into the Vacant part of the Viol, whence they would Aſcend into the Capacity of the *Receiver*; and likewiſe, when the *Air*, that was requiſite to ſupport them, was Pumped out, they alſo accompanied it, as their unpleaſant Smell evinced, and the Red Spirit, tho' it remain'd *unſtopped*. Emitted no more *Fumes* till the *Air* was let in.

Snails, Efts, *and* Leeches.

XVII. 1. Two *White Snails without Shells* of differing Sizes (the biggeſt about an *Inch* and a *half*, and the other about an *Inch* in length) were Included in a ſmall portable *Receiver*, which was carefully *Exhauſted*, and ſecured againſt the Return of the *Air*. Preſently after 'twas Remov'd from the *Engine*, it was eaſy to diſcern, that both the *Snails* thruſt out and retracted their Horns (as they are commonly call'd) at pleaſure, though their Bodies had in the ſofter places pretty ſtore of newly generated *Bubbles* ſticking to them: But though they did not loſe their Motion near ſo ſoon, as other Animals were in our *Vacuum* want to do; yet coming to look on them after ſome *Hours*, they appear'd moveleſs and very Tumid, and at the end of 12 *Hours* the Inward Parts of their Bodies ſeemed to be almoſt vaniſhed, and they ſeemed to be but a couple of ſmall full blown Bladders; and on the letting in of the *Air* they immediately ſo ſhrunk, as if the Bladders having been pricked, the receding *Air* had left behind it nothing but Skins; nor did either of the *Snails* afterwards, though kept many *Hours*, give any Signs of *Life*.

2. We included in a *Receiver*, whoſe Globular part was about the bigneſs of a large *Orange*, one of that ſort of Animals that they vulgarly call *Efts*: Having *withdrawn*, but not ſollicitouſly, the *Air*, we kept him there about 48 *Hours*; during all which time he continued *alive*, but appeared ſomewhat *Swelled* in his Belly; his under-chap moving the very firſt Night, but not the Day and Night following. By opening the *Receiver* at length under Water, we perceived, that about *half* the *Air* had been drawn out. As ſoon as the Water was impelled into the Glaſs, the Animal, that was before *Dull* and Torpid, ſeem'd, by very nimble and extravagant Motions, to be ſtrangely *Reviv'd*.

3. We took a *Leech*, that was of a moderate bigneſs, or ſomewhat ſhort of it, and having included it together with ſome *Water* in a Portable *Receiver*, that was gueſſed to be capable of holding about 10 or 12 *Ounces* of that Liquor; the *Air* was *Pumped* out after the uſual manner, and the *Receiver* being remov'd to a lightſome Place, we obſerved, as we expected, that the *Leech* keeping her ſelf under *Water*, there Emerged from divers Parts of her Body ſtore of *Bubbles*, ſome of them in a diſperſed way, but others in Rows or Files, if I may ſo ſpeak, that ſeem'd to come from determinate Points. Though this Production of *Bubbles* laſted a pretty while, yet the *Leech* did not ſeem to be very

very much *discompos'd* by her present Condition: For after 5 *Days* (tho' the *Receiver* continued well *Exhausted*) we found her very *Lively*.

XVIII. 1. We took 5 or 6 *Caterpillars* of the same sort; and had the *Air* drawn from them, and carefully kept from Returning. About an *Hour* after, I found them Moving to and fro in the *Receiver*; and even above *two Hours* after that, I could by shaking the Vessel, excite in them some Motions, that I did not suspect to be *Convulsive*. But about 10 *Hours* after they were first Included, they seem'd to be quite *Dead*; yet the *Air* being forthwith restored to them, I found the *next Day* that 3 or 4 of them, were perfectly *Alive*. *Creeping Insects.*

2. We took from a Hedge a Branch, that had a large Cobweb of *Caterpillars* in it, and having divided it into two parts, we put them into like *Receivers*; and in One of them shut up the *Caterpillars* together with the *Air*, which from the other was *Exhausted*. The Event was, That in that which had the *Air*, the little and difficultly Visible *Insects*, after a small time, appeared to *Move* up and down as before, and so continued to do for a *Day* or *two*, whereas that Glass whence the *Air* had been drawn out, and continued kept out, shewed after a very little while no *Motion* that we could perceive.

XIX. 1. *Nov.* 12. 8. at Night, There were taken 4 middle siz'd *Flesh-flies*, which having their Heads cut off were inclosed in a Portable *Receiver*, furnished with a pretty large Pipe and a Bubble at the end. As soon as the *Receiver* was *Exhausted*, those *Flies* lost their *Motion* (which was not brisk before); an *Hour* or *two* after, I approached them to the Fire, which restored not their *Motion* to them (but as to one of them I suspected it had a Languid Motion for a while); wherefore I let in the *Air* upon them, after which in a very short time (though not immediately they began one after another to *Move* their Legs, and one or two of them to *Walk*. *Winged Insects.*

2. *Sept.* 11. About Noon, we *clos'd* up divers ordinary *Flies*, and a *Bee* or *Wasp*; all which, when the *Air* was fully withdrawn, lay as *Dead*, save that for a very few *Minutes* some of them had *Convulsive* Motions in their Legs: They continued in this state 48 *Hours*, after which the *Air* was let in upon them, but none of them *Recovered*.

3. *Decem.* 11. At Night, we put a great *Flesh-Fly* into a very small portable *Receiver*, where at first it appear'd to be very *brisk* and *Lively*, but as soon as the *Air* was Drawn out, fell on his back, and seemed to have *Convulsive* Motions in her Feet and *Proboscis*, from whence she presently *Recover'd*, upon the letting in of the *Air*; which being drawn out again, she lay as *Dead*: but a while after, (within a *Quarter*, or *half* an *Hour*) I perceived, that upon shaking the *Receiver*, she stirred up and down, but faintly. The next Night, by Warmth and letting in the *Air*, the *Fly* recovered: But being next Morning *Seal'd up* again in that Glass, and kept 48 *Hours*, though over the *Chimney*, she *Died* for good and all.

4. We took a large *Grass-hopper*, whose Body, besides the Horns and Limbs, was about an *Inch* in length, and of a great Thickness in proportion to that length: This we conveyed into a Portable *Receiver* of an Oval Form,

and capable of holding (by our Gueſs) about a *Pint* of Water. When the *Air* began to be conſiderably *Rarified*, he appeared to be very ill at eaſe, and ſeemed to *Sweat* out of the *Abdomen* many little drops of Liquor, which being united trickled down the Glaſs like a little Stream, which made at the Bottom a ſmall Pool of clear Liquor, amounting to near a *quarter* of a *Spoonful*, and by that time the *Receiver* was ready to be taken off, the *Graſs hopper* was fallen upon his Back, and lay as *Dead*, and continued ſo for 3 *Hours*; After which the *Air* being let in upon him, He continued without any Signs of *Life* for a *quarter* or *half* an *Hour:* But being carried to a Sunſhiny place, the Beams of a Declining Sun preſently began to make him *Stir* his Limbs, and in a ſhort time brought him perfectly to *Life* again.

5. *Apr.* 15. We took one of thoſe *Shining Beetles* they call *Roſe Flies*, and having included it in a very ſmall round *Receiver*, which we *Exhauſted*; and though it ſtrugled much whilſt the *Air* was withdrawing, yet preſently after, I could perceive but little *Motion* (and part of that ſeemed almoſt *Convulſive*). About 6 *Hours* after, it ſeem'd quite *dead*, and upon the Return of the *Air* no Sign of *Life* enſued for a pretty while, but 3 or 4 *Hours* after I found him *Lively* enough.

6. Having obſerved *Butterflies*, not only to *Live* but to *Move* longer than was expected, I included divers of them in ſomewhat large *Receivers*. And though whilſt the *Air* continued in the Glaſſes, they *Flew* actively as well as freely up and down; and though after the *Exhauſtion* of the *Air*, they continued to *Live* and were not *Moveleſs*; nay though at the Bottom of the *Receiver* they would even *Move* their *Wings* and a little *Flutter*; yet I could not perceive any of them to *Fly*, by which I mean, perform any Progreſſive Motion ſupported by the Medium only. And by frequently inverting the *Receiver* (which I took care ſhould be pretty long to let them fall from one extream to the other,) they would fall like Dead Animals without diſplaying their *Wings*, though juſt as they came to touch the bottom, ſome of them would ſometimes ſeem to make ſome uſe of them, but not enough to ſuſtain themſelves, or to keep their falls from being Rude enough.

Ants *and* Mites. XX. 1. A Pretty number of *Ants* were included in a ſmall Portable *Receiver*, *Exhauſted* Yeſterday about Noon. They grew almoſt moveleſs as ſoon as the *Air* was *Exhauſted:* And between 6 and 7 in the Afternoon, they ſeem'd to be all quite *Dead*. Whereupon I opened the Glaſs, and though no Sign of *Life* appeared for a great while, yet this Morning I found many of them *Alive* and *Moving* to and fro.

2. We conveyed a pretty Number of *Mites*, which are reputed but Living Points, together with the mouldy Cheeſe they were bred in, to nouriſh them, into 3 or 4 very ſmall *Receivers*. One of them with the *Air* in it was *Seal'd* up at a Lamp-furnace: And from all the Reſt we *withdrew* the *Air*. This done we obſerv'd the following *Phænomena*; *viz.*

1. Thoſe *Mites*, that were incloſed in the ſmall *Glaſs* that never came near the Engine, continued *Alive*, and able to walk up and down for above a full *Week*, after they had been put in, and poſſibly would have continued much longer, if the Glaſs had not been broken.

2. Though

2. Though juſt before the *withdrawing* of the *Air*, the *Mites* were ſeen to *Move* up and down in it; yet within a few *Minutes* after the *Receiver* was applyed to the Engine, I could diſcern in them no *Life* at all, though my Eye was aſſiſted with a double Convex Glaſs. About an *Hour* after, I could not perceive any of them to *Stir*; 2 or 3 *Hours* after that, I let in the *Air*, and left the *Receiver* unſtopt in a Window.

3. About 2 or 3 *Days* after, I found a Number of my little Animals *Revived*, as an attentive Eye might eaſily perceive by the Motion of certain little white Specks, and they continu'd to appear *alive* for 2 or 3 *Days* after that, if not longer.

4. One of the *Receivers* was kept *Exhauſted* from *Munday* to *Thurſday* after all which time, our attentive Eyes being unable to diſcover any Signs of *Life* among the Included *Mites*, the *Air* was let in upon them, and after a long time, I could plainly ſee them *Creep* up and down in the Glaſſes again.

Experiments about the Weakned Spring *and ſome unobſerved Effects of the* Air; *by Mr.* Rob. Boyle. n. 120. p. 467.

LXXVIII. We took Filings of crude *Copper*, and put them into a Cryſtallin Glaſs of a Conical Shape, into which we poured ſome ſtrong *Spirit* of *Salt*, (that was fitted for our peculiar purpoſe) to the height of about a Fingers breadth above the *Filings*; and then cloſeing the Veſſel with a Glaſs-ſtopple exquiſitely fitted to it, we ſuffered it to continue unmoved in a Window for ſome *Days*, till the Liquor had both obtained a high and darkiſh *Brown* Colour by the Solution of ſome of the *Copper*, and loſt that Colour again, growing clear like common *Water*, (which is it ſelf a ſomewhat odd *Phænomenon*), and then taking out the Stopple, (without ſhaking the Liquor) and thereby giving Acceſs to the *outward Air*, we perceived, (as we had conjectured) that the upper Surface of the Liquor did in a few *Minutes* re-acquire a darkiſh *Brown* Colour, which penetrating deeper and deeper, at the end of about a *quarter* of an *hour*, the whole Body of the Liquor appeared to be likewiſe *Tinged*. The Conical Glaſs being again well ſtopt, the *Menſtruum* did again in very few *days* let fall or otherwiſe loſe its *Tincture*; which, the Stopple being taken out, it regained as before. Nor were theſe two the only Trials I made with the like Succeſs for the main; but afterwards, being deſirous by a further Trial to reſolve a Doubt I had, I kept the Glaſs yet longer in the ſame place with the ſame *Filings* and *Menſtruum* in it, for (if I miſremember not) a *Month* or *two* together; but obſerved not, that the Liquor would any more grow Clear.

2. Having taken another Conical Glaſs, wherein the Liquor was grown clearer than is uſual, and had probably been ſo a good while before, (for the Veſſel, having been hid by others which ſtood before it, had been for ſome *Weeks* forgotten:) we took out the Stopple and left it out for about *half* an *Hour*, but did not perceive the Liquor to have acquired any Colour, ſo much as at the Top. But putting in the little Stopple, I left the Veſſel cloſed for two or three *Hours*, and at my return to Viſit it, I perceived, that it had acquired a *Faint* Colour tending to a *Green*; wherefore taking out the Stopple again, I opened its Commerce with the *outward Air*, leaving the Glaſs unſtopt for 20 or 24 *hours*, but found that in all that time it had not regained it's wont-

ed dark Colour, but was only arrived at a *Green*, deep enough, but not true nor very Tranſparent.

This Obſervation being made in the ſame Veſſel that had been formerly employed, ſuggeſted to us an Enquiry, whether the advanced time of the Year, which was the middle of *October*, might not have an intereſt in the ſlow and imperfect Succeſs of this Trial.

3. Some ſtrong *Spirit* of *Salt* having been kept upon *Filings* of *Copper* till the Solution was come to be of a dark *Brown* Colour, about three Spoonfulls of it, by gueſs, was put into a *Receiver* that might hold 8 or 10 times as much: Being kept *in Vacuo* (if the time be rightly remember'd) about *half* a *Year*, it retain'd it's Colour; but the Veſſel being open'd, and the *Extern l Air* permitted a free Acceſs to it, the Solution in about an *hour* was turned into a fine Tranſparent *Green*, though no *Precipitation* of any muddy ſubſtance appeared by any Sediment to be made.

4. In one of that ſort of Conical Glaſſes that has been already deſcrib'd, we had put upon ſome *Filings* of *Copper* a convenient quantity of our *Spirit* of *Salt*; and though we obſerv'd, that for a great while it would not part with its *deep* and ſomewhat *Muddy Tincture*; yet we left it in the Window for many *Weeks* longer, and at length, towards the latter end of *December*, we found it to have loſt its *Tincture*, ſo much that the Liquor appeared like common *Water*. Upon which obſervation, though the time of the Year were unpromiſing, I thought fit to Try, whether the *Air* in that Seaſon would not have ſome, though perhaps but a ſlow, Operation on the *Saline Spirit*, and accordingly taking out the Glaſs Stopple to give free Acceſs to the *outward Air*, we obſerv'd, that in ſome hours its Operation on the Liquor was ſcarce ſenſible; but within about 24 *hours* the *Menſtruum* had acquired not juſt its former Colour, but a ſomewhat *Faint* and moderately *Tranſparent Green*: So that this *Tincted Menſtruum* as it had been very ſlow in loſing its Colour, ſo it did but ſlowly and imperfectly reacquire it.

5. We took ſome *Filings* of *Copper* and putting them, together with a *Mercurial Gage*, in a Conical Glaſs fitted with an exactly ground Stopple of the ſame matter, (which was Cryſtalline) we poured on the *Filings* as much rectified *Spirit* of *Fermented Urine* made *per ſe*, as ſufficed to ſwim an inch or better above them; then carefully Stopping the Glaſs, coming to look on it many *hours* after, we perceived that the *Mercury* in the Sealed Leg was conſiderably Depreſt, and gently drawing out the Stopple, to let in the *outward Air*, we perceived that Acceſs to have a manifeſt effect upon the *Mercury*.

6. We took a Cryſtal Glaſs of an almoſt Conical ſhape, and capable of containing between 5 or 6 *Ounces* of Water, and furniſhed with a Stopple of the ſame matter, that by grinding was exactly fitted to it. Into this we put a conſiderable Quantity of clean *Filings* of good *Copper*, on which we poured as much ſtrong *Spirit* of (*Fermented* or rather) *Putrify'd Urine*, as ſerved to ſwim about an *inch* above the *Copper*; and having let down a *Mercurial Gage*, ſo that it leaned upon the bottom and ſide of the Glaſs, we cloſed it very well with a Stopple, and ſet it in a quiet and well enlightned place, having taken good

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notice at what Mark the *Quickſilver* reſted in the Open Leg of the *Gage*. This done, we let the *Menſtruum* alone to work upon the *Filings*; which it did as we foreſaw, ſomewhat ſlowly and very calmly without producing any *Noiſe* or ſenſible *Bubbles*, acquiring by degrees a very pleaſant *Blew* Colour, and the Glaſs being kept quiet in the ſame place for 2 or 3 *days* longer, the Liquor, as I conjectured would happen, began to loſe of the *Intenſneſs* of it's *Colour*, which by Degrees grew fainter and fainter, till at the end of 3 or 4 *Days*, the Liquor was grown very *Pale*, and left me little doubt but that, if I would have ſtaid ſome days longer, it would have loſt the remaining Eye of *Blew*, and have lookt almoſt like common *Water*. But being unwilling to tarry ſo long, I took out the Stopple, that the *Air* without the Glaſs might have acceſs to that within; and leaving the Vial in the ſame place and poſture, my expectation was ſomewhat anſwered by finding, that within 4 or 5 *Minutes*, if not leſs, the upper part of the Liquor, that was *Contiguous* to the *Air*, had acquired a fine *Blew Colour*, which Deſcending deeper and deeper, before the End of the 10*th Minute* had diffuſed it ſelf, but ſomewhat weakned, through the Liquor, whoſe Colour was ſuffered to deepen for a while longer; ſo that in leſs than a *quarter* of an *hour* from the firſt unſtopping of the Viol, the Liquor was grown to be throughout of a rich *Ceruleous* Colour, which grew almoſt too opacous within a few *Minutes* longer: When carefully cloſeing the Viol again with the ſame Stopple as before, we ſet it aſide in the ſame place, where, the *Included Air* being denied all Commerce with the *External*, the Liquor began again within 2 or 3 *days* to loſe of its Colour; and, to be ſhort, afforded me the opportunity of making a 2*d* Experiment, much like the former. And the like ſucceſs I had, for the main, in a Trial or two made in another Glaſs with another portion of the ſame *Spirit* of *Urine*, put upon the *Filings* of *Copper*; ſo that the Experiment was, in all, made divers times, as well when I was not, as when I was alone: And particularly, once to be ſure that the Diurnal Air as ſuch had not any great Intereſt in the *Phænomenon*: I made the Trial ſucceſſively about Nine a Clock at *Night*.

In moſt of theſe Experiments I forbore to ſhake the Glaſs, leſt it ſhould be ſuſpected, that the Agitation of the Liquor might have raiſed ſome little fine powder that might have been ſuppoſed to have been *Precipitated* out of the Tincture, and, being thus mingled with the Liquor again, Reſtore it to its former Colour; but in truth I did not perceive any ſuch powder to be *Precipitated*. And though to obviate the Objection, I forbore to ſhake the Viol, yet I juſtly ſuppoſed, that if, by the Agitation of the Liquor, more parts of it ſhould be quickly expoſed to the Action of the *Air*, the *Coloration* would be haſtned, which upon Trial appear'd to be true.

7. We took ſuch a Conical Glaſs, as has been lately deſcrib'd, and covering the bottom of it with a convenient quantity of *Filings* of good *Copper*, we poured on them as much ſtrong *Spirit* of *Sal Armoniack* as ſerved to ſwim about a Fingers breadth above them; and, having let down ſuch a *Mercurial Gage* as is formerly mentioned, ſo that it leaned upon the bottom and ſide of the Glaſs, we cloſed it very well with a Stopple, and ſet it in a quiet and well enlightn'd place, having taken good notice at what mark the *Quickſilver* reſted

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in the Open Leg of the *Gage*: This done, we let alone the *Menſtruum* to work upon the *Filings*, which it did, as we foreſaw, ſomewhat ſlowly and very calmly, without producing any *Noiſe* or ſenſible *Bubbles*, acquiring by degrees a very pleaſant *Blew* Colour, and afforded us alſo the *Phænomenon* we chiefly lookt after; which was, that repairing from time to time to the Window to ſee what paſt, we perceived, that for 2 or 3 *days* together the *Mercury* in the *Seal'd* Leg of the *Gage* did, though very ſlowly, *Deſcend* till it appeared to be near a *quarter* of an *Inch* lower than at firſt; and probably the Depreſſion might have been greater, if the Experiment had not been diſturbed; whoſe Event yet ſeemed ſufficiently to argue, that the *Spring* of the *Air* contained in the Cavity of the Glaſs, and communicating with that in the *Open* Leg of the *Gage* or *Syphon*, was *Weaken'd* in compariſon of that in the *cloſed* Leg, which by the *Hermetick Seal* on one ſide, and the *Quickſilver* on the other, was kept from ſuch Communication. And I was further careful to obſerve, whether the *Depreſſion* did not continue at Differing Times of the Day, and found it to do ſo, as well at Night as at Noon, though at this laſt named time the Sun Shined hot upon the place and Veſſels too.

This Experiment was made, in all 4 or 5 times, though not always with equal, yet ſtill with ſome Succeſs, the *Mercury* in the *Seal'd* Leg of the *Gage* being ſometimes more and ſometimes leſs, but always manifeſtly *Depreſt*; which *Phænomenon* was confirmed, by the Obſervation, we more than once made, of the ſudden Return of the *Quickſilver* to it's former ſtation, upon the Unſtopping of the Glaſs, to give free admiſſion to the *Outward Air*.

8. A *Mercurial Gage* having been put into a Conical Glaſs, whoſe bottom was covered with beaten *Coral*, ſome *Spirit* of *Vinegar* was poured in, and then the Glaſs Stopple, which was very well ground, cloſing the Neck exactly, we obſerved, that upon the Working of the *Menſtruum* on the *Coral* Store of *Bubbles* were for a good while produced, which ſucceſſively broke in the Cavity of the Veſſel; and their Acceſſion ſo conſtipated the *Air*, that they *compreſt* the *Air* impriſoned in the cloſed Leg of the *Gage* three Marks for Diviſions which I gueſſed to amount to about the *third part* of the Extent it had before: But ſome *hours* after the *Corroſion* had ceaſed, the *Compreſſion* made by this newly generated *Air*, grew manifeſtly fainter, and the impriſoned *Gage Air* drove down the *Mercury* again till 'twas *Depreſt* within one Diviſion of its firſt ſtation; and thereabouts, or a little lower, continued 5 or 6 *Days*; ſo that in this Operation there ſeemed to have been a double *Compreſſive* Power exerciſed; the one Tranſient, by the brisk agitation of *Vapours* or *Exhalations*, and the other Dureable, from the *Aerial* and *Springy* Particles, either Produced or Extricated by the Action of the *Spirit* of *Vinegar* upon the *Coral*.

But a pretty Quantity of *Spirit* of *Vinegar* being put upon *Minium*, it continu'd divers *days* without any ſenſible *Depreſſion* of the *Mercury* in either Leg, nor did any Change appear in the *Gage*, upon the Removal of the Stopple, though 'twas evident by the great ſweetneſs acquired, that it had made a *Solution* of a great portion of the *Minium*.

9. We

9. We took ſome *Filings* of *Copper*, and in a Vial capable of holding ſome 2 or 3 *Ounces* of Water, we poured on them ſtrong *Spirit* of *Sal Armoniack* made without *Quicklime*, till the Liquor reached near an *Inch* above them. This was done about the 20*th* of *Auguſt* on the *Friday* before Noon, and the following *Munday* preſently after Dinner it had acquired a deep *Blew* Tincture, and loſt again ſo much of it, that it was Pale almoſt like common *Water*: Then to ſatisfie a *Virtuoſo*, I unſtopt the Vial, deſiring him to place his Eye level with the Surface of the Liquor, which in a *Minute* of an *Hour* or leſs appeared to his ſurpriſe and wonder, to have acquired a Deep *Blew Tincture*, that reached downwards to the thickneſs of the back of a knife, the whole Liquor becoming of the like Colour in 4 or 5 *Minutes* more, and the Glaſs being preſently ſtopt again, and left where 'twas before, appeared not at the end of 9 *days* to have loſt its *Tincture*; though now and then within that time, it ſeemed manifeſtly *Paler* than when the Vial was ſtopt.

10. We took a round Vial, holding about 8 *Ounces* of Water, and having put into it *Filings* of *Copper* and a *Mercurial Gage*, we poured on the Metal ſtrong *Spirit* of *Sal Armoniack*, till it reached to a good height in the Vial, which then being *Hermetically Sealed* up, was ſet by in a South Window, where it quickly acquired a deep *Blew* Tincture: There it ſtood about 12 *days*, before that *Tincture*, which decayed but ſlowly, did little by little grow ſo Diluted that the Liquor was *Pale* and almoſt like *Water*; During this ſtay of the Glaſs in the Window, the *Mercury* in the *Open* Leg appeared to be *Impell'd* up; and when after 9 a Clock at Night (which time I choſe to try whether the *Nocturnal Air*, would have any thing to do with the *Phænomenon*) the *Hermetick Seal* was broken off; immediately upon which there was produced a *Noiſe*, and the *Mercury* in the ſhorter and *Cloſed* Leg was briskly *Impelled* up, by our gueſs near $\frac{3}{8}$ of an *Inch*, and though the Orifice at which the *Air* had Acceſs was ſcarce wide enough to admit a middle ſized Pea, yet within a *Minute* and *half* the Surface of the Liquor being held between the Eye and the Candle, appeared to have acquired a very Lovely and Fair *Colour*, which reached downwards a *quarter* of an *Inch*; ſo that the Viol ſeemed to contain two very differing Liquors Swimming one on another; and the *Coloration* piercing deeper and deeper within 5 *Minutes* in all, the whole Liquor had attained a rich *Blew Colour*.

LXXIX. 1. To *Mingle* divers Liquors together by means of the *Air-Pump*, there were employed two ſmall Glaſſes, whereof the one could enter into the other, and the leaſt of the two was faſten'd to the Hook of an *Iron Wire*, and the greater put under it, and the ſaid *Wire* was ſo ordered, that theſe two Glaſſes were a little diſtant one from another. The *Recipient* was of a Cylindrical Figure, of which one End is all open, to be faſtned to the Cement of the *Pump*; the other is all cloſed, except a ſmall Hole, having a little Edge or Brim; through which Hole you paſs the Hook'd *Iron Wire* and tye an *Eel-skin* cloſe about the ſame; and three or four *Inches* higher, the ſame *Skin*, is alſo to be tyed about the *Iron-Wire*, to keep the *External Air* from entering into the *Recipient*, and yet without taking away the Liberty to ſtir therein what you will by

Pneumatical *Experiments by M.* Papin: *Directed; by M.* Hugens. n. 119 p. 443.

by means of the *Iron wire*, that hath a Communication Inwards and Outwards. For this purpoſe you muſt chuſe that part of the *Eel-skin* that is next to the Head, the other part being pierced with many *Holes* with *Valves* that do not always ſhut well.

To be the more ſure, that no *Air* enters by the Ligatures of the *Eel-skin*, you may apply a Tube on the *Recipient* with Cement, and pour Water into this Tube until the *Eeel skin* be quite cover'd therewith. Care alſo muſt be had, that the *Hole* be exactly filled up by the *Iron-wire*; for, if it were too big, the *Eel-skin* would be thruſt into it with great violence, and ſo hinder the Liberty of Raiſing and Sinking it.

When the *Recipient* was evacuated of *Air*, the leſſer Glaſs was by the *Iron-Wire* let down into the greater, until the Liquors they contain, did *Mingle* themſelves. Thus ſome *Aqua-fortis* was poured into the upper Glaſs, and *Spirit* of *Wine* into the lower, and the *Recipient* was ſo well *Exhauſted* of *Air*, that the *Spirit* of *Wine* boyled up with great Bubbles (as uſually it doth,) and the *Aqua fortis* caſt ſome ſmall Bubbles. After that both theſe Liquors were well *purged* of *Air*, the upper Glaſs was ſunk into the lower, ſo as that the *Spirit* of *Wine* was *Mingled* with the *Aqua-fortis*; at which Inſtant there was yet ſeen a very conſiderable *Ebullition*.

Now to know, whether the *Aqua-fortis* gave to the *Spirit* of *Wine* ſome new Vigor or Force to make it Bubble; we mixed without the *Recipient* ſome *Aqua-fortis* with *Spirit* of *Wine*; the Quantity of the former being ſomewhat more than that of the latter. This Mixture being put in *Vacuo*, inſtead of Boyling up more ſtrongly than the *Spirit* of *Wine*, (as 'twas thought it would have done, it only caſt up ſome few Bubbles: Which ſhew'd, that the *Ebullition*, which was ſeen when they were *Mixed* within the *Vacuum*, is of the ſame Nature with all thoſe that are made of *Acids* and *Alcalies*. For, in the very inſtant that they are *Mixed* they make great *Ebullitions*, but ſoon after they Mortifie one another, and loſe the Properties they had before.

'Tis alſo probable, that the *Aqua fortis* and the *Spirit* of *Wine* would Boyle always when they are *Mingled*, but that the *Preſſure* of the *Air* keeps this *Ebullition* from being ſenſible, and appears only when that Preſſure is taken off.

When you employ *Rectified Spirit* of *Wine* inſtead of *Aqua-vitæ*, there is required a greater Quantity of *Aqua fortis* to Mortifie it.

It was alſo Experimented, that the *Solution* of *Common Salt* Boyls alſo with *Spirit* of *Wine*, being *Mixed in Vacuo*; and the *Solution* of *Salt Petre* yet more. The ſame Experiment was alſo made with *Common Water*, and it's *Ebullition* with *Aqua-vitæ*, purged of *Air*, was alſo found to be very great, when *Mixed in Vacuo*.

Further, it is ſomewhat remarkable, that *Common Water* doth not Mortifie *Spirit* of *Wine*, as *Aqua-fortis* doth, though they make *Ebullitions* with it almoſt of the ſame Degree. The Experiment of it is eaſy: For, making without the *Recipient*, a Mixture of *Common Water* and *Aqua-vitæ*, this, being put within the *Vacuum*, *Bubbles* up very well, though the *Common Water* be there

there in greater Quantiy than the *Aqua-vitæ*; whereas a *Mixture* of *Aqua-fortis* and *Aqua vitæ* did not there *Bubble* up at all.

After this, the *Experimenter* being desirous to see, whether these *Ebullitions* did make *new Air*; he put in the *Recipient* a *Gage* (that is a Glass Tube fill'd either with *Water freed* of *Air*, or with *Mercury*, serving to measure the Quantity of the *Air* in the *Recipient*) which was 4 *Inches* long, and observed, that at the Instant when the Liquors were *mingled* together, the *Water* in the *Gage* rose very Nimbly to the top of the *Gage*; and then drawing out this *new Air* that was made, he made the *Gage-Water* subside again by Degrees, in like manner as when the *Common Air* is drawn out: And by this means, it was seen, that all these kinds of *Ebullition* make an *Air* which Expands it self like *Common Air*. Yet it is very remarkable, that the *Air* which is made by these *Ebullitions*, is not of the same Nature; For, it hath been found Experimentally, that the *Air* formed by the *Mixture* of *Aqua-fortis* and *Copper* remains always *Air*, and always keeps up the *Water* in the *Glass* at that Height to which it raised it; but on the contrary, that *Air* which hath been produced by the *Mixture* of *Oyl* of *Tartar* and *Oyl* of *Vitriol*, is almost all destroyed of it self in the space of 24 *Hours*, in so much that in the *Recipient*, 24 *Hours* after the *Ebullition* had been there made, there was not found much more *Air* than there was before the same was made.

2. Mr. *Boyle* (as 'tis recorded in the *Journal Book* of the *Royal Society Apr.* 30. 1668. gave an Account to the said *Society* of the Experiments he had then made about *Generating new Air*, or *Extricating* that *Air* which was lurking before in several Bodies: At which time he mentioned also some ways of *Examining*, whether the Substance thus produced be *True Air* or not.

And long before that time, *viz An.* 1664. the 15. of *Mar.* (Witness the same *Journal*) Mr. *Boyle* mentioned to the *R. Society*, that *Corals* or *Oyster-Shells* pounded, and put into *Distill'd Vinegar*, might prove fit Substances to produce *Air*, wholsome for *Inspiration*. At which time he also *proposed*, that some fit Animal might be put into a *Receiver* of his *Exhausting Engine*, and the *Air* pump'd out till the Creature grew Sickish, and that then some *new Air* might be produced in the *Receiver* by a Contrivance of making *Distill'd Vinegar* work upon the Substances before mentioned; to see whether by this means the Animal would recover.

About which time Sr. *Chr. Wren* also suggested, to put *a Fermenting* Liquor in a Glass ball, and to fit a *Stop-Cock* to it, and tye a Bladder about the top of the *Stop-Cock*, by which means the *Air*, to be *generated* by the *Fermenting* Liquor, would pass into the Bladder, and upon the turning of the *Stop Cock* be kept there in the form of *Air*. Mr. *Hook* also mentioned several Liquors, which by their working upon one another would produce an *Air*; as *Oyl* of *Tartar* and *Vitriol*; *Spirit* of *Wine* and *Turpentine*. And the same made before the *R. Society* the following Experiment: He took a Common Glass Viol with two Pipes, and some Pounded *Oyster-Shells* and *Aqua-fortis*; and as soon as the latter was by one of those Pipes poured upon the former, and the Hole stopt with good Cement, the *Ebullition*, caused by the *Shells* being Corroded

by the *Aqua fortis*, did in a very little time blow up the Bladder, tyed on the other Pipe, ſo as to ſwell it very Plump with *Air*; which Expanſion remained till the *Society* roſe, after they had order'd the ſaid Veſſel to be carefully lockt up till their next Meeting, which being the Week after, the Bladder was then found ſomewhat ſhrunk. The like Experiment was made with *Bottled Ale*, ſuppoſed to yield a more wholeſome *Air* for *Reſpiration*.

3. One Day we *mingled* equal parts of *Aqua-fortis* and *Aqua-vitæ*; and having put two equal Quantities of this Mixture in two ſmall Glaſſes with two equal bits of *Iron*, one into each; one of the Glaſſes was included *in Vacuo*. Then there was ſeen a very great *Ebullition*, and the Liquor became *black*, whilſt that which was left without the *Recipient* wrought almoſt nothing, but remained always Tranſparent, and rather *White* than *Black*. After theſe two Glaſſes had ſtood thus 12 *Hours*, that which was *in Vacuo* was taken out, and found that the *Iron* was almoſt all *diſſolved*, whereas the other was very little diminiſhed. This Experiment ſucceeds quite contrary when 'tis made with *Aqua-fortis* alone and *Copper*; for then the *Diſſolution* is leſs within the *Vacuum*; than without it.

We made ſome other *Mixtures* of divers Liquors, which make no *Ebullition* at all *in Vacuo*, no more than they do in open *Air*. *Oyl* of *Olives* makes none neither with *Vinegar*, nor with *Spirit* of *Wine* at the Inſtant that they are *Mingled*; neither doth the ſaid *Oyl* Mortifie the *Spirit* of *Wine*. Only this we Obſerved one Day, that having *Mingled* together, without the *Recipient*, ſome of that *Oyl* and *Vinegar* and *Spirit* of *Wine*, and put this Mixture *in Vacuo*, it did not Boyl up ſo ſoon as when there was no *Oyl*; but then the *Bubbles* which it made afterwards were bigger, and they began to appear again from time to time, ſo that ſome of them were ſeen a *Quarter* of an *Hour* after the *Recipient* had been Evacuated. Poſſibly this may come to paſs, becauſe that the *Oyl*, ſwimming on the Top, retains the more Volatile parts of the *Spirit* of *Wine*, which elſe would Fly away as ſoon as the *Air* is begun to be *Pump'd* out, and at the ſame time it hinders the Surface of the Liquor below from eaſily Riſing up into *Bubbles*, becauſe, to make them do ſo, the parts of the *Oyl*, that ſtick cloſe to one another, muſt be ſeparated. When therefore the Volatile parts are gathered together in a ſufficient Quantity, able to ſurmount the Reſiſtance which the *Oyl* makes to it, they iſſue out with much more Violence, than if nothing had retained them.

All theſe *Ebullitions*, hitherto ſpoken of, are greater *in Vacuo* than in the *open Air*: But with *Lime* it is not ſo. For, taking two equal Glaſſes with two equal Quantities of *Water*, and putting the one of them in *Vacuo*, the other in the *free Air*, there was let fall into both at the ſame time two equal parcels of *Lime*, one into each; and it appeared, that that which was *in Vacuo* did indeed throw up ſome bigg *Bubbles*, but yet fewer of them than that which was in the *Air:* and having taken it, an *Hour* after, out of the *Recipient*, and ſtirred the *Lime*, it was found to have only the Conſiſtence of *Dirt*, whereas the other had the Conſiſtence of *Slecked Lime*. The Reaſon of which

which may perhaps be, that the *Volatile Salts* of the *Lime* do exhale whilſt the *Recipient* is emptying.

There was alſo ſome *Plaiſter* of *Paris* ſlecked *in Vacuo*, and the *Ebullition* of it did there appear much more than it doth in the *open Air*. When it is not Touched, the *Bubbles* that iſſue out leave great *Holes* in it, and then it ſettles very Uneven; but taking Care to ſtir it until the *Bubbles* be come forth, and preſſing it when it begins to Settle, it becomes very ſmooth, and hath not ſo many little *Holes* as the *Common Plaiſter*.

I took one Day a ſmall *Recipient*, and inſtead of the *Iron Wire*, I paſſed into the little *Hole* a Sprig of a known Plant, which was *Baulme*, ſo as that the *Top* of the Plant was within the *Recipient*, and the *Roots* without. Then I cloſed the reſt of the *Hole* with Cement, and when I had taken away my little *Emptied Receiver*, with the Plant, half ſhut up therein; I put the whole into a great Glaſs fill'd with *Water*, the Root being downwards; and I ſaw, that there were formed little *Water-Drops* upon the Leaves that were *in Vacuo*. I left it 10 *Days* in this Condition, and during that time there was entered about two *Spoonfulls* of *Water* into the *Receiver*, and in all appearance this Water had preſſed through the Plant. Yet there appeared no more any *Drops* upon the Leaves; but that might very well come from the groſſer *Excrementitious* Matter that is in the *Water*, which had ſtopp'd the Conduits.

After this, to know whether any *Air* had been form'd there, I replaced the *Receiver* upon the *Engine*, and having whelmed a bigger upon it, I ſaw there was but very little *Air* formed in the ſmall one, becauſe the great *Recipient* was almoſt all Empty before the *Air* included in the little one could lift it up. Yet at laſt it did Raiſe it, and I enclined the *Engine*, to the end that the little *Receiver* might not be applyed to its *Cover* when I ſhould let the *Air* re-enter; and after this manner both the *Recipients* were filled in the ſame time. Then I looked upon the Leaves of the Plant; They were not withered, though they were not grown; only the Leaves had in the Middle a little changed their Colour, and had a ſmell ſomewhat Sowriſh; but the next Morning the Plant was quite Spoiled. We may believe that the *Preſſure* of the *Air* had made the Water enter into this Plant with ſo great a Violence, that thereby it had, as 'twere, mortified the parts, eſpecially in the Middle where the Leaves were moſt tender; but this Water ſtill kept the Leaves extended, and ſo they withered not; but, when the *Air* came to act upon them, the parts of the Plant which had ſo much ſuffered were ſoon corrupted by it. For 'tis very probable, as well by this Experiment, as by others hereafter to be mentioned, that the *Air* is a *Diſſolvent* which corrupteth Bodies.

This being done, I made the Experiment the other way, that is, with the *Leaves* in the *Air*, and the *Roots* in a *Bottle* of *Water* that was *in Vacuo*; and immediately I ſaw *Air Bubbles* iſſuing out at the End of the Tail *in Vacuo*. After this, I put Water upon the *Leaves*, to ſee whether this *Air* came from thence, and I ſaw indeed ſoon after, that theſe *Bubbles* began to ceaſe; and having taken away the *Water* wherein the *Leaves* were, I ſaw that the *Bubbles* began to iſſue out at the Tail as before: And I ſaw them ſtill come out 24 *Hours*

after, but in little Quantity; and at length it quite ceased. During these 24 *Hours* the *Roots* did lengthen about four Lines, that is, one third of an *Inch*; which is little less than they ordinarily do in the *Air*.

I kept the Plant in this condition for *four Days* upon the *Engine*, and took care from time to time to draw out the *Air* that entered into it by the *Leaves*; and then it began to *wither*, and the *Roots* shot no more.

Another time I put two *Twiggs* of *Baulme*, each into a Viol full of Water and at the end of 5 *Days*, when I saw manifestly that they both shot *Roots*, I included in the *Vacuum* that of the two which had the *longest Roots*, without taking it out of its Vial. At the End of *three Days*, observing that it was *Wither'd in Vacuo*, I took it out, and changed the Vials of the Twiggs, to see, whether that which had remained in the *Air*, and did Thrive very well in *common Water*, would also Thrive in *Water freed* of *Air*; and whether that which was *withered in Vacuo*, would revive in the *common Water* and in *Air*. *Four Days* after I found the Twigg that had been *in Vacuo* quite Spoiled, and the other still Verdant, but not Thriving; and I observed, that it did not begin to shoot in the *Water freed* of *Air* till *ten Days* after it had been put in.

This Experiment drew another after it, to know whether the *Water* purged of *Air* were less fit than *common Water* to make Plants *Vegetate*. For this end I took two Vials full, the one of *Water purged*, the other of *common Water*, and having put a Twigg of *Baulme* in each, I left them both in the *Air*. I found, that the Twigg in the *common Water* shot at the end of 6 *Days*, and in *Water purged* shot this Time neither but *ten Days* after it had been put in.

I repeated this Experiment once more, and I was much surprised to see, that the Twig in the *Water freed* of *Air* begun this time to shoot the 3*d Day*, and the other in the *common Water*, still the 6*th Day*. But this was remarkable herein, that the Twigg in the *Water purged* shot not more but one Root, which grew very long, and on the 9*th Day* only it began a little to shoot another, which lengthned but one Line in *two Days*, whereas the Twigg in the *Common Water* had then 9 or 10 Roots, which were all very long, having always lengthned *five Lines* or more in a Day.

Although this Experiment appear d at first contrary to the precedent, yet it still confirmed the first thought, to wit, that the *Air* which is mixed in *common Water* serves for *Vegetation*, considering the little Root which the Twigg shot in the *Water cleansed* of *Air*

After this, I made some Experiments upon harder Plants. One Day I put a Green piece of *Sallow wood*, part in the *Air* and part *in Vacuo*, after the manner above describ d. I put into *Water* that part which was in the *Air*, and the *Water* presently began to mount and to pass through the Middle of the Wood, and unceasantly formed *Bubbles* in the *Receiver*. These *Bubbles* continued thus for the Space of 24 *Hours*; and certainly it was the *Water*, which passing through the Wood was in part changed into *Air*. For, I made the same Experiment with a piece of *Buffe*, and the Water mounted also and passed through it, but it formed no *Bubbles*. Mean time, if there be *Valves* in *Wood*, they

they muſt needs be unable to reſiſt the *Preſſure* of the *Air*; for I have noted in *Sallow*, as well as in *Elm*, that the *Water* paſſes through them with the ſame facility what *End* ſoever you put *in Vacuo*.

One Day alſo I put the *Upper End* of a little *Elm branch* in the *Vacuum*, and the *Lower End* in the *Air*. This *lower End* I trenched in *Water*, as I had done the Roots of *Baulme* before: But it was a whole *Hour* before there appear'd any *Drop* of *Water* upon the *Elm leaves in Vacuo*, whereas upon the *Baulme leaves* the *Drops* appeared *preſently*. The Cauſe of which may be the Hardneſs of the *Elm-Wood*. But I know not, why *Water* paſſing through *Wood* forms *Bubbles*, and in paſſing through *Leaves* forms nothing but *Drops*.

I made alſo the Experiment the other way, that is, the *Leaves* in the *Water* without the *Recipient*, and the *lower End* of the Branch *in Vacuo*, and I ſaw, that there paſſed nothing for *two Hours* time; inſomuch that I cut a little of the *Upper End* of the Branch which was very Tender, and then indeed I ſaw a little Moiſture appear at the End that was *in Vacuo*, but that enough only to form *one Drop*; and there appear'd no *Bubble* of *Air*. Then I Cut the Branch yet a little Lower, and then there was formed one Drop of Water at the End that was *in Vacuo*, but it fell not. And having Cut the Branch yet a little more, the Drop of Water fell down *in Vacuo*. This ſhews, that they were not the *Valves* of the *Plant* that hindred the Water from paſſing whilſt the Branch was entire; but rather that it was the great Tenderneſs of the *Leaves*, ſuffering themſelves to be compreſſed by the *Preſſure* of the *Air*, and that ſo the Water could not inſinuate it ſelf between their parts.

Apr. 3. 1673. * I included an *Apple*, which had a little Speck of *Rottenneſs*, and ſome *Water* in the ſame *Recipient* thereby to promote the *Corruption* in caſe any ſhould come to paſs But I have not found that any *Change* happen'd to it ſince that time.

n. 121. p. 492. * *Theſe Experiments were Printed at* Paris, *in the Year* 1674.

Jun. 7. I included in a *Receiver* two Noſegays of *Roſes*, one ſuſpended at the Top, the other having its Tail in a little Veſſel full of Water. I alſo put in the ſame *Receiver* a *Gage* four *Inches* long, to know whether any *Air* would be there produced. *Two Days* after, I found my *Roſes* a little wither'd, and the *Water* already riſen to 8 or 10 *Lines* near the Top of my *Gage*; and after that the *Changes* of theſe *Flowers* became ſtill leſs, ſo that at this preſent time they are not much more wither'd, and the *Water* of the *Gage* is by three or four *Lines* near the Top. The *Roſes* which lye dipt in the Water are as much withered as the others, and as ſoon. Other *Roſes* which I had included at the ſame time, but with *Air*, grew mouldy in leſs than 8 *Days*.

At another time I included one ſingle *Roſe-button*, in a very little Glaſs, to learn, whether it would keep its *Scent*. At the End of 15 *Days* it looked a little leſs freſh, but was not at all wither'd; and having taken it out, I found it had ſtill its good *Smell*; but after that it loſt all both *Colour* and *Smell* in leſs than *two Hours*. I muſt alſo add, that it's Leaves did not appear moiſt in the *Vacuum*, but they looked all moiſt as ſoon as they were in the *Air*. Which ſhews, that the parts of the Leaves had Acted as Springs, like as *Spunges* do, and that the Weight of the *Air* coming to Preſs upon them, did

expreſs

expreſs the *Humidity* which had inſinuated it ſelf between the parts thus *Expanded*.

I did alſo include ſome *Gilli-flowers*, which *Changed* but very little; only they looked as if they had been Dipped in *Water*.

Having included ſome *Strawberries*, at the end of *two Days* they look'd leſs freſh; but after that, ſeeing they *Changed* no more, I took them out of the *Vacuum* after they had been there 15 *Days*. They had ſtill the *Smell* and *Taſte* of *Strawberries*; but they had alſo contracted a very ungrateful *Taſte* of the Cement which I then employed to cloſe them up with.

Vid. Sup. §. LXXIV. At another time, I put ſome *Strawberries* without Cement, making uſe of a *Skin*, after the manner deſcribed formerly, and I then Obſerv'd nothing new, except that their *Taſte* kept *Good*, but was a little *Sowriſh*, and that they yielded a little *Water*.

Jun. 24. I included ſome *Cherries*, to the Number of 25 or 30, in a *Receiver* which was almoſt fill'd with them. They all *burſt* but two. *Two Days* after they had a little *Chang'd* their *Colour*, and thoſe two that before remained whole, were now *burſt* like the reſt. After that, I Obſerv'd no more *Change* in them.

Jul. 20. I included in the *Vacuum* one *Cherry* with eleven great *Corants*. The *Cherry burſt* preſently, and after that, I found it not *Changed*, only it appear'd Turned, as the *Corants* alſo did: This is a Beginning of *Putrefaction* which may be imputed to the *Air* that remains in the *Receivers*.

Jul. 27. I included in the *Vacuum* four *Raſberries* and three *Corants*. The latter appear'd alſo to be *turn'd*, and the *Rasberries* looked leſs freſh than they were. But 'tis now more than 5 *Months* that I perceive no *Change* in them.

Hitherto I had employed none but *ſmall Receivers*, which did juſt hold that little Fruit I put in them, and the *Red Corants* ſeem'd to keep well enough; ſo that one Day I fill'd a *great Glaſs* (of the Figure of Cupping Glaſſes) with them, hoping to keep that as well as the *ſmall Receivers*. But I was ſurpriſed *five Days* after, to ſee that *Bubbles* were formed in the *Turpentine* which I had put about the ſaid *great Glaſs* in the place where it was faſtned to its *Cover*, and that theſe *Bubbles* were burſt outwards; and afterwards, having ſeen that the *Cover* held faſt to the Bolthead no longer, I made no doubt of the *Corants* having *produced Air* enough to lift up the ſaid great Glaſs, and to form in the *Turpentine* the *Bubbles* I had ſeen. I was confirmed in this thought, when I found by the *Smell* that they had *Fermented*. They were yet *good* except ſome that had loſt almoſt all their *Taſte*, and all their *Acidity*.

The ſame thing happen'd to me with a very *ſmall Receiver*, that could hold no more but one *Cherry* (of that kind we call *Bigarreaux*) and one *Red Corant*. Theſe Fruits yielded alſo *Air* enough to *Lift* up their *Receiver* 7 *Days* after they had been included therein: And having reiterated this Experiment, I found the ſame Succeſs; only this ſecond Time the *Receiver* was not *Lifted* up till the 11*th Day*. This Effect is rather to be aſcribed to the *Cherry* than the *Corant*; becauſe I have kept *Corants* to the Number of 11, in a ſmall Glaſs, and they

did

did not *Raiſe* it up. Whence it follows, that the *Bigarreaux* yield much more *Air* than *Acid Fruit*.

Another time I included ſome of the ſame kind of *Cherries*, a whole great Glaſs full, and found, that from the *Second Day* they had yielded *Air* enough to *Lift* up the *Cover*. I took away part of the *Cherries*, and included the reſt again.

This Second time they did not *Raiſe* the Glaſs till the 8*th Day*. The *Cherries* looked *Fair*, but they had loſt much of their *Taſte*, and afterwards they were ſpoiled in leſs than an *Hour*.

I did alſo one Day include three *Pears*, of that ſort we call *Rouſſelet*, in a like Figur'd Glaſs, which could hold no more. They *Lifted* up the Glaſs at the end of 5 *Days*, and they were not *Changed*, only one of them was a little Softer.

Another time I put a *Peach* in ſuch a Glaſs emptied of *Air*, with a *Gage* to it; and I found, that the firſt 6 *Hours* the *Quickſilver* in the *Gage* was riſen about an *Inch*. Yet it was not till the 13*th Day* that the Glaſs was *Lifted* up; and the *Peach* appear'd to have kept very well till then; but after that, it *Rotted* in a very little Time.

I did once put ſome *Bread* with a *Gage*; but I found not that for the ſpace of a whole *Month* it had yielded any *Air*; ſo that I took it out, and found it yet *good*; only it had a little *Taſte* of *Muſtineſs*, which yet appear'd not at all to the Eye, and whereof the Cauſe may be aſcribed to that little *Air* that might reſt in the *Receiver*.

One Day I included a piece of *Roaſted Mutton* with a *Gage*, and found, that in 4 *Days* it had yielded no *Air*; but after my Abſence of 6 *Weeks* I ſaw the *Mercury* was Riſen to the Middle of the *Gage*; and having taken out the *Meat* I found it of a very ill *Smell*.

Two Days after, I included a piece of *Raw Beef*, and a *Gage* with it, and I ſaw, that in *two Days* the *Quickſilver* was Riſen an *Inch* in the *Gage*; and after 6 *Weeks* Abſence, I found, the *Mercury* was got almoſt to the Top of the *Gage*, and that this *Meat* had contracted a much worſe *Smell* than that which had been *Roaſted*.

I alſo kept for 15 *Days* a piece of *Freſh Butter in Vacuo*, and I found, that it *Smelt* more Strong than when I firſt put it in: But yet it could not be ſtill *eaten* upon Bread; whereas another piece of *Butter*, which at the ſame time I had kept in the *Air*, was altogether unfit to be *Eaten*.

One Day I *covered* a *Receiver*, whoſe 4*th* part was fill'd with *Water*, and the reſt all *empty*. I put it over the Flame of a Candle, and ſaw, that the Water *Boyled* very quickly, yet the Glaſs not much *Heated*; ſo that the Water *Boyled* near a *Quarter* of an *Hour* with a great *Ebullition*, and the Glaſs was no more than *Tepid*. I then took it away from the Flame, and ſaw, that the Water continued a very great while *Boiling*, and that it began again from time to time. I then believed, that the Vapours which had been Raiſed into the *Air*, were Recondenſed by the Cold, and that that made the Hot Water *Bubble* up, as Water uſually doth when 'tis put into the *Engine*, and the *Air* that preſſes it *Exhauſted*. Mean time, I have ſince made the Experiment with n. 121. p. 544.

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a *Gage*, and *I* did not perceive, that all the *Bubbles* that iſſued out of the Water, made the *Mercury* riſe to Senſe.

After this, *I* left my *Receiver* expoſed to the *Froſt*, and *I* found that the *Ice* which was made therein was not yet quite free from *Bubbles*, though the Water thereof had *Boiled* in the *Vacuum*, which one would think, ſhould have driven out all the *Air*: Yet the *Bubbles* were there far leſs numerous than in *Ice* made of *ordinary Water*. *I* perceived not, that the *Quickſilver* was much Riſen in the *Gage*. Afterwards *I* Melted this *Ice*, and put the Water abroad to *freeze* again, ſtill without taking it out of the *Vacuum*, and *I* found that this ſecond time it was very much freer from *Bubbles*. The Glaſs did not *break*; but becauſe it was ſomewhat *Conical*, we could not know, whether it remained *whole* upon the Account of it's *Figure*, or becauſe that the *Water*, which was *Frozen* within, was *freed* of *Air*.

After this, *I* made *Spirit* of *Wine* Boil *in Vacuo*, in the ſame manner *I* did the *Water*; and *I* ſaw, that it *Boil'd* much ſooner It made the *Mercury* Riſe about an *Inch* in the *Gage*. Then *I* took it from the Fire, and ſaw it continue in its *Boiling*; and even ſinking the *Receiver* into *Cold Water*, it thereupon *Boiled* much more ſtrongly. One would think, this proceeded from an *Antiperaſtaſis*; but we have more ground to ſay, it came from hence, that the Vapours of the *Spirit* were Condenſed, and ſo made the *Receiver* more Empty; which is ſufficient to make the *Spirit* of *Wine Boil*, even though it were not *Hot*. The *Quickſilver* did in *two Hours* ſubſide again, to near half a *Line* as low as it had been. Then *I* put the *Receiver* over the Flame again, and made the *Mercury* Riſe more than *two Inches*; but then the *Receiver* Cracked.

One Day *I* took a Tube of *Plaiſter* of *Paris*, Open at one end, and Cloſe at the other. *I* applyed the Open end to the Cement as *I* was wont to do *Receivers*; and *I* ſaw it was not poſſible thus to *Exhauſt* it, becauſe the *Air* did eaſily paſs through the *Plaiſter*. *I* put therefore a Tube of *Iron* on the *Engine*, ſo as having fill'd it with *Water*, the Tube of *Plaiſter* was covered therewith; and then having cauſed the *Pump* to be Plied, *I* found, that the *Water* did paſs as eaſily through the ſaid *Plaiſter*. *I* therefore cover'd it with *Venice-Turpentine* inſtead of *Water*, and then *I* ſaw, that it *Evacuated* very well, and that nothing paſs'd through it for the ſpace of *two Hours*. Then *I* took ſome *Oyl* very *Hot*, and pour'd it over the *Turpentine*, which did Melt by this *Heat* and paſs'd through the *Plaiſter*. Than *I* took off this Tube which was ſo pervaded by the *Turpentine*, and *I* ſaw, that that had made it *Tranſparent*: Which Effect is pretty like, and is to be explicated in the ſame manner as that of the little Stone called *Oculus Mundi*. Thus we may be aſſiſted by the *Weight* of the *Air* to make divers ſorts of *Glues* penetrate *Plaiſter*, *baked Earth*, *Wood*, *&c.* And poſſibly thoſe, who ſhall make a good Number of ſuch Trials, will find their Labour and Pains recompenced, by giving to thoſe *Materials* ſuch *Properties*, as they never had before.

I did alſo put ſome *Eggs* in the *Vacuum*, and one Day *I* ſaw one of them *Break*, which *I* had put in a ſmall *Receiver*. It *burſt* upon the very firſt *Suction*: But ſince that time *I* could never make any *break*, though *I Exhauſted* as much as

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I could thoſe *Receivers* wherein *I* had put ſome. You muſt therefore begin to Crack them a little before you put them in the *Vacuum*, and then they do eaſily *Break* quite, and what is in the *Egg* Riſeth all into a very thick *Froth*. I alſo put ſome of theſe, thus ordered, over the Fire, where they *Boiled* very eaſily, not being preſſed by the *Air*, but they *Boiled* there very long, before it began to appear that they were ſo *Boiled* as to be ready to *Eat*.

All the little *Bubbles* that appear in *Muſtard*, do ſwell and *Break in Vacuo*, and after that, the *Muſtard* is ſeen to be without *Bubbles*.

One Day *I* included a *Black Ribbon* in the *Vacuum*, and then *Burnt* it with a *Burning Glaſs*. Abundance of *Smoak* iſſued out of it, which fell by little and little, and ſo permitted us to ſee the *Ribbon* plainly ; which appeared not at all *Changed*. But after *I* had returned the *Air* into it, and Touched it, *I* found it Turn'd to *Aſhes*.

Another time *I* cauſed alſo ſome *Gunpowder* to be *Burnt* after the ſame manner; and *I* was much ſurprized to ſee, that it *Burnt* Grain by Grain, none of the Grains kindled, *Firing* thoſe which Touched. Another time when the Sun had leſs Force, *I* could not at all *kindle* the Powder, but *I* made it only *Boil* and Emit ſtore of *Smoak*. *I* had put a *Gage* in the ſame *Recipient*, by means whereof *I* Obſerv'd, that that *Smoak* produced no *Air*; for the *Quickſilver* did not Riſe in the Tube. *I* noted alſo, that this *Smoak* falling upon the Paſt-board, on which *I* had put the Powder, appeared *Yellow*, of the Colour of *Brimſtone*. After that, I took out the Powder that remained, being like a Black Maſs, and having put it upon Burning Coals, I ſaw it *Burned* as doth *Salt Petre*, and ſo it appeared, that the *Sulphur* was almoſt all Exhaled. *I* was willing to reiterate this Experiment, and *I* then ſaw that the Powder, after *Boiling*, *Fuming*, and being *Kindled* Grain by Grain, (as in the firſt Experiment,) at laſt *Flaſhes* out all at once, when one hath the Patience to hold the *Fire* to it with a *Burning Glaſs*. And when the *Fumes* are grown Clearer, you may ſee *Needles* of *Salt-Petre* ſticking to the ſides of the *Receiver*.

Another time, *I* put the Weight of 12 or 15 *Grains* of *Powder* in a Glaſs ſhaped like a Cupping Glaſs, capable to hold 14 *Ounces* of Water, and having put *Fire* to it, *I* made the Powder *Boil* and *Smoak* as uſually. Afterwards, ſeeing that the Corns began to *Crack* very near one after another ; *I* then took away the *Burning Concave*, for fear all ſhould be *Kindled* together: But it was already too late ; for, the Corns did continue to *Crack* longer than a ſecond of Time, and at laſt all *Kindled*, though there was then nothing left to Heat them but the *Fire* which they had kept within themſelves. The *Receiver* was Lifted up above a Foot high without Breaking.

Another time *I* put the Weight of 18 *Grains* of *Powder*, together with a *Gage*, into a *Receiver* holding 7 *pound* of Water ; and *I* ſaw, that the *Powder* was more difficult to be *Kindled*, than in ſmall *Receivers*. Yet at length it was *Kindled* altogether, and made the *Quickſilver* Riſe to the Height of an *Inch* and a *half* in the *Gage*; and I am very well aſſured, that all that *Air* was not come from without; for that part of the *Receiver*, to which the *Cover* is applied, had always been under Water.

From what I have been relating, it may be concluded, that there is a *Fifth* part of *Air* in *Gunpowder*; ſuppoſing, as other Experiments do ſhew, that *Air* is about a *thouſand times* Lighter than Water. For, in this Experiment, the *Mercury* did Riſe to the 18*th* part of the Height where the *Air* commonly Suſtains it; and conſequently the Weight of 18 *Grains* of *Powder* did yield *Air* enough to fill the 18*th* part of a *Receiver* that contains 7 *pound* of Water. Now, this 18*th* part contains 49 *Drachms* of Water: Wherefore the *Air*, that takes up an equal Space, being a 1000 *times* Lighter, Weighs $\frac{1}{1000}$ of 49 *Drachms*, which is more than $3\frac{1}{2}$ *Grains*. It follows therefore, that the Weight of 18 *Grains* of *Powder* which I employed in my Experiment, contained more than $3\frac{1}{2}$ of *Air*, which is about the *Fifth* part of 18 *Grains*.

It may alſo be Calculated, how many times this *Air* hath been *Compreſſed* in the Powder: But this Calculation is more uncertain than the former, becauſe we know not, whether this *Air* took up more or leſs than the 5*th* part of the Space which the *Powder* poſſeſſed. But yet 'tis certain, that, though it had even taken up *three fourths* of the whole Room of the *Powder*, and that the 14 *Grains* of the other Matter had taken up no more than the one remaining *fourth* part, ſtill this *Air* would have been *Compreſſed* about *three hundred* times. To Calculate this, I ſuppoſe, that the Space of a *Cubick Foot* can hold only 72 *pounds* of *Gunpowder*, which do contain more than 14 *pounds* of *Air*, by the foregoing *Calculus*: which Quantity of *Air* is therefore found incloſed in the *three fourths* of a *Cubick Foot*. Now, this Space doth uſually contain but about 6 *Drachms* of *Air*: Wherefore, to make it hold *fourteen pounds* of *Air*, which is near *three hundred* times *ſix Drachms*, it muſt needs be, that that *Air* be *Compreſſed* near 300 times.

There is reaſon to believe, that this *Compreſſion* is much greater, becauſe a *Cubick Foot* can hold much more than 72 *pounds* of *Powder*, and becauſe alſo that the *Fifth* part of the Weight muſt not, in appearance, poſſeſs alone the *three fourths*, and all the reſt take up no more than *one fourth* of the Space poſſeſſed by all the *Powder*.

I ſhould therefore make no difficulty to believe, that all the Effect of *Gunpowder* comes from the *Air* which is *Compreſſed* therein, and eſpecially in the *Salt Petre*; for I have not yet Obſerved, that *Brimſtone* yields *Air*. Poſſibly alſo we may find in time, that all other *Fulminations*, *Ebullitions* and *Fermentations*, that make ſuch ſurprizing Motions, are nothing elſe but *Air Compreſſed* expanding it ſelf.

N. 122. p. 542. One Day I included in the *Vacuum* an Inſect which reſembles a *Beetle*, but is a little bigger; and when I perceived it to appear *Dead*, I gave it *Air* again, and it ſoon after *Recovered*. Then I put it in the *Vacuum* again, and having left it there, for an *Hour*, I readmitted the *Air*, and found, that then the Inſect needed much more time to *Recover*. I included it there the third time, and having left it there *two Days*, I gave it *Air* again, and ſaw it needed about *ten Hours* before it began to *Stir* again; yet it recovered well enough this time: But having put it in again, the fourth time, and left it there 8 *Days*, it would never *Stir* again.

Intending

Intending to try the like upon a *Butterfly*, *I* saw, that when *I* readmitted *Air* to it, that the top of its Back, which before was much *Swelled*, did *fall in* more than it ſhould, and the Inſect would not *Recover*.

I alſo *Killed* in the *Vacuum* many Animals that Breath, as *Birds*, *Mice*, *Ratts*, *Rabbets*, *Cats*; and ſome of them *I Recovered* by quickly giving them *Air* again, before the *Engine* was quite *Exhauſted*; but *I* never ſaw any of them *Revive*, that had been in a *perfect Vacuum*.

M. *Guide* did make frequent *Diſſections* of ſuch Animals as we had thus *Kill'd*, and Obſerv'd, amongſt other things, that their *Lungs* fell to the *Bottom* in *Water*. He ſaith, that the Solidity or *Cloſeneſs* of the *Lungs* of Animals that have *Died in Vacuo*, comes from hence, that the *Blood*, which is propelled into the *Lungs* by the *Vena Arterioſa*, doth ſo ſtrongly preſs the *Bronchi* of the *Arteria Aſpera*, that it expreſſes the *Air* out of them, and glues as 'twere their ſides to one another. But for my part, *I* do not believe, that the *Blood* of the *Vena Arterioſa* can thus Compreſs thoſe *Bronchi*, becauſe that the ſaid *Blood* is incloſed in its Veſſels, that keep and hinder it from Compreſſing others. Yet *I* am not ignorant, that the things that are included in the *Oeſophagus* do indeed Compreſs the *Aſpera Arteria*, and that the *Aſpera Arteria* by being filled Compreſſes alſo the *Oeſophagus*, upon the account of the Scituation of theſe two *Conduits*. But it appears not at all, that the ſmalleſt *Ramifications* of thoſe *Bronchi*, and of the *Vena Arterioſa*, are Scituate in the ſame manner; for the *Bronchi* being harder than the *Arterial Vein*, they will Compreſs it more eaſily, than be Compreſſed by it; and ſo, if you ſhould blow them up with Bellows, they would *Glue* the ſides of that *Vein* together, and hinder the *Circulation:* which is directly contrary to the Experiment; as M. *Guide* himſelf obſerveth.

It is therefore far more probable, that if the *Lungs* be Compreſſed, that Compreſſion be made by the *Pleura*, which may be Swelled within the *Breaſt* as the Skin is Swelled without. But it is not neceſſary, that the *Lungs* be Compreſſed *in Vacuo*, to make them *Subſide* in *Water*, for I have divers times put pieces of *Lungs* and whole *Lungs* in the *Vacuum*, and they remained there extreamly Swelled; but as ſoon as the *Air* was again intromitted, they became very Flat and Red, and *Sunk* to the *Bottom* in *Water*. Which ſhews, that 'tis ſufficient for getting the *Air* out of the *Lungs* to render them *Cloſe* and *Red*; and *I* have not been able to produce this Effect but by means of the *Exhauſting Engin*. For, *I* have left *Lungs* a whole Night between two Plates with a great Weight upon them, to endeavour to Expreſs the *Air* out of them, but it would not ſucceed, and thoſe *Lungs* did ſtill *Float* upon the Water. *I* have alſo tried to make the *Air* re-enter into the *Lungs* after *I* had rendered them *Solid* in the *Engine*, and that *I* found very eaſie; for, drawing them out from the *Bottom* of the *Water*, *I* did Blow into the *Aſpera Arteria*; and the *Lungs* Swelled again, and reſumed their *Ordinary Colour*, and *Floated* on the *Water*. And this is that which befalls the *Lungs* of *Infants New-Born*.

LXXX. *I Seal'd* up a round Glaſs *Hermetically*, and covered it with a double Bladder very carefully, and including it in a large *Receiver*, *I* found, according

A Pneumatical Experiment; by M. Joh. Chr. Sturmius. *Ph. Coll.* n. 2. p. 8.

cording to my Expectation, that after about 200 *Exhauſtions* had been made, it broke all in pieces with a very great *Noiſe*.

LXXXI. Papers, *of Leſs General Uſe*, Omitted.

n. 251. p. 144. 1. A Liſt of the *French Academicians* at their New *Regulation* in the Year 1699. by *M. Geoffry*.

n. 99. p. 6158. 2. An Account of ſome of the *Natural things*, with which the Intelligent and Inquiſitive Signior *Paulo Boccone*, of *Sicily*, hath lately preſented the *R. S.* and enriched their *Repoſitory*.

n. 246 p. 393. 3. Remarks by Mr. *Ja Petiver*, on ſome *Animals*, *Plants*, *&c.* ſent to him from *Maryland*, by the Rev. Mr. *Hugh Jones*.

n. 255. p. 295. 4. A Catalogue of *Shells*, *&c.* gathered at the *Iſland* of *Aſcenſion*, by Mr. *Ja. Cunningham*, Chirurgeon, with what *Plants* he there Obſerved; Communicated to Mr. *Ja. Petiver*.

n. 246. p. 390.
n. 247. p. 461.
n. 249. p. 44.
n. 250. p. 70. 5. An Account of a *China Cabinet*, filled with ſeveral *Inſtruments* and ſome *Natural Curioſities*, of that Country, ſent to the *R. Society* by Mr. *Buckley*, Chief Surgeon at *Fort St. George*; by *Hans Sloane* M. D.

n. 10. p. 167. 6. A *Thermoſcope* and a *Baroſcope* (invented by Mr *Rob. Boyle*) deſcribed, by Dr. *Wallis*.

n. 13. p. 218. 7. Dr. *Hook's Wheel Barometer* (deſcrib'd in his *Micrography*) is here ſomething Improv'd; by Himſelf.

n. 91. p. 5168. 8. *Experiments* Propoſed, to explicate the Reaſon of the *Suſpenſion* of *Mercury* in the *Torricellian Tubes* at an unuſual Height; by Dr. *Wallis*.

n. 206. p. 998. 9. Some *Queries*, concerning the Nature of *Light* and *Diaphanous Bodies*; by Mr. *Edm. Halley*.

n. 79. p. 3060. 10. *Queries*, concerning the different Effects of the *Sun's Heat* collected by a *Burning Concave*, and that of *Fire*, upon *Gold*, *&c.* by P. *Fr. Lana*.

n. 66. p. 2020. 11. An *Experiment* concerning the Progreſs of *Artificial Conglaciation*, and the remarkable Accidents therein obſerved; by the *Florentine Philoſophers*, and publiſhed in their *Saggi di Naturali Eſperienze*.

n. 23. p. 424. 12. Propoſals to try the Effects of the *Pneumatical Engine* Exhauſted, in *Plants*, *Seeds*, *Eggs* of *Silk Worms*, *&c.* by Mr. *Rob. Boyle*, and Dr. *Beale*.

LXXXII. Accounts *and* Emendations *of Books*, Omitted,

n. 27. p. 501. 1. THE *Hiſtory* of the *Royal Society* of *London*, for the Advancement of *Experimental Philoſophy*; by *Tho. Sprat*.

n. 36. p. 715. 2. The Progreſs and Advancement of *Knowledge* ſince the Days of *Ariſtotle*; in an Account of ſome of the moſt Remarkable late *Improvements* of *uſeful Learning*; by *Joſ Glanvill. Lond*, 1668 in 8°.

n. 8. p. 145. ☞ 3, A Narration of the *Eſtabliſhment* of the *Lyncei*, an *Italian Academy*, and of their *Deſign* and *Statutes*.

n. 203. p. 886. 5. *Diogenes Laertius*. *Græce* & *Latine*; Cum Commentariis integris Doctorum Virorum. *Amſtel.* 1692.

n. 194. p. 535. 6. C. *Plinii* Hiſtoria Naturalis. *Notwithſtanding the great Care of* R. P. Harduine

Harduine, *in this Curious* Edition, yet *He hath paſt over ſeveral* Faults; 3 *of which Mr.* Halley *hath here* Corrected, *viz.*

1. *Lib.* 2, *Cap.* 13. Defectus [*Solis* & *Lunæ*] *Ducentis Viginti Duobus* Menſibus redire in ſuos Orbes certum eſt: *whereas it ought to be,* CCXXIII; *at which Time that* Period *is* Completed; *and the* Moon *Returns to the* Sun *and to the ſame* Node *Accurately enough, to her* Apogæum *very near, and within a few* Degrees *to the ſame* Place *of the* Heavens.

2 *Lib.* 11. *Cap.* 37. Jecur maxime Vetuſtatis Patiens Centenis durare Annis *Obſidionum* exempla prodid're; *which Mr* Halley *conjectures ſhould either be* Hoc *Seniorum* exempla, or Hoc *Sirorum* exempla prodidêre.

3. *Lib.* 20. *Cap.* 14 *Inſtead of* Syriation *& Vomicas Vulvæ curavit illa, Mr.* Halley *Reads* Satyriaſin *& Vomicas Vulvæ curavit.*

7. Pinax rerum *Naturalium Britannicarum*, continens *Vegetabilia. Animalia*, & *Foſſilia*, in hoc *Inſula* reperta. Auth. *Chr. Merret.* M. D. n. 20. p. 364. n. 24. p. 448.

8 Muſeo Coſpiano anneſſo a quello del famoſo *Uliſſe Aldrovandi*,& donato alla ſua Patria dall' Illuſtriſſimo Signore Ferdinando *Coſpi* Patricio di *Bologna* & Senatore, *&c.* Deſcrizzione di *Lorenzo Legati Cremoneſe.* In *Bologna* 1678 in *Fol.* n. 140. p. 1011.

9. Muſei *Petiveriani* Centuria Prima; Rariora Naturæ continens: viz. *Animalia, Foſſilia, Plantas*, ex variis Mundi Plagis advecta; Ordine digeſta; Nominibus propriis ſignata; & Iconibus Æneis eleganter illuſtrata. *Lond.* 1696. in 8°. n. 224. p. 393.

10. 1 Saggi di Naturali Experienze, fatte nell' *Academia del Cimento*, in *Firenze*; *An.* 1667. in *Fol.* n. 33. p. 640.

2. Eſſays of Natural Experiments made in the *Academy del Cimento* under the Protection of the moſt Serene Prince *Leopold* of *Tuſcany. Engliſh'd* by the Ingenious *Rich Waller* Eſqr. *Lond.* 1684. in 4°. n. 164. p. 757.

11. 1. *Miſcellanea Curioſa* Medico-Phyſica, *Academiæ Naturæ Curioſorum*, Annus *Primus. Lipſiæ* 1670 in 4°. n. 68. p. 2077.

2 Annus *Secundus*; Anni *Scil.* 1671. Jenæ. 1671. in 4°. n. 85. p. 5024.

3. *Ephemeridum* Medico-Phyſicarum *Germaniæ* Annus *Tertius*, *&c. Lipſiæ* & *Francofurti.* 1673. in 4°. n. 101. p. 15.

4 Annus IV & V. Anni 1673 & 1674, *&c.* Cum Appendice. *Francofurti* & *Lipſiæ* 1676. in 4°. n. 129. p. 742.

12. 1. *Thomæ Bartholini* Acta Medica & Philoſophica *Hafnienſia. An.* 1671 & 1672. *Hafniæ.* 1673. in 4°. n. 97. p. 6135.

2. *An* 1673. *Hafniæ.* 1675. in 4°. n. 114. p. 315.

13. *Georgii Hieronymi Velſchii* Hecatoſteæ 2. Obſervationum *Phyſico-Medicarum* Auguſtæ Vindelicorum. 1675. n. 127. p. 673.

4. *Stephani Chauvini* Lexicon Rationale, ſive Theſaurus Philoſophicus, *&c. Rotorodami.* 1692. in *Folio.* n. 199. p. 731.

A. &

14. 1. Collegium *Experimentale* ſive *Curioſum*, in quo Primaria hujus Seculi inventa & Experimenta *Phyſico Mathematica*, *A.* 1672. quibuſdam Naturæ Scrutatoribus ſpectanda exhibuit, & ad Cauſas ſuas Naturales demonſtrativâ Methodo reduxit, *Jo. Chriſtophorus Sturmius Norimbergæ.* 1676. in 4°. n. 121. p. 509.

2. Pars Secunda. *Altorfi.* 1685. in 4°. n. 175. p. 1184.

15. Experienze intorno a diverſe *Coſe Naturali*, & particolarmente à quelle che ci ſon portate dall' *Indie*; fatte da *Franceſco Redi* in *Firenze.* 1671. in 4°. n. 92. p. 6001.

16 Ob-

n. 207. p. 33. 16. *Observationi Naturali, ove si contengono materie* Medico Fisiche, *&c.* Natural Observations, containing several *Medico Physical*, and *Botanical* matters; with diverse *Natural Productions*; several sorts of *Phosphori*, *subterraneous Fires* in *Italy*; and other Curious Subjects; in Familiar Letters, by Signior *Paul Boccone*. M. D. *Bononia*, 1684. in 12o

n. 207. p. 37. n. 249. p. 53. 17. *Museo di* Fisica, *& di* Esperienze, *arrichito di Figure di* Piante Nove, *Osservazione*, *Note Medicinali e Ragionamenti*, *secondo i Principii di Neoterici*, *disposito in Decade* VIII. by *S.* Paolo Boccone. Upon this Book Mr. *Ray* adds here some Remarks of his own.

n. 73. p. 2214. 18. *Philosophus Autodidactus*, exhibitus in Epistola, ex *Arabica* in *Latinam* Linguam versa, ab *Edvardo Pocockio*; *Oxon.* 1671. in 4o

n. 69. p. 2114. 19. *Prodromo* Overo Saggio di alcune Inventioni nouve premesso all' *Arte Maestra*, di P. *Francisco Lana. S. I.* in *Brescia*, 1670. in 4o.

n. 72. p. 2179. 20. Of the *Usefulness* of *Experimental Natural Philosophy*, the 2d *Tome*; by the Honourable *Robert Boyle*, Esquire, *Oxon.* 1671. in 4o.

n. 103. p 53. 21. About the Excellency and Grounds of the *Mechanical Hypothesis*, some Considerations occasionally proposed to a Friend, by *R. B.* E. *Lond.* 1674. in 4o

n. 181. p. 116. 22. A Free Enquiry into the Vulgarly receiv'd Notion of *Nature*; by the Hon. *R. Boyle*, Esq; *Lond.* 1686. in 8o

n. 40. p. 810. 23. *Ren. des Cartes* Epistolæ; Pars *Prima* & *Secunda*. *Lond.* 1668 in 4o.

n. 22. p. 392. 2. Le Tome *Troisieme* & Dernier des *Lettres* de M. *des Cartes*.

n. 54. p. 1094. 24 Le *System General* de la *Philosophie*; par *Francois Bayle*. D. M. a *Tholouze*, 1696. in *Fol.*

n. 62. p. 2034. 25. A Discourse in Vindication of *des Cartes*'s *Systeme*; by Mr. *des Fourneillis*: To which is annexed, the *System General* of the same *Cartesian* Philosophy, by *Francis Bayle*. M. D. *Lond.* 1670.

n. 70. p. 2137. 26. *Philosophia Veterum*, è Mente *Renati des Cartes* breviter digesta; ab *Antonio le Grand*, *Lond.* 1670. in 12o.

n. 80. p. 3094. n. 108. p. 192. 27. *Antonii le Grand* institutis *Philosophiæ*, secundum Principia *Renati de Cartes*, nova Methodo adornata, & explicata, *Lond.* 1672 in 8o.

n. 94. p. 6046. 28. *Antonii le Grand* Historia *Naturæ*. *Lond.* 1673, in 8o.

n. 123. p. 570. 29. De Consensu *Vet.* & *Novæ Philosophiæ*, Lib. 4. seu Promotæ per *Experimenta Philosophiæ* pars *prima* : Auth. *J. B. du Hamel.* P. S. L. in 12o.

n. 65. p. 2105. 30. 1. De *Corporum Affectionibus* cum Manifestis tum Occultis, Libri 2. seu Promotæ per *Experimenta Philosophiæ* Specimen. Auth. *J. B. du Hamel*, Paris,

Ibid. p. 2106. 1670. in 12o. *Mr.* Boyl's *Discourse* (*in his* Origine of Forms and Qualities,) *concerning the Necessity of the* Creator's Concourse *in the* Preservation *of all things*,

n. 98. p. 6151. *being Misunderstood by Mr.* du Hamel, *is here* Explain'd.

2. De *Corpore Animato*, Libri 4, seu Promotæ per *Experimenta Philosophiæ* Specimen alterum: Auth. *Joh. Baptista du Hamel.* P.S. *L. Parisiis*, 1673, 12o.

n. 131. p. 790. 31. Clavis *Philosophiæ* Naturalis, *Aristotelica Cartesiana*; Editio secunda, aucta Opusculis Philosophicis varii Argumenti; quibus Errores Scholarum passim deteguntur, ac veritas *Philosophiæ*, quam *Cartesianam* vocant, confirmatur, Auth. *Jo. de Raei. Amst.* 1677. in 4o.

n. 65. p. 2007. 32. Elementa *Physica*, sive nova *Philosophiæ* Principia; ubi *Cartesianorum* Principiorum

Principiorum Falsitas ostenditur, ipsiusque Errores ac Paralogismi ad Oculum demonstrantur ac refutantur; a *Fran. Willhelmo* Libero Barone de *Nuland*, &c. *Hagæ Comitis*, 1669. in 12°.

33. Placita Philosophica *Guarini*. n. 20. p. 365.

34. *Physica*, in Decem Tractatus Distributa; Auth. *Honorato Fabri*. S. J. *Lugd. Gal.* 1669. in 4°. n. 68. p. 2082.

35. *Honorati Fabri*. S. J Tractatus duo; quorum Prior est de *Plantis* & de *Generatione Animalium*; Posterior de *Homine*. n. 18. p. 325.

36. Traite de *Physique* par *Jaques Rohault*. a *Paris*, 1671. in 4°. n. 70. p. 2138.

37. Propositiones *Hydrostaticæ* ad Illustrand. *Aristarchi Samii* Systema destinatæ, & quædam *Phænomena Naturæ* generalia. Auth. *Francisco Jessop*. Arm. *Lond.* 1687 in 4°. n. 191. p. 440.

38. *Casp. Bartholini* Thom. F. Specimen *Philosophiæ Naturalis*. Accedit de *Fontium, Fluviorumque Origine* Dissertatio Physica: *Amstelodam*. 1697. in 12°. n. 237. p. 62.

39. *Thomæ Cornelii Consentini* Progymnasmata *Physica*. n. 30. p. 576.

40. Les Essays *Physiques* du Sieur *de Launay*. n. 30. p. 579.

41. *Erasmi Bartholini* de *Naturæ* Mirabilibus Quæstiones Academicæ *Hafniæ*, 1674. in 4°. n. 107. p. 159.

42. Decameron *Physiologicum*: Or Ten Dialogues of *Natural Philosophy*. To which is added the Proportion of a *Streight Line*, equal to half the Arch of a *Quadrant*. By Mr. *Hobbs*. n. 138. p. 965.

43. Cosmopœia Divina, seu *Fabrica Mundi* explicata, per *Ludov de Beaufort*. M D. *Lugd. Batav.* 1656. in 12°. n. 59. p. 1051.

44. *Cartesius Mosaizans*; Auth. *Joh. Amerpoel Leowardiæ* 1659. in 12°. Ibid. p. 1053.

45. The Divine History of the *Genesis* of the *World*, explicated and illustrated, *Lond.* 1670. in 4° n. 60. p. 1083.

46. A Treatise of the *Bulk* and *Selvage* of of the *World*, &c. by *Nath. Fairfax*. M. D. *Lond.* 1673. n. 99. p. 6172.

47. *Telluris Theoria sacra*: Authore *T. Burnetio*. *Lond.* 1681. in 4°. *Ph. Col.* 3. p. 75.

48. *Archeologiæ Philosophicæ*, sive Doctrina Antiqua de *Rerum Originibus*; Libri duo Auth. *Tho Burnet*. Lond. 1692. n. 201. p. 796.

49. Considerations on a Book Entituled, the *Theory* of the *Earth*: Published some Years since by the Learned Dr. *Tho. Burnet*. Written by *Jo. Burnet*, Jun. Gent. n. 203. p. 888.

50. The Wisdom of God manifested in the *Works* of the *Creation*; in 2 Parts. by Mr. *J. Ray*. *Lond.* 1692. in 8°. n. 196. p. 611.

51. 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 Mr. *J. Ray*. *Lond*, 1693, in 8°. Ib. p. 615.

52. The Prodromus of a Dissertation concerning a *Solid* contained in a *Solid*; by *Nicolaus Steno*: *English'd* out of *Latin*. *Lond.* 1671. in 8°. n. 72. p. 2186.

53. An Essay toward a *Natural History* of the *Earth*, and Terrestrial Bodies, especially *Minerals*: As also of the *Sea*, *Rivers* and *Springs*. With an Account of the *Universal Deluge*, and of the Effects it had upon the *Earth*. By *J. Woodward*, M. D. *Lond.* 1695. in 8°. n. 215. p. 115.

54 In

n. 219. p. 181. 199. 54. La Vana Speculatione disingannata dal senso: Lettera Risponsiva circa *i Corpi Marini*, che *Petrificati* si travano in varii Luoghi Terrestri. *Di Agostino Scilla* Pittore Academico della *Fucina*, in Napoli, 1670. in 4o *This Book is here* Abridg'd, *some short* Notes *added, and some of the* Author's Figures *annexed and explained, by two of the* Fellows *of the* Royal Society.

n. 8. p. 145. n. 11. p. 191. 55. 1. The Origin of *Forms* and *Qualities*, illustrated by Considerations and Experiments; by the Hon. *Robert Boyle*, Esq.

n. 66. p. 2034. 2 The same in *Latin. Oxon.* 1669 in 12o.

n. 28. p. 532. 56. Free Considerations about *Snbordinate Forms*; by the Hon. *Rob. Boyle.*

n. 63. p. 2057. 57. Tracts written by the Hon *Rob. Boyle*, about the *Cosmical Qualities* of things; the Temperature of the *Subterraneal* and *Submarine Regions*; and the *Bottom* of the *Sea*; together with an Introduction to the History of *Particular Qualities. Oxon.* 1670. in 8o

n. 127. 669. 58 Experiments, Notes, *&c.* about the *Mechanical* Origin of diverse *Particular Qualities:* Among which is inserted a Discourse of the Imperfection of the *Chymists Doctrine* of *Qualities*; together with some Reflections upon the *Hypothesis* of *Alcali* and *Acidum:* By the Hon. *Rob. Boyle* Esq *Lond* 1675. in 8o

n. 130. p. 766. 59. *Roberti Boyle* Nobilissimi *Angli & Soc. Regiæ* dignissimi *Socii*, Opera Varia *Genevæ.* 1677. in 4o *This Edition and Translation* is here complained of *for several Reasons.*

n. 53. p. 1069. 60. Certain *Philosophical Essays*, and other Tracts; by the Hon. *Rob. Boyle.*

n. 162. p. 702. 61. Experiments and Considerations about the *Porosity* of *Bodies*, in two Essays; by the Hon. *Robert Boyle* Esq *Lond.* 1684. in 8o.

n. 96. p. 6101. 62. Several Tracts written by the Hon *Rob. Boyle*; of the strange Subtility, Efficacy, and determinate Nature of *Effluviums*; of new Experiments to make the Parts of *Fire* and *Flame* Stable and *Ponderable*; together with some Additional Experiments about Arresting and Weighing of *Igneous Corpuscles*; as also a Discovery of the *Perviousness* of Glass to Ponderable parts of *Flame*, with some Reflections on it by way of Corollary.

n. 170. p. 982. 63. An Essay of the great Effects of even *Languid* and *Unheeded Motions. Lond.* 1685.

n. 1. p. 8. n. 3. p. 46. 64. New Observations and Experiments in order to an *Experimental History* of *Cold.* by the Hon. *Rob. Boyle.* Esqr.

n. 78. p. 3043. 65. Dissertations sur la Nature du *Froid* & du *Chaud*; par le Sieur *Petit.* Avec un Discours sur la Construction & l'Usage d'un *Cylindre Arithmetique*, invente par le meme Autheur. a *Paris.* 1671.

n. 267. p. 724. 66 Thaumantiadis Thaumasia, sub Præsidio Dom *Chr. Sturmii. Noriburgæ.* 1699.

n. 42. p. 845. 67. A *Continuation* of new Experiments Physico Mechanical, touching the *Spring* and *Weight* of the *Air*, and their Effects; the I, *Part*, *&c.* by the Hon. *Rob Boyle.* F. R. S. Ox. 1668. in 4o.

n. 50. p. 1017. 68 *Georgii Sinclari* Ars Nova & Magna *Gravitatis & Levitatis. Roterodami.* 1669. in 4o

n. 92. p. 5199. *Some Complaints and Suggestions by that Author, (in his Preface) are here* Answer'd;

69. Demonstratione

69. Dimoſtratione Fiſico-Matematica Delle ſette Propoſitioni, che promeſſe *Donato Roſetti.* In *Firenze* 1668. in 4°. n. 65. p. 2013.

70. Obſervations touching the *Torricellian Experiment*, and the various Solutions of the ſame, eſpecially touching the *Weight* and *Elaſticity* of the *Air*. *Lond.* 1674. in 8°. n. 104. p. 78.

71. Tracts written by the Hon. *Rob. Boyle*, of a Diſcovery of the admirable *Rarefaction* of the *Air* (even without *Heat*;) New Obſervations about the *Duration* of the *Spring* of the *Air*; New Experiments touching the *Condenſation* of the *Air* by meer *Cold*; and its *Compreſſion* without *Mechanical Engines*: And the admirably Differing *Extenſion* of the ſame Quantity of *Air Rarified* and *Compreſſed*. *Lond.* 1670. in 4°. n. 67. p. 2052.

72. Tracts, written by the Hon. *Rob. Boyle*, containing new Experiments touching the *Relation* betwixt *Flame* and *Air*, and about *Exploſions:* An Hydroſtatical Diſcourſe, occaſion'd by ſome Objections of Dr. *Hen. More*, &c. To which is annext an *Hydroſtatical* Letter, about a way of *Weighing Water* in *Water:* New Experiments of the *Poſitive* or *Relative Levity* of Bodies *under Water*; of the *Air's Spring* on Bodies *under Water*; and about the differing *Preſſure* of Heavy *Solids* and *Fluids*. *Lond.* 1672. in 8°. n. 92. p. 5197.

73. Tracts, conſiſting of Obſervations about the *Saltneſs* of the *Sea:* An Account of a *Statical Hygroſcope* and its Uſes; together with an Appendix about the Force of the *Air's Moiſture*: And a Fragment about the *Natural* and *Preternatural State* of Bodies by the Hon. *Rob. Boyle*. To all which is premiſed, a *Sceptical Dialogue* about the *Poſitive* or *Privative* Nature of *Cold:* By a Member of the *R. Society*. *Lond.* 1673. in 8°. n. 97. p. 6127.

74. Tracts, containing. 1. Suſpicions about ſome *Hidden Qualities* of the *Air*, with an Appendix touching *Celeſtial Magnets*, and ſome other Particulars 2. Animadverſions upon Mr. *Hobb's Problemata* de *Vacuo*. 3. A Diſcourſe of the Cauſe of *Attraction* by *Suction*: By the Hon. *Rob. Boyle*. Eſqr. *Lond.* 1674. in 8°. n. 110. p. 226.

75. A Diſcourſe concerning the Origin and Properties of *Wind*, &c. by *R. Bohun*. *Oxon.* 1671. in 8°. n. 90. p. 5147.

76. Aero-Chalinos, or a *Regiſter* for the *Air*, &c. by *Nath. Henſhaw*. M. D. *Lond.* 1677. in 12°. n. 133. p. 834.

CHAP. II.

Hydrology.

To Sound the Depth of the Sea without a Line, by Dr. Hook. n. 9. p. 147. n. 24 p. 439.

I. TAKE a Globe of Firr or Maple, or other light Wood, as A. let it be well ſecured by Varniſh, Pitch, or otherwiſe, from Imbibing Water; then take a piece of Lead, or Stone, *D*, conſiderably Heavier than will Sink the Globe: Let there be a long Wire Staple *B*, in the Ball *A*, and a Springing Wire *C*, with a bended end *F*, and into the ſaid Staple, preſs in with your Fingers the Springing Wire on the bended end: And on it hang the Weight *D*,

Fig. 45. by its Hook *E*, and ſo let Globe and all ſink gently into the Water, in the poſture repreſented in the *Figure*, to the bottom, where the Weight *D*, touching firſt is thereby ſtopt; but the Ball, being by the Impetus it acquired in Deſcending carried downwards a little after the Weight is ſtopt, ſuffers the ſpringing Wire to fly back, and thereby ſets it ſelf at Liberty to Re-aſcend. And by obſerving the time of the Balls ſtay under Water (which may be done by a Watch, having, Minutes and 2*ds*; or by a good Minute Glaſs; or beſt of all by a Pendulum, Vibrating ſeconds; the which muſt be three Foot, three Inches, and one fifth of an inch long, *viz:* between the middle of the Bullet, and the upper end of the Thread, where it is faſtened, or held when it Vibrates,) You may, with the help of ſome Tables, come to know any *Depth* of the *Sea*.

Note, That care muſt be had of proportioning the Weight and Shape of the Lead, to the Bulk, Weight, and Figure, of the Globe; after ſuch a manner, as upon Experience ſhall be found moſt convenient.

In ſome of the Trials already made with this *Inſtrument*, the Globe being of Maple-wood, well covered with Pitch, to hinder ſoaking in, was $5\frac{13}{16}$ Inches in Diameter, and Weighed $2\frac{1}{2}$ *pounds*; the Lead, of $4\frac{1}{2}$ *pound Weight*, was of a *Conical*, (but is now uſed of a *Globous)* Figure 11 *Inches* long, with the ſharper end downwards, $1\frac{9}{16}$ at the bottom in Diameter. And in thoſe Experiments made in the *Thames*, in the Depth of 19 *foot* Water, there paſſed between the Immerſion and Emerſion of the Globe, 6 *Seconds* of an hour; and in the Depth of 10 *Foot* Water, there paſſed $3\frac{1}{2}$ Seconds, or thereabouts.

In the ſame Trials it was alſo found, that there was no difference in time, between the Submerſions of the Ball at the greateſt Depth, when it roſe two Wherry's length from the place where it was let fall, being carried by the Current of the Tide) and when it roſe only a Yard, or ſo, from the ſame place where it was let down: And that it muſt be ſo in great Depths and Stronger Currents, is as certain, as eaſy to be Demonſtrated.

And if it be alleged, that it muſt be known, when a Light Body Aſcends from the bottom of the Water to the Top, in what proportion of Time it Riſes; it may be conſidered, that in this Experiment the Times of the Deſcent and Aſcent are both taken and computed together; ſo that, for this purpoſe, there needs not the nicety which is alleged.

Of other Experiments of this way of *Sounding* without a *Line*, made by the Noble Lord Viſcount *Brounker*, Sir *Robert Moray* Knight, and Mr. *Hook*, in the Channel at *Sheerneſs*; the following Account was given; *vid.*

	Ounce.	*Grains.*
A Wooden Ball A weighed——	$32\frac{9}{16}$	00
Another Wooden Ball B, ——	30	22
A Lead A—— —— ——	30	00
Another Lead B, —— ——	$30\frac{3}{4}$	00

The

The *Ball* B, and the Lead B, were let down at 16 *Fathom*; and the *Ball* returned in 48 ſingle *ſtroaks* of a *Pendulum*, held in the Hand, *Vibrating* 58 ſingle *ſtroaks* in a *Minute*.

A Second time repeated with the ſame ſucceſs; therefore the Motion was 4 *Foot* every *ſecond*.

Again, the *Ball* A, and the Lead B, whoſe Nail was bended into a ſharper Angle; the *Ball* returned in 39 *ſtroaks*. A ſecond time repeated with the ſame ſucceſs at the ſame *depth*.

Ball B, Lead B, in which Trial the Line, not being clear, ſtopped a little the Motion; the Ball returned in 47 at the ſame *depth*.

Ball A, Lead A, ar 8 *Fathom* and 1 *Foot*, returned at 20; repeated at 8 *Fathom*, returned at 19.

Tried the third time at 10 *Fathom* and 4 *Foot*, returned at 28.

A fourth Trial, at the ſame depth, juſt the ſame.

At a fifth, at 10 *Fathom* 5 *Foot*, returned in 27.

A ſixth Trial juſt the ſame.

A ſeventh at 12 *Fathom* 5 *Foot*, returned in 37.

An 8th Trial, juſt the ſame.

Another Day near the ſame place.

Note, That the *Pendulum* was this Day adjuſted, and made a little ſhorter, there having been but 58 *Vibrations* in a *Minute* the other Day.

Ball A, Lead B, at 14 *Fathom*, returned in $32\frac{1}{2}$.

A Second Trial, a little after, in the ſame place, returned in 33. In the making of which Trial, the *Vibrations* were told aloud, and the Lead having been let down by a Line, was found to touch the bottom in juſt half the time the Ball ſtaid under Water. By a ſecond Trial, the *Aſcending* and *Deſcending* was found to be in *equal Times*. And by a third Trial, with another Lead, the very ſame found, *vid.* $16\frac{1}{2}$ *deſcending*, and $16\frac{1}{2}$ *aſcending*. This Lead and Ball let down without a Line, the Ball returned in 13 *Vibrations*; a Sign it went not to the bottom.

A Trial made with a Lead, whoſe Iron Crook was faſtned at the top of it, ſucceeded very well, and the Ball returned in $34\frac{1}{2}$: But by reaſon of the Current, the Experimentors could not perceive, when the Lead touched the bottom. This Lead being let down without a Line, the Ball returned in $32\frac{1}{2}$. The depth of Water was now found by the Ships Lead, to be 14 *Fathom*. Fig. 46.

Another Trial was made with a Line, bowing the Point of the Lead, and the Ball returned in 34 The ſame let down without a Line, the Ball returned in 6 or 7 *Vibrations*; a Sign again it went not to the bottom. In a Tryal with another Lead, the Ball returned in 34. Repeated again with the ſame ſucceſs. Fig. 47.

In a Trial with a Lead, whoſe Nail was ſet awry, the Ball returned in 34. After which Tryal the *Depth* was found to be juſt 14 *Fathom*: The laſt Lead and Ball being let down without a Line, the Ball returned at 35. In another Trial with a Lead that never failed, the Ball returned in 34, and the Lead touch'd the Bottom at 17. Fig. 48.

By a Tryal with another Lead, the ſame Time was found exactly.
By a 3d Tryal with this laſt, the very ſame.

Theſe Trials were made near about High water, at the depth of 14 *Fathom* juſt, by Meaſure; and in them, the Motions ſeem to be 5 *Foot* every *Second*.

In all theſe Trials, the greateſt difficulty was, in the uſe of *Conical* Figures, with Iron Crooks, to bend the Iron that it might be ſure to carry down the Ball with it to the bottom, and when come thither, to let it go: for almoſt every one of theſe Leads failed in one of theſe requiſites, till by ſeveral Trials they had been adjuſted.

It is not to be Omitted, That the laſt Trials being made near High-Water, the Ball was found to Riſe (by the Boat being permitted to drive) far off upon one ſide, out of the way, That any light thing, ſuffered to ſwim on the Water, wou'd be carried; which ſeemed to argue a motion of the Under-parts of the Water, differing from that of the Upper (a thing which is ſaid to be at certain Times of the Tides, both at the Mouth of the *Sound*, and of the *Streights*; which deſerves to be further enquired into.) The Angle made by theſe different motions, ſeemed to be about 40 *gr.*

To fetch up Water from any Depth; *by Dr.* Hook. n. 9. p. 149. n. 24. p. 447. Fig. 49.

II. Let there be made a Square *Wooden Bucket* C, whoſe Bottoms EE, are ſo contriv'd, that as the Weight A ſinks the Iron B, (to which the Bucket C, is faſtened by two Handles DD, on the end of which are the moveable Bottoms, or Valves EE, and thereby draws down the Bucket; the reſiſtance of the Water keeps up the Bucket in the Poſture C, whereby the Water hath, all the while it is deſcending, a clear paſſage through; whereas, as ſoon as the Bucket is pulled upwards by the Line F, the reſiſtance of the Water to that Motion, beats the *Bucket* downward, and keeps it in the poſture G, whereby the Included Water is kept from getting out, and the Ambient Water kept from getting in.

By the advantage of this Veſſel; you may come to know the Conſtitution of the Sea-Water in ſeveral Depths; and whether it be *Salter* at and towards the *Bottom*, than at or near the *Top*: Likewiſe whether in ſome places of the Sea, any *ſweet Water* is to be found at the *bottom*.

Directions for obſerving Tides; *by Sir* Rob. *Moray*. n. 17. p 298.

III. 1. To obſerve in what Proportion the *Increaſes* of the *Tides* from the *Neap* to the *Spring Tides*, and their *Decreaſes*, and the Riſings and Fallings of the *Ebbs*, happen to be in regard of one another. It is ſuppoſed upon ſome Obſervations made by Sir *Rob. Moray* (though not throughly and exactly performed,) that theſe *Increaſes* are in the Proportion of *Sines*; the firſt Increaſe exceeding the loweſt in a ſmall proportion; the next in a greater; the 3*d* greater than that; and ſo on to the midmoſt, whereof the Exceſs is greateſt, diminiſhing again from that, to the higheſt *Spring Tide*; ſo as the proportions before and after the Middle, do greatly anſwer to one another, or ſeem to do ſo.

2. To obſerve, the Increaſe and Decreaſe of the *Velocity* of the *Current*; which is alſo ſuppoſed to be according to the Proportion of *Sines*.

3. The

3. The exact measures of the *Heights* of every utmost *High-Water* and *Low-Water* from one *Spring-Tide* to another.

4. The exact *Heights* of *Spring-Tides* and *Spring-Ebbs*.

In order to all which this following *Apparatus* is proposed to be made use of. In some convenient place upon a Wall, Rock, or Bridge, *&c.* Let there be an Observatory standing as near as may be to the Brink of the Sea, or upon some Wall; and if it cannot be well placed just where the *Low-Water* is, there may be a Channel cut from the Low-Water to the bottom of the Wall, Rock, *&c.* The Observatory is to be raised above the *High-Water* 18 or 20 *Foot*; and a Pump of any reasonable Dimension, placed perpendicularly by the Wall, reaching above the *High-Water* as high as conveniently may be. Upon the top of the Pump a Pulley is to be fastned, for letting down into the Pump a piece of floating Wood, which as the Water comes in may Rise and Fall with it. And because the *Rising* and *Falling* of the Water amounts to 60 or 70 *Foot*, the Counterpoise of the Weight, that goes into the Pump, is to hang upon as many Pulleys, as may serve to make it Rise and Fall within the space by which the Height of the Pump exceeds the Height of the Water. And because by this means the Counterpoise will Rise and Fall slower, and consequently by less proportions, than the Weight it self, the first Pulley may have upon it a Wheel or two, to turn Indexes at any proportion required, so as to give the *minute parts* of the Motion, and *Degrees* of Risings and Fallings. And because if the *Hole*, by which the Water is let into the Pump be as large as the *Bore* of the Pump it self, the Weight that is Raised by the Water, will Rise and Fall with an Undulation according to the Inequality of the Sea's Surface, 'twill therefore be fit, that the *Hole*, by which the Water enters, be less than half as bigg as the *Bore* of the *Pump*; any Inconvenience that may fall thereupon, as to the Periods and Stations of the *Floud* and *Ebb*, not being considerable.

5. To observe the Position and Strength of the *Wind*; the state of the *Weather*; The Heights of the *Barometer*, *Thermometer*, *Hygroscope*; and the *Moon's Age*, and *Place* in all respects.

IV. 1. The true Time of the *Tides* at all times of the *Moon*, is very rudely and slightly reckoned up by most Seamen and Astronomers; most of them reckoning, as if the *Moon* being upon such a set *Point* of the *Compass* (as the Seaman calls it) or so many *hours* past the *Meridian* (as the Almanack-Makers reckon) it were *High-Tide* in such and such a Port at all Times of the *Moon*. And thus they reckon the *Tides* every Day to differ constantly 48 *min.* As for Instance; a *South-West Moon* makes a *Full Tide* at *London*, that must be understood that it is *High-Tide* at *London*, when the *Moon* is 3 *hours* past the *Meridian*. Now this is true indeed at the *New* and *Full Moon*, but not at other Times of the *Moon*, which few take any notice of: Only Mr. *Booker* had wont to give this *Caveat*, that about the *first* and *last Quarters* of the *Moon*, the *Neap-Tides* did not flow so long as the *Spring-Tides* by *one Point* of the *Compass*; but he gives no Rule to proportion the difference.

Tides *observed at* London; *by Mr.* Hen. Philips. n. 34. p. 656.

But

But obſerving this more narrowly, I find, that at *London* the *Tides* fall out at the leaſt *two Points*, that is, one *hour* and a *half* ſooner, in the *Quarters* than in the *New* and *Full Moon*. I have alſo found by many Trials, that the true Time of the *Tides* might be found out to be ſomewhat ſhorter and ſhorter, from the *New* and *Full Moon*, unto the *Quarters*; yet not in an Equal manner neither gradually Decreaſing from the *New* and *Full Moon* until the *Quarters*; but rather, that there was ſome little difference of Alteration both at the *New* and *Full Moons*, and alſo at the *Quarters*; and that the greateſt difference fell out in the midſt between them, agreeing very well to a *Circular Proportion* after this manner.

Fig. 50. 1. Divide a *Circle* into 12 Equal parts or *hours*, according to the *Moon's* Motion or diſtance from the *Sun*, from the *New Moon* to the *Full*.

2. Let the Diameter of the *Circle* be divided into 90 parts or *Min.* that is, according to the Time of the *Difference* of *Tides* between the *New* or *Full Moon*, and the *Quarters*; which is one *hour* and an *half*.

3. Make Perpendicular Lines croſs the Diameter of the *Circle* from *hour* to *hour*.

4. Reckon the Time of the *Moon's* coming to the *South* in the Circumference of the *Circle*, and obſerve the Perpendicular Line, that falls from that point upon the Diameter; and the proportional *Min.* cut thereby, will ſhew how many *Hours* or *Min.* are to be *Subſtracted* from the time of *High Tides* at the *New* and *Full Moon*, that ſo you may have the True Time of the *Tides* that preſent day.

For *Example*; At *London*, on the day of *New* and *Full Moon* it is *High-Tide* at 3 of the Clock, that is, when the *Moon* is 3 *hours* paſt the *Meridian*; and ſo by the common Rule, the *Moon* being about 4 days old, it will be *South* about 3 of the Clock, and it will be *High-Tide* three *hours* afterwards, that is, at 6 of the Clock. But now by this Rule, if you count this time of the *Moon's* coming to the *South* in the Circumference, the Perpendicular Line, which comes from 3 to 9, cuts the Diameter at 45 *min.* which ſhews, that ſo much is to be abated from the time of *High Tide* in the *New* and *Full Moons*; So that it is *High-Tide* 45 *min.* before 6 of the Clock; that is, at 5 *hours* 45 *min.* and not at 6 of the Clock, according to the common Rule.

The like you may do for any other Port or place, knowing the Time of *High-Water* at the *New* and *Full Moon* in that place: And you may do it the more readily, if you ſet down the Time of *High-Water* at the *New* and *Full Moon* under the Diameter, as I have done for *London*, where it is *High-Tide* at *III* of the Clock. So that when the *Moon* is *South* at *III* of the Clock, the Perpendicular cuts the Diameter at *II hours* 15 *m.* and ſo when the Moon is *South* at *IX.* of the Clock, by adding *Two hours* 15 *min.* you may have the Time of *High-Water*, which is *XI* of the Clock and 5 *Min.*

And thus you may eaſily make a Table, which by the *Southing* of the *Moon* ſhall readily tell you the time of *High-Tide* at any time of the *Moon*, as I have done here for *London*: to which all other places may be reduced to correſpond

Moon South.	Tide. London.	Moon. South.	Tide. London.	Moon South	Tide London	Moon South	Tide. London
H. M	H. M	H. M.	H. M	H. M.	H. M	H. M	H. M
XII. 0	3 0	II. 0	5 15	VI. 0	7 30	IX. 0	11 15
10	3 9	10	5 21	10	7 4	10	11 29
20	3 18	20	5 27	20	7 52	20	11 43
30	3 27	30	5 33	30	8 4	30	11 57
40	3 36	40	5 40	40	8 1	40	12 10
50	3 45	50	5 46	50	8 25	50	12 24
I. 0	3 54	IV. 0	5 52	VII. 0	8 36	X. 0	10 37
10	4 2	10	5 59	10	8 48	10	2 50
20	4 9	20	6 6	20	9 0	20	1 3
30	4 16	30	6 13	30	9 13	30	1 16
40	4 23	40	6 20	40	9 26	40	1 29
50	4 30	50	6 28	50	9 39	50	1 42
II. 0	4 37	V. 0	6 36	VIII. 0	9 53	XI. 0	1 54
10	4 44	10	6 44	10	10 6	10	2 3
20	4 50	20	6 53	20	10 20	20	2 16
30	4 57	30	7 2	30	10 33	30	2 27
40	5 3	40	7 11	40	10 47	40	2 38
50	5 9	50	7 20	50	11 1	50	2 49

These things I have found to fall out right at *London* for many Years, and so I suppose they may in other places. If the difference be not so much between the *Neap Tides* and *Spring Tides* in other places, the *Diameter* must be divided into fewer parts.

2. Having taken notice that the *Tides* seldom hold out so long as Mr. *Philips*'s Calculation give them, *I* observed them my self more diligently, and with the help of my Friends and Servants, *I* noted the times of above 80 *High-Waters* at *Tower-Wharfe* and *Greenwich*, whereby *I* found that the greatest and least differences betwixt the *Moon's* true *Southing* and the *High Waters*, were not, as Mr. *Philips* had placed them, at the *Full* or *New* and *Quarter Moon's*, but the greatest nearer to the *Neaps*, the least to the *Highest Spring-Tides* *I* found also, that the Inequality was not the same that he had made it, and after a Trial or two, that *I* could represent and answer above 60 of these Observations with less than one *Quarter* of an *Hours* difference; which, considering how Difficult it is to determine the *Time* of an *High-Water* exactly, *I* cannot but esteem a very good Agreement. *By Mr.* Flamstead. n. 143. p. 12.

3. At the *Bar* of *Dublin*, on the *New* and *Full Moons*, a *South South East Moon* makes *High Water*, that is at *half* an *hour* after *Ten*. *At* Dublin; *by Mr.* W. Molyneux. n. 184. p. 192.

At *Rings End*, at 3 *Quarters* after 10.

At the *Custom House* at *Dublin*, at 11.

On

On the Quarter Days.

High-Water on the *Bar*, at 5 a Clock.
At *Rings-End*, at a *Quarter* paſt 5.
At the *Cuſtom-Houſe*, *half* an *Hour* paſt 5.
A *Southerly Wind* between *S. S. E.* and *S. S. W*, blowing freſh makes it *flow* near half an Hour longer than its uſual Courſe.

N. B. That this Obſervation makes the *Tides*, upon the *Quarter Moons*, come in *Later*, in reſpect of the *Moon*'s *Southing*, than upon *New* and *Full Moons*, by *half* an *hour*; whereas in the River of *Thames*, as high as *London*, the *Quarter Moons* make *High-Water* above an Hour and Quarter *ſooner*, in that reſpect, than the *New* and *Full*; as may be ſeen by the accurate *Tide-Tables* of Mr. *Flamſtead*; but it is from hence evident, that the ſame Tables are not applicable to the *Sea-Ports*; where there is not the ſame Reaſon for the Anticipation of the *Neap Tides* upon the *Quarter Moons*.

The Cauſe of this *Phænomenon* ſeems to be, that the *Impulſe* of the Ocean in the *Quarter Moons* is not ſo vigorous as in the *New* and *Full*; nor the Motion of the Waters ſo quick, (as is evident by daily experience :) Whence it comes to paſs that in the *Open Sea*, and in Ports upon the Sea-Coaſt, as this of *Dublin*, the *High-Water-Time* falls out *Later* than when the Motion is more Rapid in the *New* and *Full*; but on the contrary, in *Rivers*, at any conſiderable diſtance from the Sea, the reſiſtance of the Weight of the Freſh Water, which is kept ſuſpended during the time of the *Flood*, is Longer overcome by the more potent *Impetus* in the *New* and *Full* than by the weaker in the *Quadratures*: and from hence this difference ſhould be ſtill more and more conſiderable as the *Port* is farther *Removed* from the *Sea*.

4. Our *Diurnal Tides* from about the latter end of *March*, till the latter end of *September*, are about a *foot* higher (perpendicular; which is always to be underſtood) in the *Evening* than in the *Morning*, that is, in every *Tide* that happens after 12 in the *Day*, before 12 at *Night*. On the contrary, the *Morning Tides* from *Michaelmaſs* 'till our *Lady Day* in *March* again, are conſtantly Higher by about a *Foot*, than thoſe that happen in the *Evening*. And this Proportion holds in both, after the gradual Increaſe of the Tides Riſing from the *Neap* to the *Higheſt Spring*; and the like decreaſe of its Height 'till *Neap* again is deducted.

Nigh Plimouth; *by Mr.* Sam. Colepreſs. n. 33. p. 632.

The Higheſt *Menſtrual Spring-Tide* is always the *Third Tide* after the *New* or *Full Moon*, if a croſs Wind do not keep the Water out, as the *N E.* or *N. W.* uſually doth; whoſe contrary Winds, if ſtrong, commonly make thoſe to be *High Tides* upon our *Southern* Coaſts, which otherwiſe would be but low.

The *Higheſt Springs* make the *Loweſt Ebbs*: (Though I am informed by an expert Water-man, that it ſometimes happens, that there may be a very *low Ebb*, though no *High Spring*, which they term an *Out let*, or *Gurges* of the Sea; as when a great Storm chances off at Sea, and not on the Land.)

The Water neither *Flows* nor *Ebbs* alike in reſpect of equal Degrees; but its *velocity* Increaſeth with the *Tide* till juſt at Mid-Water, that is *Half flown*, or at *Half Flood*, at which time the *Velocity* is ſtrongeſt, and ſo decreaſeth proportionably,

proportionably 'till *High-Water* or *Full Sea*. As may be guessed at by the following *Scheme*, collected by Observations made at several Times and Places. And although it be restrain'd to *Plymouth-Haven*, or the like, where the Water Riseth about 16 *Foot* (I say usually, because it may vary in this Port from the *lowest Neap* to the *Highest Annual Spring* above 7 or 8 *Foot*) yet it may indifferently serve for other places, where it may Rise as many *Fathom*, or not so High, by a proportional *Addition* or *Substraction*.

	Time.		*Height*	
	h.	′	*f.*	*inch.*
	1	0	1	6
	2	0	2	6
Flowing	3	0	4	0
	4	0	4	0
	5	0	2	6
	6	0	1	6

	Time.		*Height.*	
	h.	′	*f.*	*inch*
	1	0	1	6
	2	0	2	6
Ebbing.	3	0	4	0
	4	0	4	0
	5	0	2	6
	6	0	1	6

The usual *Number* of *Tides*, or Times of *High Water* from *New Moon* to *New Moon*, or from *Full Moon* to *Full Moon*, is 59.

In Hong-road, 4 *Miles from* Bristol; *by Cap.* Sam. Sturmy, n. 41. p. 813.

5. 1. I have observed, That our *Annual Spring Tides* do happen in *March* and *September*, either at the *Tide* next before the *Sun*'s Ingress into the *Æquinoctial* Points of *Aries* and *Libra*, or the next *Tide* after, according as the *Moon* is near her *Full* or *Change*, when the *Sun* thus enters into the said *Signs*: And then it flows in height about 45 *Foot*; the lowest *Neap Tides* flowing in height 25 *Foot*.

Signs.

2. That the *Lowest Neap* makes the *highest Spring*, if the *N. E.* Winds hinder not, by blowing hard, and so keep back the *Tides*; as usually they do when they blow: Whose contrary Winds, *S. W.* if they blow hard, make here the *Highest Tides*.

3. That from about the latter end of *September*, they are about 1 *Foot* and 3 *Inches* higher, perpendicularly in the *Evening* than in the *Morning*; that is, if *High Water* happen after the *Sun* is past the *Meridian*, or in the *Tides* betwixt *Noon* and *Midnight*. But from *Michaelmas* to our *Lady-day*, we find the contrary, the *Day Tides* being, in that Season, higher by 15 *Inches* than the *Night-Tides*, or the *Tides* between *Midnight* and *Noon*. And this proportion holds in both, after the Gradual Increase of the Tides rising from the *Neap* to the highest *Spring*, and the like Decrease of their Height till *Neap* again.

4. That the *Highest Menstrual Spring-Tide* is always the third after the *Full Moon* or Change-day, if it be not kept back by *N. E.* Winds.

5. That it *flows* here on the *Change-day*, when the *Moon* is *E. S. E.* the Tide *flowing* in for the space of 5 *Hours*, and *Ebbing* 7 *Hours*. But in *Neap-Tides* it does not *flow* here by two *Points* of the Compass so long.

6. That the Water *flows* nor *Ebbs* equal Spaces in equal Times, but its *Velocity* is ſtrongeſt at the firſt, both of the *Flood* and *Ebb*, and ſo gradually Decreaſeth until *Full Sea*, or *Low Water*. This is obſerved in *Spring Tides* only, as you may ſee by the following Table, which I have made from my Obſervations of our *Tides* here. And I have farther Obſerved, that it hath *Flow'd* or *Ebbed* at the firſt of the *Tide* one *Foot* in 6 *Minutes*, or that then the *Tide* Ran out a *Foot* in 6 *Minutes*, or did Riſe ſo much in Height.

	Time		Height.	
	h.	′	*f.*	*Inch.*
	0	15	2	7½
	0	30	2	6
	0	45	2	6
	1	00	2	6
	0	15	2	6
	0	30	2	5½
	0	45	2	5
	2	00	2	5
Flowing.	0	15	2	3
	0	30	2	3
	0	45	2	3
	3	00	2	3
	0	15	2	2
	0	30	2	1
	0	45	2	1
	4	00	2	1
	0	15	1	9
	0	30	1	8
	0	45	1	8
	5	00	1	8
	5	00	44	1

	Time.		Height.	
	h.	′	F.	In
	0	15	2	7½
	0	30	2	6
	0	45	2	6
	1	00	2	6
	2	00	9	0
Ebbing.	3	00	8	0
	4	00	6	9
	5	00	5	0
	6	00	4	0
	7	00	3	0
	7	00	44	10½

7. The Uſual *Number* of *Tydes* from *New Moon* to *New Moon*, or from *Full* to *Full*, is 59.

8. In the River of *Severn*, 20 Miles above *Briſtol* near *Newnham*, 160 Miles from the River's Mouth (*Lundy*) the *Head* of the Flood at its coming in in *Spring Tides*, ariſeth in height like a Wall near 9 *Foot* high, and ſo runs for many Miles together, covering at once all the Shoales which were dry before; at which time all Veſſels, that lie in the way of the ſaid *Head Tides*, or (as it is vulgarly called) *Boar*, are commonly Overſet, or carried upon the Banks, and the *Head* of the Tide being paſt, ſuch Veſſels are left dry again, It *flows* there but two *Hours* and 18 *Foot* in height, and it *Ebbs* ten *Hours*. The Reaſon of the ſaid *Boar* is doubtleſs the ſtraightning and ſhoaling of the River in that Place,

Place, it being there but half a Mile broad; as it is but twenty Pearches over, three *Miles* higher; running Tapering to *Gloceſter*.

6. We have been informed by a curious Gentleman, that the *Annual higheſt Tides* about *Cheapſtow* Bridge, were at St. *David*'s and *Michaelmaſs* Stream; that is the one a little before the *Vernal*, and the other ſomewhat after the *Autumnal Equinox*, which agrees alſo with the Conjecture of a very Intelligent *Mathematician*, who is withal of Opinion, that becauſe both are not far from the *Equinoxes*, (though the one before, the other after) it might well give Occaſion to think it was depending on the *Æquinox*.

At Cheapſtow, by ----- Ibid. p. 816.

7. Our great *Bay* Mr. *Camden* calls *Waſhes*, whereas they are only two ſmall Arms of the Sea, running into it, *viz. Foſdike* and *Croſs-keys*; 'tis full of Sands, making two Channels to *Lyn*, and as many to *Boſton*. It may be uſeful to *Travellers* to have a Table when to paſs over the ſaid *Waſhes*, tho' without a Guide, I would not adviſe them, eſpecially after great *Freſhes*, which make the Sands ſhift, and conſequently *Quick*, and Horſes many times ſtick faſt, the way to get them out is, by ſeveral Peoples trampling round them at a Diſtance, which by degrees Raiſeth them.

A Table of the Waſhes *in* Lincolnſhire; *by Mr.* Chr. Merrit. n. 223. p. 352. n. 224. p. 392.

Moon's Age.	*Foſdike Begins.*	*Ends.*	*Full Sea.*	*Mooon's Age.*	*Foſdike. begins.*	*Ends.*	*Full Sea.*
	h. ′	*h.* ′	*h.* ′				
1 16	10 0	4 45	7 0	9 24	4 24	11 09	1 24
2 17	10 48	5 33	7 48	10 25	5 12	11 57	2 12
3 18	11 36	6 21	8 36	11 26	6 00	12 45	3 00
4 19	12 24	7 9	9 24	12 27	6 48	1 33	3 48
5 20	1 12	7 57	10 12	13 28	7 36	2 21	4 36
6 21	2 0	8 45	11	14 29	9 24	3 9	5 24
7 22	2 48	9 33	11 48	15 30	9 12	3 57	6 12
8 23	3 36	10 21	12 36				

Croſs-Keys begins to be *fordable* fifteen *Minutes* after *Foſdike*. and *Ends* an *Hour* ſooner.

8. It is *High Water* upon the Day of the *New* and *Full Moon*.

The Tides in France; *by*---- n. 185. p. 220.

On the Coaſt of *Gaſcony* and *Guienne*.

At 3 *h.* at the Mouth of *Garonne*, and the Iſle of *Ree*.

At $3\frac{1}{2}$ *h.* at St. *John de Luz*, at *Bayonne*, and *Memiſſan*.

At $3\frac{3}{4}$ *h.* at *Royan*, *Brouage* and *Rochelle*.

At 3 *h.* on the Coaſt of *Poitou*.

At $3\frac{1}{4}$ *h.* at *Ollonne* and *Beauvoir*.

On the Coaſt of *Britany*.

At $1\frac{1}{2}$ *h.* at *Bell Iſle*.

At 3 *h.* at the Mouth of the *Loyre*, at *Garande*, *Morbihan*, *Blavet*, and *Concarneau*.

At $3\frac{3}{4}$ *h.* at *Arenars*, *Vannes*, and *Auray*.
At $2\frac{1}{4}$ *h.* at *Apenmark*, *Audierne*, the Race of *Fontenay*, and *Le Conquet*.
At $3\frac{3}{4}$ *h.* at *Breſt*, and at Cape *de Four*.
At 4 *h.* at St. *Paul de Leon*.
At $4\frac{1}{2}$ *h.* at *Port Blanc*.
At 6 *h.* at St. *Malo* and *Caneale*.

On the Coaſt of *Normandy*.

At 7 *h.* at *Granville*, and *Barneville*.
At 8 *h.* at *Cherbourg* and *Barfleur*.
At 9 *h.* at *Caen* and *Honfleur*, at the Mouth of the *Seine*, and at *Haver de Grace*.
At $9\frac{3}{4}$ *h.* at *Feſcan* and St. *Valeri*.
At $10\frac{1}{2}$ *h.* at *Rouen*, *Dieppe*, and *Treport*.

On the Coaſt of *Picardie*.

At 11 *h.* at the Mouth of the *Somme*, at *Eſtaple*, *Boulogne*, and *Ambletenſe*.
At 11 *h.* at *Calais*.
At 12 *h* at *Dunkirk*, *Newport*, and *Oſtend*.

At Bermudas; *by Mr.* Rich. Norwood. n. 30. p. 565.

9. 1. I have only taken a general notice; of the *Tides* as, that it is *high Water* about 7 of the Clock on the *Change-Day* (in ſome Creeks an hour or two later.) The Water *Riſeth* but little, as about 4 Foot at High Water; but at *Spring-Tides* it may be a Foot more. The *Tides* without, are very various in their *Setting*; Sometimes the *Tide* of *Flood* ſets to the *Eaſtward*, ſometimes to the *Weſtward*: But in fair, Calm, and ſetled Weather, the ſaid *Tide* ſets from the *South-Eaſt* toward the *North-weſt*, as they ſay.

By Mr. Rich. Stafford. n. 40. p. 792.

2. The Water about our Iſland (*Bermudas*) does not *Flow*, by any Mans Obſervation, above 5 *Foot*; and that but at one Seaſon of the Year, between *Michaelmas* and *Chriſtmas*; at other times not above 3 *Foot*. It is *High-Water* when the *Moon* is about an hour High; and the like after her going down. It *Flows* in from the *North-Weſt* and runs to the *South-Eaſt* neareſt, and in that part of the Land which lies moſt to the North-Weſt there it is *High Water* ſooneſt: But the *Tide* does not always *Ebb* and *Flow* directly that Courſe round about our Coaſt; but I ſuppoſe, the Reaſon is that ſome points of Land, or Sholes, may turn its *North-Weſt* and *South Eaſt* Courſe.

At Cabo Cors Caſtle *on the Coaſt of* Guiney; *by Mr.* Heathcot. n. 158. p. 578.

10. The Sea Runs here along the Shore continually to the *Eaſtward*, at a very great Rate, except at *Full* and *Change*, for then it runs to *Weſtward*, or at leaſt makes a great Abate. *Nov.* 24. 1683. *I* took the time of the *High-Water* at the *Caſtle* (as near as *I* could) at 3 *h.* 30′. *p. m.* It *Flowed* about 6 *Foot*.

An Hypotheſis *about the* Flux *and* Reflux *of* Sea; *by Dr.* Wallis. n. 16. p. 263.

V. 1. The *Sea's Ebbing* and *Flowing*, hath ſo great a Connexion with the *Moon's* Motion, that in a manner all Philoſophers (whatever other Cauſes they have

have joyned with it) have attributed much of it's Cauſe to the *Moon*; which either by ſome *Occult Quality*, or particular Influence, which it hath on moiſt Bodies, or by ſome *Magnetick Vertue* drawing the Water towards it, (which ſhould therefore make the Water there *Higheſt*, where the *Moon* is *Vertical*) or by its *Gravity* and Preſſure downwards upon the Terraqueous Globe (which ſhould make it *Loweſt* where the *Moon* is *Vertical*) or by whatever other means (according to the ſeveral Conjectures of Inquiſitive Perſons) hath ſo great an Influence on, or at leaſt Connexion with, the *Sea's Flux* and *Reflux*, that it would ſeem very unreaſonable to ſeclude the conſideration of the *Moon*'s motion from that of the *Sea*: The *Periods* of *Tides* (to ſay nothing of the greatneſs of them near the *New-Moon* and *Full Moon*) ſo conſtantly waiting on the *Moon*'s motion, that it may be well preſumed, that either the one is Governed by the other; or at leaſt both from ſome Common Cauſe.

The firſt that I know of, who took in the conſideration of the *Earth*'s Motion, (*Diurnal* and *Annual*) was *Galilæo*: Who in his *Syſteme of the World*, hath a particular and very rational diſcourſe on this Subject. But that diſcourſe is to be look'd upon only as an Eſſay of the General Hypotheſis; which as to Particulars, was to be afterwards adjuſted from a good *General Hiſtory* of *Tides*; which it's manifeſt enough, that he had not; and which is yet in a great meaſure Wanting.

And what I ſay of *Galilæo*, I muſt in like manner deſire to be underſtood of what I am now ready to ſay to you. For I do not profeſs to be ſo well skill'd in the *Hiſtory* of *Tides*, as that *I* will undertake preſently to accommodate my General Hypotheſis to the Particular Caſes; or that *I* will indeed undertake for the certainty of it, but only as an *Eſſay* propoſe it to further Conſideration, to ſtand or fall, as it ſhall be found to anſwer Matter of Fact.

I conſider therefore that in the *Tides*, or the *Flux* and *Reflux* of the *Sea*, beſides extraordinary Extravagances, or Irregularities, whence great Inundations or ſtrangely *High Tides* do follow, (which yet perhaps may prove not to be ſo meerly Accidental as they have been thought to be, but might from the Regular Laws of Motion, if well conſidered, be both well accounted for, and even foretold; there are theſe 3 notorious Obſervations made of the *Reciprocation* of *Tides*. Firſt the *Diurnal Reciprocation*, whereby *twice* in ſomewhat more than 24 *hours*, we have a *Flood* and an *Ebb*; or a *High Water* and *Low-Water*. Secondly, the *Menſtrual*; whereby in one *Synodical* Period of the *Moon*, ſuppoſe from *Full Moon* to *Full Moon*, the Time of thoſe *Diurnal Viciſſitudes* doth move round through the whole Compaſs of the Νυχθήμερον, or Natural Day of 24 hours: As for Inſtance, if at the *Full Moon*, the *Full Sea* be at ſuch or ſuch a place juſt at *Noon*, it ſhall be the next day (at the ſame place) ſomewhat before *One* of the *Clock*; the day following, between *One* and *Two*; and ſo onward, till at the *New Moon* it ſhall be at *Midnight*; (the other *Tide*, which in the *Full Moon* was at *Midnight*, now the *New Moon* coming to be at *Noon*), and ſo forward till at the next *Full Moon*, the *Full Sea* ſhall (at the ſame place) come to be at *Noon* again. Again, That of the *Spring Tides* and *Neap Tides* (as they are call'd); about the *Full Moon* and *New Moon* the *Tides* are at the *Higheſt*, at the *Quadratures* the *Tides* are at the *Loweſt*: and at the times Intermediate,

mediate, proportionably. Thirdly, the *Annual*; whereby it is obſerved; that at ſometimes of the Year, the *Spring-Tides* are yet much Higher than the *Spring-Tides* at other times of the Year: Which Times are uſually taken to be at the *Spring* and *Autumn*; or the two *Æquinoxes*; but I have reaſon to believe (as well from my own Obſervations for many Years, as of others who have been much concerned to heed it whereof more will be ſaid by and by;) that we ſhould rather aſſign the beginnings of *February* and *November*, than the two *Æquinoxes*.

1. Now in order to give an account of theſe three *Periods*, according to the Laws of Motion and Mechanick Principles; we ſhall firſt take for granted, what is now a days pretty commonly entertained by thoſe who treat of ſuch matters; That a Body in *Motion* is apt to *Continue* in its *Motion*, and that in the ſame degrees of *Celerity*, unleſs hinder'd by ſome contrary *Impediment*: (like as a Body at *Reſt*, to continue ſo, unleſs by ſome ſufficient *Mover*, put into *motion*:) And accordingly (which daily Experience Teſtifies) if on a Board or Table, ſome Looſe Incumbent Weight be for ſome time *Moved*, and have thereby contracted an *Impetus* to *Motion* at ſuch a *Rate*; if that Board or Table chance by ſome external obſtacle, or otherwiſe, to be ſtopped, or conſiderably retarded in its *Motion*, the incumbent looſe Body will ſhoot forward upon it: And contrary wiſe, in caſe that Board or Table chance to be Accelerated or put forward with a conſiderably greater ſpeed than before, the looſe incumbent Body, (not having yet obtained an equal *Impetus* with it) will be left behind, or ſeem to fly backward upon it. Or, (which is *Galilæo*'s Inſtance,) if a broad Veſſel of Water, for ſome time evenly carried forward with the Water in it, chance to meet with a Stop, or to ſlack its motion, the Water will Daſh forward and Riſe Higher at the fore part of the Veſſel: And contrary wiſe, if the Veſſel be ſuddenly put forward Faſter than before, the Water will Daſh backwards, and Riſe at the hinder part of the Veſſel. So that an Acceleration or *Retardation* of the Veſſel which carries it, will cauſe a Riſing of the Water in one part, and a Falling in another: (which yet by its own Weight, will again be reduced to a Level as before.) And conſequently, ſuppoſing the *Sea* to be but as a Looſe Body carried about with the *Earth*, but not ſo United to it as neceſſarily to receive the ſame degree of *Impetus* with it, as its fixed parts do, The *Acceleration* or *Retardation* in the Motion of this or that part of the *Earth*, will cauſe (more or leſs, according to the proportion of it) ſuch a Daſhing of the Water, or *Riſing* at one part, with a *Falling* at another, as is that which we call the *Flux* and *Reflux* of the *Sea*.

Now this premiſed, we are next, with him, to ſuppoſe the *Earth* carried about with a *Double motion*; the one *Annual* in *B E C*, the *Great Orb*, in which the *Center* of the *Earth B*, is ſuppoſed to move about the *Sun A*. The other *Diurnal*, whereby the whole moves upon its own *Axis*, and each point in its Surface deſcribes a Circle, as *D E F G*.

It is then manifeſt that if we ſuppoſe, that the *Earth* Moved but by any one of theſe Motions, and that regularly, (with an equal Swiftneſs;) the *Water*, having once attained an equal *Impetus* thereunto, would ſtill hold equal pace with it, there being no occaſion, from the Quickning or Slackning of the *Earth's motion*, (in that part where the *Water* lieth) for the *Water* thereon either to be caſt

caſt Forward or Backward, and thereby to *Accumulate* on the other parts of the *Water:* But the True *Motion* of each part of the Earth's Surface being compounded of thoſe Two *motions*, the *Annual* and *Diurnal*; (the *Annual* in *B E C*, being, as *Galilæo* there ſuppoſeth, about three times as faſt as a *Diurnal motion* in a great Circle, as *D E F*;) while a point in the *Earth's* Surface moves about its Center *B*, from *G*, to *D*, and *E*, and at the ſame time its Center *B*, be carried forwards to *C*; the True *Motion* of that Point forwards, is made up of both thoſe *Motions*; to wit of *B*, to *C*, and of *G*, to *E*; but while *G*, Moves by *D*, to *E*, *E* moves backward by *F*, to *G*, contrary to the motion of *B*, to *C*; ſo that the true motion of *E*, is but the difference of *B C*, and *E G*: (for, beſides the motion of *B*, above the Center; *G*, is alſo put forward as much as from *G* to *E*; and *E*, put backward as much as from *E*, to *G*:) ſo that the *Diurnal motion*, in that part of the *Earth*, which is next the *Sun*, as *E F G*, doth abate the progreſs of the *Annual*, and moſt of all at *F*; and in the other part, which is from the *Sun*, as *G D E*, it doth Increaſe it, and moſt of all at *D*, that is in the Day time there is abated, in the Night time is added, to the *Annual* Motion, about as much as is *G E*, the Earth's Diameter. Which would afford us a Cauſe of two *Tides* in 24 *hours*; the One upon the greateſt *Acceleration* of *Motion*, the Other upon its greateſt *Retardation*.

2. And thus far *Galilæo*'s Diſcourſe holds well enough; But then in this it comes ſhort; that as it gives an Account of *Two Tides*, ſo thoſe *Two Tides* are always to be at *F*, and *D*; that is at *Noon* and at *Midnight*: Whereas Experience tells us, that the time of *Tides*, moves in a *Months* ſpace through all the 24 hours; of which he gives us no account. For though he do take notice of a *Menſtrual Period*; yet he doth it only as to the Quantity of the *Tides*, greater or leſs; not as to the Time of the *Tide*, ſooner or later.

To help this *J. Bapt. Balianus* makes the *Earth* to be but a *Secondary* Planet, and to *move* not directly about the *Sun*, but about the *Moon*; the Moon mean while *moving* about the *Sun*; in like manner as we ſuppoſe the *Earth* to *move* about the *Sun*, and the *Moon* about it. But though this might furniſh us with the Fundation of a *menſtrual Period* of *Accelerations* and *Retardations* in the Compound Motion of ſeveral parts of the *Earths* Surface; yet there is no good reaſons to admit of this *Hypotheſis*.

Riccioli. *Almag. Nov. Tom.* 1. *l.* 4. *c.* 10. *n.* 111. *p.* 276.

Inſtead of this, that *Surmiſe* of mine, (for I dare not yet, with confidence, give it any better name,) of what I have ſpoken to you heretofore, (and which hath occaſioned this preſent account which I am now giving you,) is to this Purpoſe.

The *Earth* and *Moon* being known to be Bodies of ſo great Connexion, as that the *Motion* of One follows that of the *Other*, may well enough be looked upon as one Body, or rather one Aggregate of Bodies, which have one common *Center of Gravity*; which Center of Gravity according to the known Laws of *Staticks*) is in a ſtraight Line Connecting their reſpective *Centers*, ſo divided as that its parts be in Reciprocal Proportion to the *Gravities* of the Two Bodies. As for Example; Suppoſe the *Magnitude* (and therefore, probably, the *Gravity*) of the *Moon* to be about a *One and fortieth* part of that of the *Earth*; And the Diſtance of the *Moon's Center* from the *Center* of the *Earth*, to be about 56 *Semidiameters* of the *Earth*, the diſtance of the *Common Center of Gravity* of the two Bodies, will be from that

of

of the *Earth* about $\frac{1}{42}$ of 56 *Semi-diameters*, that is about $\frac{1}{3}$ of a Semidiameter of the Earth, above its Surface, in the Air, directly between the *Earth* and *Moon*.

Now ſuppoſing the *Earth* and *Moon*, jointly as One Body, carried about by the *Sun*, in the *Great Orb* of the *Annual* Motion; this Motion is to be eſtimated, (according to the Laws of *Staticks* in other Caſes) by the Motion of the *Common Center* of *Gravity* of both Bodies. For we uſe in *Staticks* to eſtimate a Body, or Aggregate of Bodies, to be Moved upwards, downwards, or otherwiſe, ſo much as its *Common Center* of *Gravity* is ſo Moved, howſoever the Parts may change places amongſt themſelves.

And accordingly the Line of the *Annual* Motion will be deſcribed, not by the *Center* of the *Earth* (as we commonly eſtimate it,) but by the *Common Center* of *Gravity* of the Bodies, *Earth* and *Moon*, as one Aggregate.

Fig. 52. Now ſuppoſing *ABCDE*, to be a part of the *Great Orb* of *Annual Motion*, deſcribed by the *Common Center* of *Gravity*, in ſo long time as from a *Full Moon* at *A*, to the next *New Moon* at *E*; the *Center* of the *Earth* at *T*, and that of the *Moon* at *L*, muſt each of them, (ſuppoſing their *Common Center* of *Gravity* to keep the Line *AE*,) be ſuppoſed to deſcribe a Periphery about that *Common Center*, as the *Moon* deſcribes her Line of *Menſtrual* Motion. And in like manner, *EFGHI*, from that *New Moon* at *E*, to the next *Full Moon* at *I*.

Fig. 53. From *A* to *E*, (from *Full Moon* to *New Moon*) *T* moves (in its own *Epicycle*) upwards from the *Sun*: And from *E* to *I*, (from *New Moon* to *Full Moon*) it moves downwards, towards the *Sun*. Again, from *C* to *G*, (from *Laſt Quarter* to the following *Firſt Quarter*,) it moves forward according to the *Annual Motion*; but from *G* forwards to *C*, (from the *Firſt Quarter* to the enſuing *Laſt Quarter*) it moves contrary to the *Annual Motion*.

It is manifeſt therefore, according to this *Hypotheſis*, that from the Laſt Quarter to the Firſt Quarter (from *C* to *G*, while *T* is above the Line of the *Annual* motion) its *Menſtrual* motion in its *Epicycle* adds ſomewhat of *Acceleration* to the *Annual* motion; and moſt of all at *E*, the *New Moon*: And from the Firſt to the Laſt Quarter (from *G* forward to *C*, while *T* is below the Line of the *Annual* motion,) it abates of the *Annual* motion; and moſt of all at *I*, or *A* the *Full Moon*.

So that in purſuance of *Gallilæo*'s Notion, the *Menſtrual* Adding to, or Detracting from the *Annual* motion, ſhould either leave behind, or caſt forward the looſe Waters incumbent on the Earth, and thereby cauſe a *Tide*, (or Accumulation of Waters,) and moſt of all at the *Full Moon* and *New Moon*, where thoſe Accelerations or Retardations are greateſt

Now this *Menſtrual* Motion, if nothing elſe were ſuperadded to the *Annual*, would give us two *Tides* in a Month, and no more; (the one upon the Acceleration, and the other on the Retardation;) at *New Moon* and *Full Moon*; and two *Ebbs* at the Two *Quarters*; and in the Intervals, *Riſing* and *Falling* Water.

But the *Diurnal* motion ſuperadded, doth the ſame to this *Menſtrual*, which *Galilæo* ſuppoſeth it to do to the *Annual*; that is, doth Add to, or Subſtract from

from the *Menſtrual* Acceleration or Retardation; and ſo gives us *Tide upon Tide.*

For in whatſoever part of its Epicycle we ſuppoſe *T* to be; yet becauſe, while by its *Menſtrual* motion, the Center moves in the Circle *LIN*; each Point in its Surface, by its Diurnal motion moves in the Circle *LMN*: Whatever Effect (Accelerative or Retardative) the *Menſtrual* would give, that Effect by the *Diurnal* is Encreaſed in the Parts *LMN*, (or rather *lMn*, the Semicircle) and moſt of all at *M*; but diminiſhed in the Parts *NOL* (or rather *nOl*) and moſt of all at *O*. So that at *M* and *O*, (that is when the Moon is in the *Meridian* below or above the Horizon,) we are to have the *Diurnal* Tide or *High-Water*, occaſion'd by the greateſt Acceleration or Retardation, which the *Diurnal* Arch gives to that of the *Menſtrual*; which ſeems to be the true cauſe of the *Daily Tides*, and withal gives an Account, not only why it ſhould be every Day, but likewiſe why at ſuch a time of the Day; and why this time ſhould in a Month run through the whole 24 Hours, *viz.* becauſe the Moon's coming to the Meridian above and below the Horizon, (or as the Sea men call it, the Moon's *Southing* and *Northing*) doth ſo: As likewiſe of the *Spring Tides* and *Neap Tides*. For, when it ſo happens, that the *Menſtrual* and *Diurnal* Accelerations or Retardations, be coincident, (as at the *New Moons* and *Full Moons* they are) the Effect muſt needs be the greater. And although (which is not to be diſſembled) this happen but to One of the Two *Tides*; that is, the *Night-Tide* at the *New Moon* (when both motions do moſt of all Accelerate) and the *Day Tide* at *Full Moon* (when both do moſt Retard the *Annual* motion;) yet, this Tide being thus raiſed by two concurrent cauſes; tho' the next Tide have not the ſame cauſe alſo, the *impetus* contracted, will have influence upon the next Tide; upon a like Reaſon, as a *Pendulum* let fall from a higher Arch, will (tho' there be no new Cauſe to occaſion it) make the Vibration on the other ſide (beyond the Perpendicular) to be alſo greater: Or, of Water in a broad Veſſel, if it be ſo jogged, as to be caſt forward to a good height above its Level, will upon its Recoiling, by its own Gravity, (without any additional Cauſe) mount ſo much the higher on the hinder part. Fig. 54

But here alſo, we are to take notice, that though all parts of the Earth by its *Diurnal* motion, do turn about its Axis, and deſcribe Parallel Circles; yet not equal Circles; but greater near the *Æquinoctial*, and leſſer near the Poles, which may be a Cauſe why the *Tides* in ſome parts may be much greater than in others. But this belongs to the particular Conſiderations, (of which we are not now giving an Account) not to the General *Hypotheſis*.

3. The *Annual High Tides* having been obſerved (groſly) to happen about the *Spring* and *Autumn*; they are generally referred to the two *Æquinoxes*. But the Inhabitants of *Rumney-marſh* in *Kent*, where the Sea being kept out with great Earthen Walls, that it doth not at *High Water* overflow the Level; are generally agreed by their Obſervations, (and Experience dearly bought) that their Times of Danger are about the beginning of *February* and of *November*: That is, at thoſe *Spring Tides* which happen near thoſe Times; to which they give the Names of *Candlemaſs Stream*, and *Allhallond Stream*: And if they eſcape thoſe *Spring-Tides*, they apprehend themſelves out of Dan-

ger for the reſt of the Year. And as for *March* and *September* (the two *Æquinoxes*) they are as little ſollicitous of them, as of any other part of the Year. And I have my ſelf very frequently obſerved (both at *London*, and elſewhere) that in thoſe Months of *February* and *November*, (eſpecially *November*) the Tides have run much higher than at other times; Particularly in *November* 1660. I found the Water ſo High in *King-ſtreet Weſtminſter*, that it came up not only into the Boots, but into the Body of the Coach; and the *Pallace-Yard* (all, ſave a little place near the *Weſt* End) over-flowed; as likewiſe the *Market Place*; and many other places; and their Cellars generally filled up with Water. And in *November* 1665. it may be well remembred what very High Tides there were, not only on the Coaſts of *England* (where much hurt was done by it) but much more in *Holland*, where, by reaſon of thoſe Inundations, many Villages and Towns were overflowed.

'Tis true, there does not happen any ſingle Signal Accident, which might caſt it on theſe times, yet there is a Compound of Two that may do it: Which is the *Inequality* of the *Natural Day*, (well known to *Aſtronomers*) ariſing from a double Cauſe. *Firſt*, Becauſe the Sun, by reaſon of its *Apogæum* and *Perigæum*, doth not at all times of the Year diſpatch, in one Day, an equal Arch of the *Ecliptick*: *Secondly*, Equal Arches of the *Ecliptick* do not in all parts of the *Zodiack* anſwer to equal Arches of the *Æquinoctial*, by which we are to Eſtimate Time.

According to the *Firſt* of theſe Cauſes, we ſhould have the *Longeſt* Natural Days in *December*, and the *Shorteſt* in *June*, which if it did operate alone, would give us at thoſe times *Two Annual High Waters*. According to the *Second* Cauſe, if operating ſingly, we ſhould have the *longeſt* Days in the Two *Solſtices* in *June* and *December*, and the Two *ſhorteſt* at the *Equinoxes*, in *March* and *September*; which would at thoſe times give occaſion of *Four Annual High Waters*.

But the True Inequality of the *Natural Days*, ariſing from a Complication of thoſe Two Cauſes; ſometimes Croſſing, and ſometimes Promoting each other, though we ſhould find ſome Increaſes or Decreaſes of the Natural Days, at all thoſe Seaſons anſwerable to the reſpective Cauſes, (and perhaps of *Tides*, proportionably thereunto: Yet the *longeſt* and *ſhorteſt* Natural Days abſolutely of the whole Year (ariſing from this Complication of Cauſes) are about thoſe times of *Allhallontide* and *Candlemaſs*; (or not far from them) about which thoſe *Annual High Tides* are found to be: As will appear by the *Tables of Æquation* of *Natural Days*. And therefore, I think, we may with very good Reaſon, caſt this *Annual Period* upon that cauſe, or rather Complication of Cauſes. For (as we before ſhewed in the *Menſtrual* and *Diurnal*) there will, by this Inequality of *Natural Days*, ariſe a Phyſical Acceleration and Retardation of the Earth's Mean Motion, and accordingly a caſting of the Waters Backward or Forward; either of which will cauſe an Accumulation or *High Water*.

I muſt here add, (that I be not miſtaken) that whereas I caſt the Time of the *Daily Tides* to be at all Places, when the Moon is there in the Meridian; it muſt be underſtood of *open Seas*, where the Water hath ſuch free Scope for its

its Motion, as if the whole Globe of Earth were equally covered with Water: Well knowing, that in *Bayes* and *Inland Channels*, the position of the Banks and other like Causes must needs make the times to be much different from what we suppose in the *Open Seas*: And likewise, that even in the *Open Seas*, *Islands*, and *Currents*, *Gulfs* and *Shallows*, may have some Influence, though not comparable to that of *Bays*, and *Channels*. And moreover, though I think that Sea-men do commonly reckon the time of *High Water* in the Open Seas, to be then, when the Moon is there in the Meridian (as this *Hypothesis* would cast it:) Yet I do not take my self to be so well furnished with a *History* of *Tides*, as to assure my self of it; much less to Accomodate it to particular Places and Cases.

It may be thought perhaps, that if the Earth should thus describe an *Epicycle* about the *Common Center* of *Gravity*, it would (by this its change of place) disturb the Celestial Motions, and make the apparent Places of the Planets, especially some of them, different from what they would otherwise be. For though so small a removal of the Earth, as the *Epicycle* would Cause, (especially if its Semi-diameter shou'd not be above $1\frac{1}{3}$ of the Earth's Semi-diameter) would scarce be sensible, if at all, to the remoter Planets; yet as to the nearer it might.

To this my Answer is, That such difference hath been observ'd, and hath very much Puzzl'd *Astronomers* to give an Account of. Mr. *Horrocks* was fain to have recourse to somewhat like *Kepler*'s *Amicable Fibres* (which he had no affection to at all) to give Account of the Inequalities of the Moon's Motion. And other *Astronomers* have introduced (some upon one Supposition, some upon another) some kind of *Menstrual Æquation*, to solve the Inequalities of the Moon's Motion, according to her *Synodical* Revolution, or different Aspects (of *New Moon*, *Full Moon*, &c.) besides what concerns her own *Periodical Motion*. For which, this Consideration of the *Common Center* of *Gravity* of the *Earth* and *Moon*, is so proper a Remedy (especially if it shall be found precisely to answer those *Phænomena*, which I have not Examined, but am very apt to believe) that it is so far from being, with me an Objection against it, that it is one of the Reasons, which make me Inclineable to Introduce it.

The like Consideration may reasonably be had of *Jupiter* and *Saturn*, and their *Satellites*, which yet, because of their smallness, may chance to be so little, as that at this distance, the Change of their Apparent Places may not be discernable. For all these *Satellites* are to their *Principals*, as so many *Moons* to the *Earth*. And Mr. *Horrocks* expresseth some such little Inequalities in *Saturn*'s Motion, of which he could not imagine what Account to give: Which, for ought I know, might have been accounted for, if at that time the *Satellites* of *Saturn* had been discovered; and that Mr. *Horrocks* had thought of such a Notion as the *Common Center* of *Gravity* of *Saturn* and his *Companions*, to be considerable, as to the guiding of his *Motion*.

Some Objections Answered; by Dr. Wallis. ib. p. 281.

2. 1. To the first Objection, *That it appears not how two Bodies, that have no Tye, can have one common Center of Gravity:* That is (for so I understand the Intendment of the Objection) can Act or be Acted in the same manner, as if they were Connected; *I* shall only Answer, that it is harder to shew How they have, than that they have it. That the Load-stone and Iron have somewhat Equivalent to a Tye though we see it not, yet by the Effects we know. And it would be easie to shew that two Loadstones, at once applied, in different positions, to the same Needle, at some convenient distance, will draw it not to Point directly to either of them, but to some Point between both; which Point is, as to those two, the *common Center* of *Attraction*; and it is the same as if some one Loadstone were in that Point. Yet have these two Load-stones no Connexion or Tye, though a *Common Center* of *Virtue*, acccording to which they joyntly Act. And that there is somewhat that doth Connect the Earth and Moon, (as much as what Connects the Loadstone, and the Iron which it draws,) is past doubt to those, who allow them to be carried about by the Sun, as one Aggregate or Body, whose parts keep a respective Polition to one another: like as *Jupiter* with his *four Satellites*, and *Saturn* with his *One*.

2. To the Second Objection; *That at* Chatham *and in the* Thames, *the* Annual Spring Tides, *happen about the* Æquinoxes; *not (as this Hypothesis doth Suppose elsewhere to have been Observed) about the beginning of* February *and* November. If their meaning be, that *Annual High Tides*, do then happen, and then only, If this prove true, it will ease me of half my work: For it is then easily Answered, that it depends upon the *Obliquity* of the *Zodiack*, the parts of the *Æquinoctial* answering to equal parts of the *Zodiack*, being near the *Solstitial* points greatest, and near the *Æquinoctial* points least of all. But besides, this *Annual* Vicissitude of the *Æquinoxes*, not to say of the four *Cardinal Points* (which my *Hypothesis* doth allow and assert;) I believe it will be found, that there is another *Annual* Vicissitude answering to the *Sun's Apogæum* and *Perigæum*. And that the greatest Tides of all will be found to be upon a Result of these two Causes cooperating. And to what is said to be observed at *Chatham*, and in the *Thames*, contrary to that I alledge as observed in *Rumney Marsh*; I must at present ἀπέχεσθαι, and refer to a *melius inquirendum*. For a good Diary of the Height and Time both of *High-Water* and *Low-Water*, for a Year or two together, even at *Chatham*, or *Greenwich*; but rather at some place in the Open Sea, or at the *Land's End* in *Cornwal*, or on the West Parts of *Ireland*; or at St *Helen's* or the *Bermudas*; *&c.* would do more to the resolving of this Point, than any Verbal Discourse without it.

3. To the third Objection, *That supposing the Earth and Moon to move about a* Common Center *of* Gravity; *if that the* Highest Tides, *be at the* New-Moon *when the* Moon *being neareſt to the Sun the* Earth *is fartheſt from it, and it's Compound Motion at the Swifteſt; and that the* Tides *Abate as the* Earth *approacheth nearer, till it comes into the supposed Circle of her* Annual Motion: *It may be demanded, why do they not still Abate as the* Earth *comes yet nearer to the* Sun *and the Swiftness of its Compound Motion, still Slackens? And so, why have we not* Spring-Tides *at the* New-Moon (*when the motion is Swifteſt*) *and* Neap Tides *at* Full Moon (*when the Motion is Sloweſt*): *But* Spring-Tides

at

at both? The Anſwer (if obſerved) is already given in my *Hypotheſis* it ſelf. Becauſe the Effect is indifferently to follow, either upon a Suddain *Acceleration*, or a ſuddain *Retardation*. Now both of theſe happening, the One at the *New Moon* the other at the *Full-Moon*, do cauſe *High Tides* at both.

4. To the 4*th* Objection, *That the* Higheſt Tides *are not at all places, about the* New-Moon *and* Full Moon; *and particularly, that in ſome places of the* Eaſt Indies, *the* Higheſt Tides *are at the* Quadratures: I Anſwer in general; That as to the particular *Varieties* of *Tides* in ſeveral Parts of the World, I cannot pretend to give a Satisfactory account, for want of a competent *Hiſtory* of *Tides*, *&c.* Becauſe (as is intimated in what I wrote in the general) the Various Poſitions of *Channels*, *Bays*, *Promontories*, *Gulfs*, *Shallows*, *Currents*, *Trade Winds*, *&c.* Muſt needs make an innumerable Variety of Accidents in particular places, of which no ſatisfactory account is to be given from the general *Hypotheſis* (though never ſo true) without a due conſideration of all thoſe. Which is a Task too great for me to undertake, being ſo ill furniſhed with Materials for it.

5. To the 5*th* Objection, *That, the* Spring-Tides *happen not, with us juſt at the* Full *and* Change, *but two or three days after:* I ſhould with the more confidence attempt an Anſwer, were I certain, whether it be ſo in the *Open Seas*, or only in our *Channels*. For the Anſwers will not be the ſame in both Caſes. If only in our *Channels*, where the *Tides* find a large indraught; but not in the *Open Seas*: We muſt then ſeek a Reaſon of it from the particular Poſition of theſe places. But if it be ſo generally in the wide *Open Seas*: We muſt then ſeek a Reaſon of it from the general *Hypotheſis*. And, till I know the matter of Fact, I know not well which to offer at. I know that Mariners uſe to ſpeak of *Spring Tides* at the *New* and *Full* of the *Moon*; though I have ſtill had a ſuſpicion that it might be ſome Days after, as well in the *Open Seas*, as in our narrower *Channels*. And therefore I have choſen to ſay, in my Papers, *About the New* and the *Full*, rather than *at the New* and *Full*; and even when I do ſay *At*, I intend it in that laxer ſence in which I ſuppoſe the Mariners are to be underſtood, for *Near* that Time. The truth is, the *Flux* and *Reflux* of Water in a Veſſel by reaſon of the jogging of it; though it follow thereupon; yet is, for the moſt part, diſcernable ſome time after. For there muſt, upon that Jog, be ſome time for Motion, before the Accumulation can have made a *Tide*. And ſo I do not know but that we muſt Allow it in all the *Periods*: But in my Conjectural *Hypotheſis* (while it is yet but a Candidate) I did not think my ſelf Oblig'd to ſpeak more nicely.

But now, (after all) the Cleareſt Evidence for this *Hypotheſis* (if it can be had) will be from *Celeſtial Obſervations*. As for inſtance; Suppoſing the *Sun* at *S*, the *Earth's* Place in its *Annual Orb*, at *T*; and *Mars* (in Oppoſition to the *Sun* or near it) at *M*: From whence *Mars* ſhould appear in the *Zodiack* at ♈, and will at *Full Moon* be ſeen there to be, the *Moon* being at C, and the *Earth* at *C*; (and the like at the *New-Moon*.) But if the *Moon* be in the *Firſt Quarter* at *A*, and the *Earth* at *a*; *Mars* will be ſeen, not at ♈, but at *α*; too *Slow*: And when the *Moon* is at *B*, and the *Earth* at *b*, *Mars* will be ſeen at *β*; yet *Fig. 55.*

too

too *Slow*: Till at the *Full-Moon*, the *Moon* at *C*, the Earth at *c*, *Mars* will be ſeen at γ, its true Place, as if the *Earth* were at *T*. But then after the *Full*, the *Moon* at *D* the *Earth* at *d*; *Mars* will be ſeen, not at γ, but at δ; too *Forward*, and yet more when the *Moon* (at the *Laſt Quarter*) is at *E*, the *Earth* at *e*, and *Mars* ſeen at ϵ. If therefore *Mars* (when in *Oppoſition* to the *Sun*) be found (all other allowance being made) ſomewhat too *Backward* before the *Full Moon*, and ſomewhat too *Forward* after the *Full Moon*, (and moſt of all, at the *Quadratures*) it will be the beſt confirmation of the *Hypotheſis*. The like may be fitted to *Mars* in other Poſitions, *mutatis mutandis*; and ſo for the other *Planets*

But this Proof, is of like Nature as that of the *Parallaxis* of the *Earth's Annual Orb* to prove the *Copernican Hypotheſis*. If it can be Obſerved, it proves the Affirmative; but if it cannot be obſerved, it doth not convince the Negative, but only proves that the Semidiameter of the *Earth's Epycicle* is ſo ſmall as not to make any diſcernable *Parallax*. And indeed I doubt that will be the Iſſue. For the Semidiameter of this *Epicycle*, being little more than the Semidiameter of the *Earth* it ſelf, or about $1\frac{1}{3}$ thereof (as is conjectured, in the *Hypotheſis*, from the Magnitudes and Diſtances of the *Earth* and *Moon* compared;) and there having not as yet been obſerved any Diſcernable *Parallax* of *Mars*, even in his neareſt Poſition to the *Earth*, it is very ſuſpicious, that here it may prove ſo too.

The Variety *of the* Annual-Tides, *in ſeveral places of* England, *Conſidered*; *by Dr.* Wallis. n. 34. p. 652.

3. In my *Hypotheſis* for *Tides*, I caſt the *Annual High Tides* for the Coaſt of *Kent*, (and conſequently the *Rivers* of *Thames* and *Medway*) about the beginning of *November* and *February*: Which agrees with Obſervations on thoſe Coaſts, and particularly with that of yours [Mr. *Oldenburgh's*] of *Feb.* 5. $166\frac{7}{8}$.

The laſt year [1667] when I was preſent in the *R. S.* I remember an account was brought us of the *Annual High Tides* on the *Severn*, and at *Cheapſtow bridge*, to be about the beginning of *March*, and the end of *September*. Which though they agree not with the particular times on the Coaſt of *Kent*, yet in the general they agree thus far, That the one is about as much before the one *Æquinox*, as the other is *after* the other *Æquinox*. You now acquaint me with the *High-Tides* about *February* 22, about the Coaſt of *Plymouth*, which is later than that of the Coaſt of *Kent*, but ſooner than that on the *Severn*. And I doubt not but that in other parts of the World will be found other *Varieties*.

The Reaſons of theſe *Varieties* are (as I have formerly ſignified) to be attributed to the particular Poſition of thoſe Parts rather than to the General *Hypotheſis*.

Of which this, in brief, may ſerve for ſome account at preſent. The *General Hypotheſis* of the *Earths* Diurnal Motion from Weſt to Eaſt, would caſt that of the Waters, not following ſo faſt from Eaſt to Weſt; which cauſeth the *Conſtant Current* within the *Tropicks*, where the Circles are greateſt, Weſtward from the Coaſt of *Africa* to that of *America*, (which is alſo the Cauſe of the conſtant *Eaſtern Brieze* blowing in thoſe parts.) But the Sea thus beating on the Coaſt of *America*, is caſt back as with an *Eddy* on either hand, and conſe-

ſequently

ſequently returnsfrom the *American* Shore Eaſt-ward towards the Coaſt of *Europe*; where, the Parallel Circles to the *Æquator* being leſs, and conſequently the Diurnal Motion ſlower, doth not caſt the Waters ſo ſtrongly Weſtwards, as between the *Tropicks*, and ſo not ſtrong enough to overcome the *Eddy*, which it meets with from the other Motion, which gives the Sea a North Eaſterly Motion (on theſe Coaſts) as to its uſual Courſe. The *Current* therefore of our Seas being North Eaſterly, we are next to conſider, at what time it runs more to the North, and at what more to the Eaſt. When it runs moſt Northerly, it runs up the *Iriſh Sea*, and ſo up the *Severn*: When moſt Eaſterly, it runs ſtraight up the *Channel*, and ſo to the Coaſt of *Kent*: When between theſe, it beats againſt *Devonſhire* and *Cornwall*, and thoſe parts. We are therefore to conſider (as to the *Annual Periods*) that the *Annual Motion* of the *Earth* in the *Zodiack*, and the *Diurnal* in the *Æquator*, are not preciſely in the ſame direction, but make an Angle of $23\frac{1}{2}$ *Deg.* at the *Æquinoxes*; but run, as it were, Parallel at the *Solſtices:* And as they be nearer or farther from theſe Points, ſo is the Inclination *Varied*. Which ſeveral Directions of Motion, do cauſe the Compound Motion of both to *Vary* from the Eaſt and Weſt more or leſs, according as the Sun's poſition is farther or nearer the *Solſtices*. And therefore nearer to the *Æquinoxes* this Inclination doth caſt the conſtant *Current* of our Seas more to the North and South; and further from it, more to the Eaſt and Weſt. Which is the reaſon why the *Current* up the *Iriſh-Sea* is nearer to the *Æquinoxes* (at the beginning of *March* and end of *September*) and up the *Channel* or *narrow Seas*, farther from it (at the Beginning of *February* and of *November*:) and againſt the Coaſts of *Devonſhire* and thereabout, at ſome Intermediate Time.

Animadverſions upon Dr. Wallis's *Hypotheſis; by Mr.* Joſ. Childrey. n. 64. p. 2061.

4. I fear Dr. *Wallis* may be miſtaken about the *Annual* Viciſſitudes of the *Tides*, which he contendeth to be about *Allhallontide* and *Candlemaſs*; For

1. Our *Engliſh Seamen* (who are more to be truſted than the Inhabitants of *Rumney Marſh*) uſe to ſay, that the *Higheſt Tides* in the Year ſeem to happen rather about the *Æquinoxes*, than thoſe two other aſſigned times, when the Natural days are longeſt and Shorteſt.

2. If that which he Suppoſeth ſhould be the Cauſe of the *High-Tides*, he mentions at *London* in *Nov.* 1660 and 1665, the like might be expected every *November*; and as frequently in *February*; of which he gives not one Inſtance. But thoſe *High-Tides* in the *Thames* in *November*, if we dare credit the *London Watermen*, are cauſed by the coming down of the *Land Waters* after a very great *Rain*, which being encountered by the *Tide* of *Flood* from the Mouth of the *Thames*, cannot but Swell to an unuſual Height. To induce us to believe which, we need only conſider, that the latter end of *October*, and the beginning of *November* (or rather both thoſe whole Months) are generally the *Rainieſt* part of the whole Year. Now if the great *Rains* fall ſo, that the *Land-Waters* come down to the flowing part of the *Thames*, juſt upon the *Full* or *Change*, when the *Spring-Tides* happen, as they did (for Example) *Septem.* 30. 1555. and *October* the 22. 1629. (*Stow* and *Howes* are my Authors,) thoſe *Spring-Tides* muſt be the Higher, as proceeding from a Double Cauſe.

3. There

3. There is another thing notoriously known by all Sea-men, to be a Cause of *high* or *low Tides*, namely the sitting of the Wind at such or such a Point of Compass, and Blowing hard. It is the constant saying of all Sea-men in *Kent*, that ever I met with, that the North West Winds make the *Highest Tides* in the *Thames*, *Medway*, and all the Coasts about the *South* and *North Forelands*; and likewise on the Coast of *Holland* and *Flanders*. And the Reason they alledge for it is, because (say they) that Wind doth with equal Force Blow in the *Tide* of *Flood* at both Ends of this *Island* of *Britain*, that is, from the Northward between the Coasts of *Scotland*, *Norway*, and *Jutland*; and also from the Westward by the Coasts of *Cornwal*, *Devonshire*, *Dorsetshire*, &c. up along the *Sleeve*; and for the same reason they say (and I think truly) that a South East Wind Deads and Hinders the *Tides* there. Agreeably to this I very well remember, when I was a Boy and lived at *Rochester*, that when the *Tides* were, unusually *High*, the Wind was always North West, and the *Moon* near the *Full* or *Change*. And the Inhabitants about *Chatham*, the Hundred of *Hoo*, and the Isle of *Graine*, will with one Voice say, that they never fear their Low Marshes being overflowed by the *Tide*, but when the Wind is at North West or thereabout, upon the *Spring Tides*. Here at *Weymouth* those Able and Antient Sea-men, I have talked with, tell me, that a *S. S. E* Wind makes the *greatest Tides*, and that according to the degree of the Wind, *cæteris paribus*, the *Tides* rise more or less notably, but that they never observe any extraordinary Swelling *Tides* about *Allhallontide* or *Candlemass*, unless the Wind be about *S. S. E.* And the Reason they give for that Wind's Raising the *Tides* there, is, (in my opinion) very convincing, if we consider the lying of the Haven in the Map. And for the same Reason, I suppose, the Wind from the same Point may make the *Highest Tides* at *Southampton*; a Westerly Wind at *Bristol* and *Severne*; an Easterly Wind at *Hull*; a North-East Wind at *Wisbych* and *Lyn*; a Southerly Wind upon the opposite Coasts of *England* and *Ireland*, &c. And I am confident if more particular Enquiry be made in *Rumney Marsh*, it will be found, that *Dimchurch-Wall* is never in danger of being Overflowed or broken by the *Tides*, but upon very stormy and Tempestuous Weather; especially when the Wind either blows right on upon the Shore, or when it sits in that Point, that Raiseth the *Tides* Highest there. And if we do but consider, that *Allhallontide* and *Candlemass* are no more famous for the longest and shortest Natural Days, than they are generally infamous for Stormy Weather; especially the former Season, (*Wet* and *Windy* Weather being most concomitant,) we have good ground to Attribute *High Tides*, at those times of the Year, to another Cause than the Author supposeth; and make a more than probable Conjecture at the occasion of the Mistake. It is true, *March* is very often more stormy than *February*, (though seldom so stormy as *October* and *November*) which possibly might occasion that Opinion, which some hold, (of which number, *Pliny* is one) that the *Highest Tides* are about the *Æquinoxes*. And if the thing were found to hit pretty frequently in *March*, Men might not be careful to observe the other *Æquinox*; though yet it cannot be deny'd, that we have Blustering Weather many times before *Michaelmass*. In Confirmation of all this that I have said, concerning the Influence of the

the *Winds* being conſiderable on the *Tides*, I ſhall add theſe following Collections of my own out of *Hiſtories*, *Chronicles*, &c

1250. *Octob.* 1. (Saith *Holinſhead*) upon the *Change* of the *Moon*, was a moſt dreadful *Inundation* of the Sea, that did exceeding much hurt to *Holland* beyond Sea, *Holland* in *Lincolnſhire*, and the Marſh-Ground in *Flanders*, and drowned *Winchelſea*. But he tells us withal, that an unheard of *Tempeſt* of *Wind* accompanied it.

1555. *Sept.* 30. (Saith *Stow*) was a Notable *Inundation* of the *Thames*; but he ſaith withal, that it was by occaſion of a great *Wind*, and *Rain* that had fallen; the *Moon* was in *Perigæo*.

$15\frac{69}{70}$. *March* 10. I find this Manuſcript Note in Latine in an Ephimerides for that Year, over againſt the Day; *Septentrionis maxima Sævitia: Nivis flocci magni, ingens frigus. Maxime* Tumeſcebat æſtus Maris *die & nocte*; *nam excurrebat in Agros late.*

1592, *Sept.* 6 *Wedneſday*, (ſaith *Stow*) the Wind being Weſt and by South, as it had been for two Days before very Boiſterous, the *Thames* was made ſo *void* of *Water*, by forcing out the Freſh, and keeping back the Salt, that Men in diverſe places might go 200 Paces over, and then fling a Stone to Land, *&c.*

1600. *Decemb.* 8. I find this Note written in another Ephimerides for that Year, over againſt the Day, by an unknown Perſon, who, as it ſeems, was then at *Venice* (where a South Eaſt Wind makes the *Higheſt Tides*) *Inundatio Venetiis 6. ped temp. Sirocco.*

1601. (Saith *Grimſton* in his *Netherland Hiſtory*) the Sea being forced in by a ſtrong *N W* Wind, did ſome miſchief to *Oſtend.*

1601. *Octob.* 26. *St. n.* a great *Tempeſt* (ſaith the ſame Author) and the Wind Weſt North Weſt, and the *Tide* much *Higher* than uſual at *Oſtend.*

1602. *Feb.* 23, 24, *ſt. n.* Blew a Terrible North Weſt Wind, which made the Water riſe higher than uſual at *Oſtend. Idem.*

1604 *March.* 1. *n. ſt.* The *Wind* was very Great at Weſt, and North Weſt, with a furious *Tempeſt*, the *Tide* at *Oſtend* Riſing ſo *High*, as it had not done in forty Years before. *Idem.*

The *Perigæoſis* of the *Moon* alſo ſeems to have (at leaſt) ſome Influence on the *Tides*, and to make them ſwell higher than elſe they would do. For I have found by obſerving the *Tides* (as often as I had leiſure) ſeveral *High Tides* and *Inundations* (though I muſt not ſay all,) to happen upon the *Moon*'s being in, or very near, her *Perigæum*. For Example,

That famous Inundation mentioned before out of *Holinſhead*, 1250, *Octob.* 1. Was when the *Moon* was in *Perigæo*, as appears by Calculation.

1530. *November* 5. That Inundation on which was made the Diſtick.

Anno ter deno poſt ſeſquimille, Novembris,
Quintâ, ſtat ſalſis Zelandia *tota ſub Undis*;

Was, when the *Moon* was in *Perigæo*.

Jan. 13. $155\frac{1}{2}$. The Sea, (ſaith *Michell* in his Chronicle) brake in at *Sandwich*, and overflowed all the Marſhes thereabout, and drowned much Cattle; the *Moon* in *Perigæo*.

1570. *Novemb.* 1. Was a dreadful Flood at *Antwerp*, and on all the Coaſts of *Holland*, that made infinite Spoil; the *Moon* in *Perigæo*.

1600. *Decemb.* 8. Above mentioned; the *Moon* in *Perigæo*.

$160\frac{6}{7}$. *Jan.* 20. Was a great *Inundation* in *Severne*, mentioned in *How*'s Chronicle; that did much hurt in *Somerſetſhire* and *Gloceſterſhire*, &c. the *Moon* in *Perigæo*.

1643. *Jan.* 23. *ſt. n.* (ſaith a little *Low Dutch Chronicle* that I have) was a terrible High *Water-Flood* in *Frieſland*, &c. whereby much hurt was done to the *Dykes*; and at *Gaes* by *Haerlingen*, the Dead Bodies ſtreamed out of the Earth; the *Moon* in *Perigæo*.

1651. *Feb.* 23. *ſt. n.* (Saith the ſame *Chronicle*) was St. *Peter*'s High Flood, whereby much hurt was done to the *Dykes* in *Frieſland*, *Embderland*, and elſewhere, and not far from *Dockum* by *Oudt-woudumer-Ziil*, is a Breach of 42 Roods long, broken in the *Dyke*: The *Moon* in *Perigæo*.

Aug. 2. 1657 *ſt. v.* At *Feverſham* (where I then lived) was a very high *Spring Tide*; and yet the Wind was at South Eaſt, which deads the *Tides* there; the *Moon* in *Perigæo*.

Aug. 22. 1658. *ſt. v.* At *Feverſham* was a very *High Tide* in the Afternoon, though the Wind was Southerly, and blew very ſtiff, which the Seamen there wondred at; the *Moon* in *Perigæo*.

1661. Upon *Michaelmaſs Day*, was a great *Overflowing* of the *Severn*, that it drowned the lower Ground lying by it; I lived then in *Gloceſterſhire*, and immediately as ſoon as I heard of it, I noted it down in my Memorandums; the *Moon* in *Perigæo*.

The Scheme of the Weather printed in the *Hiſtory of the* R. S. tells us, that *May* 24. 1663. was a very great *Tide* at *London*. But it tells us withal that the ſame day the *Moon* was in *Perigæo*.

Sept. 1. 1669. Here at *Weymouth*, I obſerved my ſelf a very *High-Tide*; and ſo did ſeveral Seamen in that Town, who wondered at it, the Weather being very Calm, and that little Wind that was being at North Eaſt, which uſes to contribute nothing at all to the *Tides* in that Haven; the *Moon in Perigæo*.

Further, that which inclines me to believe, that the *Perigæoſis* of the *Moon* is of ſome concernment in this matter, is, becauſe it is a Maxim amongſt our *Kentiſh Seamen*, that they never have two *Running Spring Tides* (as they call them) together, but that the next *Spring Tide*, after a *High Running Spring*, is proportionably weak and ſlack; which, if true, is very correſpondent to my opinion, becauſe if the *Moon* be in *Perigæo* at this *Spring-Tide*, ſhe will be in *Apogæo* at the next. Accordingly I have received this account at *Weymouth*, that this preſent *Feb.* $16\frac{69}{70}$ the *Spring-Tides* ran very *High* after the *Change*, though the Weather was pretty Calm, and that Wind that was not very favourable

vourable to the *Tides*, and that the Spring Tides after the *Full*, were very *Low*, and weak, which is exactly according to my Conjecture.

But I conceive that the beſt Touch-ſtone to prove the Soundneſs of my Opinion (which I confeſs I never had the opportunity to do yet,) is to have it obſerv'd, whether thoſe *Neap-Tides* be not apparently Higher (*conſideratis conſiderandis*) that happen at the *Moon*'s being in *Perigæo* either at the *Firſt* or *Laſt Quarter*: Becauſe it is a received and demonſtrable Truth in *Aſtronomy*, that the *Moon* being in *Perigæo* at either *Quarter*, comes then nearer the Earth than when it is in *Perigæo* at the *Change* or *Full*.

5. That the *Winds* have a great Influence on the *Tides* of particular Coaſts and Havens, I do not at all queſtion; and the like I ſay of *Land-Waters* which are as to Inland Rivers, very conſiderable; eſpecially as to Inundations upon Riſing of the Water: For that the *Tide* and *Land-floud* ſhould joyntly make a greater Inundation than either ſingly would have done, is not to be doubted. But in my Eſſay I take no notice of theſe, becauſe my buſineſs was to give a Statical account of *Stated* Periods (*Diurnal*, *Menſtrual*, *Annual*) ariſing from Regular Motions; not of Accidental Extravagances, ſuch as theſe are. *Anſwer'd by Dr. Wallis. ib. p. 2068.*

The *Moon's Perigæoſis* alſo is far from being contrary to my *Hypotheſis*: But for as much as it doth not ſtill fall out at the ſame time of the *Day*, *Month*, or *Year*, I could not make it a Component of any of thoſe noted Periods, *Diurnal*, *Menſtrual*, or *Annual*; (and of more Periods than theſe, I did not know that there hath been any general notice taken, of which I might think my ſelf obliged to give an account:) But it may very well influence any or all thoſe, according as it falls out advantageous or diſadvantageous for them.

And as I do ſo readily concur with him in all the particulars by him ſuggeſted; ſo I think he will not be difficult in aſſenting to all the Materials of my *Hypotheſis*. The account which I give of the *Diurnal* and *Menſtrual* Periods (from the *Common Center* of *Gravity* of the *Earth* and *Moon*,) he doth allow as very Rational: And conſequently (which is the Foundation of it,) that any *Acceleration* or *Retardation* of the Compound Motion of the particular parts in the *Earth's* Surface, is to give ſuch an *Accumulation* of Waters as cauſeth a *Tide*; and the Complication of ſuch *Accelerations* and *Retardations* concurring or interfering one with another, doth occaſion the perplex *Varieties* in them.

If therefore there be no other Periods of *Tides* but theſe, or no other remarkable, my work is done, and I need not be further ſollicitous: For, then there will ſeem to be either no other inequality of motions, or none conſiderable. But, if there be alſo obſervable an *Annual* Period, (as perhaps there may be) then are we to ſeek for the Cauſe thereof in ſomewhat of Inequality, which doth (for the *Annual* Period) Annually recur; or (for any other Period,) which doth recur in ſuch a time as that other Period doth require.

'Tis true I have not inſiſted on the *Moon's Apogæum* and *Perigæum* (with the Inequality of Motion depending on it; or the Obliquity of its Orb (which cauſeth another Inequality both in the Motion of Longitude and Right Aſcenſion,) becauſe I did not know of any Periodical Viciſſitude of *Tides* conſonant

thereunto. When any ſuch ſhall be diſcovered, we have here a Foundation ready for the Salving of it. And I the rather think they may be conſiderable, becauſe the *Earth* and *Moon's Appropinquation* and *Elongation*, doth really alter the Diſtance of the *Common Center* of *Gravity* (of the *Earth* and *Moon*) from the Earth (rendring the Earths Epycicle Elliptical;) and much favours what Mr. *Childrey* obſerves of the *Moon in Perigæo*. But as to any *Annual* Viciſſitude, it is not of uſe, becauſe it doth not *Annually* recur.

But if the *Annual High-Tides* be at the *Æquinoxes*, not at the times I have aſſign'd, then ſo much of the *Hypotheſis* as concerns the *Excentricity* may be ſpared, (or allowed to be ſo little as not to be remarkable;) and that of the *Obliquity* alone will give a ſufficient account of it. Or if (to which he ſeems rather to incline) there be no ſuch *Annual* Viciſſitudes at all; then may that of the *Obliquity* be ſpared alſo, and yet the *Hypotheſis* be perfect without it. And, till ſome ſuch be obſerved, and acknowledged, it will be ſufficient to ſay, That, though both the *Excentricity* and *Obliquity* do cauſe ſome Inequality in the Motion; yet ſo little, as that in the *Tides* it is not remarkable, they falling juſt as if the three Motions, (*Annual*, *Menſtrual*, *Diurnal*,) were all exactly Circular, and on Parallel Axes.

But as to matter of Fact in *Rumney Marſh* I ſay, that (according to the beſt account I can there get, and the unanimous conſent as well of Fiſher-men and other Water-men, as of other Inhabitants,) it is conſtant; hardly miſſing (or very ſeldom) any one Year (be the Weather fair or foul;) and as well about *Candlemaſs*, as about *Allhallontide*, every year, though not then ſo High: Of which (though they do not pretend to give any reaſon of it,) I think a Cauſe may be very Rationally aſſigned. For if you conſult the Tables of the *Inequality* of *Natural Days* (which Parallel I make uſe of for the Explication of this) you will find, that about one of the Extreams (in *January*) the Increaſe and Decreaſe of the *Natural Days* Fluctuates very much; ſometime Increaſing, ſometime Decreaſing, according as this or that of the two Cauſes, thwarting one another, doth prevail: But about the other Extream (in *October*) it is much otherwiſe; the Increaſings and Decreaſings going on in a continual courſe for a long time together. And the ſame Cauſes, applyed to the buſineſs of *Tides*, may very rationally be ſuppoſed to produce as Unequal Effects. And though the Seamen at *Weymouth* have not obſerved any ſuch ſignal Effects about *Allhallontide* and *Candlemaſs*: Yet thoſe about *Chepſtow* obſerve the like to happen about the Beginning of *March* and End of *September*, (the one as much before the *Vernal*, as the other is after the *Autumnal Æquinox*, like as in our caſe it happens) which they call by the Name of St. *David's Stream* and *Michaelmas Stream*; as we do thoſe in *Kent*, *Candlemaſs Stream*, and *Allhallon Stream*: Of theſe different Seaſons at *Chepſtow bridge* from thoſe of *Rumney Marſh*, I have already given my remarks. But ſince it is not yet (it ſeems) agreed, Whether ſuch an *Annual* Phænomenon happen; or, if ſo, not at that time; (ſo that, for ought yet appears, it may be at the Seaſons I deſign, that is, between the *Winter-Solſtice* and the two *Æquinoxes* on either ſide of it, though, on ſeveral Coaſts, ſeverally Remote,) I think it beſt to let this part of the *Hypotheſis* ſtand as it is unrevoked, as that which, when it ſhall be

be discovered, and agreed on, stands ready enough to give a Rational Account of it, and, in the mean time, does no hurt. And in such a Complication of Causes so Abstruse, scarce any thing but *Observation* will determine, which of the Causes, and in what Degree, is to be judged predominant.

VI. The sole Principle upon which Mr. *Newton* proceeds to Explain most of the great and surprising Appearances of Nature, is no other than that of *Gravity*, whereby in the Earth all Bodies have a *Tendency* towards it's *Center*; and there is the like *Gravitation* towards the *Center* of the *Sun*, *Moon*, and all the *Planets*. *Mr.* Newton's Theory *of the* Tides *Explain'd*; *by Mr.* Halley. n. 226. p. 445.

Now this Force of *Descent* Decreases, as the Square of the *Distance* of the Heavy Body from the *Center* Increases.

There is also Room to suspect, that the Force of *Gravity* is, in the *Cælestial Globes*, proportional to the *Quantity* of *Matter* in each of them.

From these Principles it is evident, that if the *Earth* were alone, that is to say, not affected by the Actions of the *Sun* and *Moon*, the Ocean being equally pressed by the Force of *Gravity* towards the Center, would continue in a perfect *Stagnation*, always at the same Height, without either *Ebbing* or *Flowing*; But the *Sun* and *Moon* having a like Principle of *Gravitation* towards their *Centers*, and the *Earth* being within the *Activity* of their *Attractions*, it will plainly follow, that the Equality of the Pressure of *Gravity* towards the Center will thereby be Disturbed; and though the smallness of these Forces, in respect of the *Gravitation* towards the *Earth's Center*, renders them altogether imperceptible by any Experiments we can devise, yet the Ocean being Fluid and yielding to the least Force, by its *Rising* shews where it is less Prest, and where it is most Prest by it's *Sinking*. p. 445.

Now if we suppose the Force of the *Moon's Attraction* to Decrease, as the Square of the *Distance* from its *Center* Increases (as in the *Earth* and other *Celestial Bodies*) we shall find, that where the *Moon* is perpendicularly either above or below the *Horizon*, either in *Zenith* or *Nadir*, there the Force of *Gravity* is most of all Diminished, and consequently that there the Ocean must necessarily *Swell* by the coming in of the Water from those parts where the pressure is greatest, *viz.* in those places where the Moon is near the *Horizon*. Thus let *M* be the *Moon*, *E* the *Earth*, *C* it's *Center*, and *Z* the place where the *Moon* is in the *Zenith*, *N* where in the *Nadir*. Then by the *Hypothesis* it is evident, that the Water in *Z*, being nearer, is more Drawn by the *Moon*, than the *Center* of the *Earth C*, and that again more than the Water in *N*, wherefore the Water in *Z*, has a Tendency towards the *Moon*, contrary to that of *Gravity*, being equal to the Excess of the *Gravitation* in *Z*, above that in *C*: And in the other Case, the Water in *N*, tending less towards the *Moon* than the Center *C*, will be less Pressed, by as much as is the Difference of the *Gravitations* towards the *Moon* in *C* and *N*. This rightly understood, it follows plainly, that the *Sea*, which otherwise would be *Spherical*, upon the Pressure of the *Moon*, must form it self into a *Spheroidal* or *Oval* Figure, whose longest Diameter is where the *Moon* is *Vertical*, and shortest where she is in the *Horizon*; and that the *Moon* shifting her Position as she turns round Fig. 56.

the

the Earth once a Day, this *Oval* of Water ſhifts with her, occaſioning thereby the *two Floods* and *Ebbs* Obſervable in each 25 *Hours*.

And this may ſuffice, as to the general Cauſe of the *Tides*; it remains now to ſhew how naturally this Motion accounts for all the Particulars that has been Obſerv'd about them; ſo that there can be no Room left to doubt, but that this is the True Cauſe thereof.

The *Spring-Tides* upon the *New* and *Full Moons*, and *Neap-Tides* on the *Quarters*, are occaſioned by the attractive Force of the *Sun* in the *New* and *Full*, Conſpiring with the Attraction of the *Moon*, and producing a *Tide* by their United Forces: Whereas in the *Quarters*, the *Sun* Raiſes the Water where the *Moon* Depreſſes it, and the contrary; ſo as the *Tides* are made only by the Difference of their Attractions. That the Force of the *Sun* is no greater in this Caſe, proceeds from the very ſmall Proportion the Semidiameter of the *Earth* bears to the vaſt Diſtance of the *Sun*.

It is alſo Obſerved, that *cæteris paribus*, the *Æquinoctial Spring-Tides* in *March* and *Sept.* or near them, are the *Higheſt*, and the *Neap-Tides* the *Loweſt*; which proceeds from the greater Agitation of the Waters, when the Fluid *Sphæroid* revolves about a *Great Circle* of the *Earth*, than when it turns about in a *Leſſer Circle*; it being plain, that if the *Moon* were conſtituted in the *Pole* and there ſtood, that the *Sphæroid* would have a fixt Poſition, and that it would be always *High-Water* under the *Poles*, and *Low Water* every where under the *Æquinoctial*: And therefore the nearer the *Moon* approaches the *Poles*, the leſs is the Agitation of the Ocean, which is of all the Greateſt, when the *Moon* is in the *Æquinoctial*, or fartheſt diſtant from the *Poles*. Whence the *Sun* and *Moon*, being either Conjoyned or Oppoſite in the *Æquinoctial*, produce the greateſt *Spring Tides*; and the ſubſequent *Neap-Tides*, being produced by the *Tropical Moon* in the *Quarters*, are always the leaſt *Tides*; whereas in *June* and *Decem.* the *Spring Tides* are made by the *Tropical Sun* and *Moon*, and therefore leſs Vigorous; and the *Neap-Tides* by the *Æquinoctial Moon* which therefore are the Stronger. Hence it happens, that the Difference between the *Spring* and *Neap-Tides* in theſe Months is much leſs conſiderable, than in *March* and *September*. And the Reaſon why the very *Higheſt Spring Tides* are found to be rather before the *Vernal* and after the *Autumnal Æquinox*, *viz.* in *Feb.* and *Oct.* than preciſely upon them, is, becauſe the *Sun* is nearer the *Earth* in the *Winter Months*, and ſo comes to have a Greater Effect in producing the *Tides*.

Hitherto we have conſidered ſuch Affections of the *Tides* as are Univerſal, without Relation to particular Caſes; what follows from the Differing Latitudes of Places, will be eaſily underſtood by the following *Figure*.

Fig. 57. Let *Ap EP*, be the *Earth*, cover'd over with very deep Waters; *C*, its *Center*; *P*, *p*, its *Poles*; *AE*, the *Æquinoctial*; *Ff*, the *Parallel* of *Latitude* of a Place; *Dd*, another *Parallel* at equal Diſtance on the other ſide of the *Æquinoctial*; *Hh*, the two Points where the *Moon* is *Vertical*; and let *Kk*, be the Great Circle wherein the *Moon* appears *Horizontal*. It is evident, that a *Spheroid* deſcribed upon *Hh*, and *Kk* ſhall nearly Repreſent the Figure of the *Sea*; and *Cf*, *CD*, *CF*, *Cd*, ſhall be the *Heights* of the *Sea* in the places, *f*, *D*,

D, *F*, *d*, in all which it is *High-Water*: And seeing that in 12 Hours time, by the *Diurnal* Rotation of the *Earth*, the Point *F*, is transferred to *f*; and *d*, to *D*: The Height of the Sea *C F*, will be that of the *High-Water* when the *Moon* is Presẽt, and *C F*, that of the other *High Water*, when the *Moon* is Under the Earth: Which in the Case of this Figure is less than the former *C F*.

And in the Opposite Parallel *D d*, the contrary happens. The *Rising* of the Water being always alternately Greater and Less in each place, when it is produced by the *Moon* Declining sensibly from the *Æquinoctial*: that being the greatest of the two *High-Waters* in each *Diurnal* Revolution of the *Moon*, wherein she approaches neares either to the *Zenith* or *Nadir* of the Place: Whence it is, that the *Moon* in the Northern Signs, in this part of the World, makes the *Greatest Tides* when Above the Earth, and in the Southern Signs, when Under the Earth; the Effect being always the greatest where the *Moon* is Fartheſt from the *Horizon*, either Above or Below it. And this alternate Increase and Decrease of the *Tides* has been Observ'd to hold true on the Coast of *England*, at *Bristol* by Capt. *Sturmy*, and at *Plymouth* by Mr. *Colepress*.

But the Motions hitherto mentioned are somewhat altered by the Libration of the Water, whereby though the Action of the *Luminaries* should cease, the *Flux* and *Reflux* of the Sea would for some time continue. This Conservation of the Impressed Motion diminishes the Differences that otherwise would be between two Consequent *Tides*, and is the Reason why the *Highest Spring Tides* are not precisely on the *New* and *Full Moons*, nor the *Neaps* on the *Quarters*; but generally they are the *Third Tides*, after them, and sometimes later.

All these things would regularly come to pass, if the whole Earth were covered with Sea very Deep: but by Reason of the Shoalness of some places, and the Narrowness of the Streights, by which the *Tides* are in many Cases Propagated, there Arises a great diversity in the Effect, and not to be accounted for, without an Exact Knowledge of all the Circumstances of the Places, as of the Position of the Land, and the Breadth and Depth of the Channels by which the *Tide* flows; for a very Slow and Imperceptible Motion of the whole Body of the Water, where it is (for Example) 2 *Miles* deep, will suffice to Raise its Surface 10 or 12 Feet in a *Tides* time; whereas, if the same Quantity of Water were to be conveyed upon a Channel of 40 *Fathoms* deep, it would require a very great Stream to effect it, in so large Inlets as are the *Channel* of *England* and the *German Ocean*; whence the *Tide* is found to set strongest in those places where the Sea grows narrowest; the same Quantity of Water being to pass through a smaller Passage: This is most evident in the Streights, between *Portland* and *Cape de Hague* in *Normandy*, where the *Tide* runs like a Sluce; and would be yet more between *Dover* and *Calis*, if the *Tide* coming about the Island from the North did not Check it. And this Force being once Impressed upon the Water, continues to carry it above the *Level* of the ordinary Height in the *Ocean*, particularly where the Water meets a Direct Obstacle, as it is at St. *Malo's*; and where it enters into a long Channel, which running far

into

into the Land, grows very ſtreight at its Extremity, as it is in the *Severn Sea* at *Chepſtow* and *Briſtol*.

This Shoalneſs of the Sea, and the Intercurrent Continents are the Reaſon, that in the Open *Ocean* the time of *High Water* is not at the *Moon*'s Appulſe to the Meridian, but always ſome Hours after it; as it is obſerved upon all the *Weſt Coaſt* of *Europe* and *Africa*, from *Ireland* to the *Cape of Good Hope*: In all which, a *S.W.* Moon makes *High Water*, and the ſame is reported to be on the *Weſt ſide* of *America*. But it would be endleſs to account all the particular Solutions, which are eaſie *Corollaries* of this *Hypotheſis*; as why the *Lakes*, ſuch as the *Caſpian Sea*, and *Mediterranean Seas*, ſuch as the *Black Sea*, the *Streights*, and *Baltick*, have no ſenſible *Tides*: For *Lakes* having no communication with the *Ocean*, can neither Increaſe or Diminiſh their Water, whereby to Riſe and Fall; and *Seas* that communicate by ſuch Narrow Inlets, and are of ſo immenſe an extent, cannot in a few Hours time receive or empty Water enough to Raiſe or Sink their Surface any thing ſenſibly.

Vid. inf. §. XI.

Laſtly, The Cauſe of thoſe *Extraordinary Tides* in the Port of *Tunkin* in *China*, is propoſed by Mr. *Newton* to be from the Concurrence of Two *Tides*; the one propagated in ſix Hours, out of the great *South-Sea*, along the Coaſt of *China*; the other out of the *Indian Sea*, from between the Iſlands in 12 Hours, along the Coaſt of *Malacca* and *Cambodia*. The one of theſe *Tides* being produced in North Latitude, is, as has been ſaid, Greater, when the *Moon* being to the North of the *Æquator*, is above the Earth, and leſs when ſhe is under the *Earth*; the other of them, which is propagated from the *Indian Sea*, being raiſed in South Latitude, is greater when the *Moon*, declining to the South, is above the *Earth*, and leſs when ſhe is under the Earth. So that of theſe *Tides* alternately Greater and Leſſer, there comes always ſucceſſively two of the Greater, and two of the Leſſer together every Day; and the *High Water* falls always between the times of the arrival of the two greater Floods; and the *Low Water* between the Arrival of the two Leſſer Floods. And the *Moon* coming to the *Æquinoctial*, and the alternate Floods becoming Equal, the *Tide* Ceaſes, and the Water Stagnates: But when ſhe has paſſed to the other ſide of the *Æquator*, thoſe Floods which in the former Order were the Leaſt, now becoming the Greateſt, that that before was the time of *High Water* now becomes the *Low Water*, and the Converſe. So that the whole Appearance of theſe *ſtrange Tides*, is without any forcing Naturally deduced from theſe Principles.

VII. 1. In the *Offing* between the *Northforeland* and *Southforeland*, it run *Tide* and *Half Tide*, that is, it is either Ebbing Water or Flood upon the *Shore*, in that part of the *Downs*, three Hours, (which is, groſly ſpeaking, the time of *half* a *Tide*) before it is ſo *off* at Sea. And it is a moſt certain Obſervation, that where it flows *Tide* and *half Tide*, tho' the Tide of Flood runs *aloft*, yet the Tide of Ebb runs *under-Foot*, that is, cloſe by the Ground; and ſo at the Tide of Ebb, it will flow *under Foot*.

Under Currents *in the* Dawns, *at the* Streights-Mouth, *and in the* Baltick; *by Dr.* Tho. Smith. n. 158. p. 564.

There is a vaſt Draught of Water poured continually out of the *Atlantick* into the *Mediterraneun*, the Mouth or entrance of which between *Cape Spartel* or

or *Sprat*, as the Sea-men call it, and *Cape Trafalgar*, may be near 7 Leagues wide, the *Current* ſetting ſtrong into it, and not loſing its force till it runs as far as *Malaga*, which is about 20 Leagues within the *Streights*. By the benefit of this *Current*, tho' the Wind be contrary, if it does not overflow, Ships eaſily turn into the *Gutt*, as they term the Narrow Paſſage, which is about 20 Miles in length. At the end of which are two Towns, *Gibraltar* on the Coaſt of *Spain*, which gives denomination to the *Streights*, and *Ceuta* on the *Barbary* Coaſt: At which places *Hercules* is ſuppoſed to have ſet up his *Pillars*. What becomes of this great quantity of Water poured in this way, and of that, which runs from the *Euxine* into the *Boſphorus* and *Propontis*, and is carried at laſt through the *Helleſpont* into the *Ægean* or *Archipelago*, is a curious Speculation, and has exerciſed the Wit and Underſtanding of Philoſophers and Navigators. For there is no ſenſible Riſing of the Water all along the *Barbary* Coaſt even down to *Alexandria*, the Land beyond *Tripoli*, and that of *Egypt* lying very low, and eaſily overflowable. They obſerve indeed that the Water riſes 3 Feet, or 3 Feet and half, in the *Gulf* of *Venice*, and as much, or very near as much, all along the *Riviera* of *Genoua*, as far as the River *Arno*: But this rather adds to the Wonder.

My Conjecture is, that there is an *Under-Current*, whereby as great a quantity of Water is carried *out*, as comes *flowing* in. To confirm which, beſides what I have ſaid above about the difference of Tides in the *Offing*, and at the *Shore* in the *Downs*, which neceſſarily ſuppoſes an *Under-Current*, I ſhall preſent you with an Inſtance of the like Nature in the *Baltick Sound*, as I received it from an able Sea-man, who was at the making of the Trial.

3. He told me, that being there in one of the *King*'s Frigats, they went with their Pinnace into the middle Stream, and were carried violently by the *Current*: That ſoon after they ſunk a Bucket with a large Cannon Bullet to a certain depth of Water, which gave check to the Boat's Motion; and ſinking it ſtill lower and lower, the Boat was driven a Head to the Windward againſt the *upper Current*; the *Current aloft*, as he added, not being above 4 or 5 Fathom deep, and that the lower the Bucket was let fall, they found the *Under Current* the ſtronger.

VIII. The *Euripus* is a Streight of the *Ægean Sea*, ſo narrow that a Galley can ſcarce paſs through it under a Bridge, built between the *Cittadel* and the *Donjon* of *Negropont*. But not only this place, where the Bridge is, is call'd the *Euripus*, but alſo 10 or 12 Leagues on each ſide of it, where the Channel being more large, the inconſtant Courſe is not ſo ſenſible, as at the Foot of the *Caſtle*. For 3 or 4 Leagues on each ſide there are found 6 or 7 Gulfs, wherein this Water ſhuts it ſelf up, to iſſue from thence as often as it enters there; and the Situation of theſe Gulfs contributes to the oddneſs of this *Flux* and *Reflux*; of which the *Moon* ſeems to be the Principal Cauſe.

The Irregular Flux and Reflux of the Euripus, *by F.* Jacq. Paul. Babin. n. 71. p. 2153.

There are 20 Days of each *Moon* in which the Courſe of the *Euripus* is *Regular*, and 10 in which it is *Irregular*; that is to ſay, 5 Days before and 5 Days after the *New* and *Full Moon*, the Courſe of it is *Regular* and Strong: And then you ſee there the like Phænomena with thoſe of the *Ocean* at *Bour-*

deaux. The Sea hath 2 *Fluxes* and *Refluxes* in 24 Hours, and every Day it Retardeth almoſt an Hour. But there are 9 or 10 *Changes* of the Courſe of the Water during the remaining 10 Days of *Inequality*; unleſs it blow hard, for then the Courſe changeth not above 6 or 7 times. I once ſtay'd on the Mill (which is under the Bridge) $1\frac{1}{2}$ *Hour*, and I ſaw the Courſe of the Water *Change Thrice*, though the Wind was pretty High; and the Wheels of the Mill turned as often diverſe ways. *M. de la Hogue*, a *Pariſian* Gentleman, being curious, ſtayed there almoſt a whole Day with a Janiſſary; and the *Moon* being near the *Full*, he obſerved the ſame thing that happens in the *Ocean*. But though he deſigned to ſtay there full 24 Hours during the *Irregular* Days, he was diſſwaded from it for fear of the *Turks*, that might take him for a *Spy*, and do him ſome miſchief.

The Water Riſeth not much above a Foot; and when it Riſeth it Runs into the Sea, and when it Sinks, it flows into the Channel going towards *Conſtantinople*.

The ſmall *Gulfs*, that are on the left ſide of the Port of *Negropont*, are fill'd when the Water Riſeth; and Emptied, running towards *Theſſalonica* or *Conſtantinople*, when it Deſcends. F. *Vabois* took notice of the ſame at *Conſtantinople*, *viz.* That the Waters of the *Black Sea*, that come from *Conſtantinople*, drive the *Euripus* in its Riſing towards the *Main Sea*, and that thereafter the Waters retire themſelves towards the ſame place again from whence they came. The ſame Perſon alſo obſerved, That that ſwelling of the *Euripus* which is *Irregular*, laſted not above a good quarter of an Hour, and the Sinking thereof, three good Quarters, tho' then the Water ran with more rapidity, and ſeemed to us to come away in thrice as great plenty, than when he ſaw it riſe. I know not whether this proceeded from the Wind, not being able to aſſure you, that this effect is ordinary.

Between the Aſcent and Deſcent there is a little Interval, wherein the Water ſeems to be at Reſt and Stagnating, ſo that if there be no Wind ſtirring it, bits of Wood and Straw lie ſtill upon the Water without Motion.

From what I have ſaid, 'tis not difficult to reconcile the Authors that have written ſo differently of the *Euripus*. For thoſe that have ſaid, that there is nothing in it but what is ſeen in the *Ocean*, that is, two *Fluxes* and *Refluxes* in 24 Hours, have only obſerved it in thoſe 20 Days of its *Regularity*. And the Ancients have not delivered a falſhood, when they ſay that there are 7 *Reciprocations* in one Day, becauſe that happens when the Winds trouble and retard the Courſe of the Water: And I do aſſure, by often reiterated Obſervations, that when 'tis ſtill Weather, the *Flux* and *Reflux* is made even to 9 or 10 *times* in a Natural Day.

Extraordinary Tides about the Orkney's; *Communicated by Sir* Rob. Moray. n. 98. p. 6139.

IX. In *Fairay-Sound* (betwixt the Iſles of *Fairay* and *Ætha* in *Orkney*) the Sea runneth North Eaſt, for the ſpace only of 3 Hours in *Flowing*, and 9 Hours South Weſt in *Ebbing*. This is the Courſe of the *Tide* only in the middle of the *Sound*, which is but one Mile broad.

Whilſt the Sea runneth from Weſt to Eaſt in *Flowing* through *Weſtra Firth* (which is 8 Miles in breadth) there are no greater *Surges*, than in any other place

place of the Sea; and in a Calm Day it is as ſmooth as any Lake, though there is conſtantly a great *Current*, in the *Flux* and *Reflux* of the Sea. Yet at the South Eaſt End of a little Iſland, on the *S. E.* ſide of *Weſtra*, and about a Mile from it, the Sea no ſooner begins to run Weſtward in *Ebbing*, but there beginneth a *Surge* to appear, which continually Encreaſeth until the *Ebb* be half ſpent, and afterwards it decreaſeth until it be *Low Water*; at which time there appeareth no ſuch thing. Eaſt and Weſt from this *great Surge*, there are ſome few *leſſer Surges* ſeen, which are *gradually leſs* toward the Eaſt and Weſt. I having occaſion to paſs that way, in a little Boat, when we had paſſed over the *Eaſtmoſt Surges*, and were beginning to aſcend the biggeſt, upon the 10th of *April*, at one of the Clock in the Afternoon, the *Surge* before us was ſo high, that it intercepted the ſight of the Sun, and ſome *deg.* of the Firmament above it. The *Surge* is about a quarter of a Mile in length. When there is any Wind, which occaſioneth the Breaking of the Tops of the *Surges*, there is no paſſing that way. The *Current* of the *Tide* is ſo ſtrong there, that there is no need of Sails or Oars, ſave only to direct the Boat as doth the Helm.

X. In that Tract of Iſles, on the *Weſt* of *Scotland*, called by the Inhabitants the *Long-Iſland*, as being about 100 Miles long from North to South, there is a multitude of ſmall Iſlands, ſituated in a Fretum or *Firth*, that paſſes between the Iſland of *Euſt* and the *Herris*; amongſt which there is one called *Berneray*, ſome three Miles long and more than a Mile broad, the length running from Eaſt to Weſt, as the *Firth* lies. At the Eaſt end of this Iſland, where I ſtaid ſome 16 or 17 Days, I obſerved a very ſtrange Reciprocation of the *Flux* and *Reflux* of the Sea, and heard of another no leſs remarkable.

Extraordinary Tides in the Weſt Iſles *of* Scotland; *by Sir* Rob. Moray. n. 4. p 53.

Upon the Weſt ſide of the *Long Iſland*, the *Tides* which came from the South Weſt, run along the Coaſt Northward; ſo that during the *ordinary Courſe* of the *Tides*, the *Flood* runs Eaſt in the *Firth*, where *Berneray* lies, and the *Ebb* Weſt. And thus the Sea *Ebbs* and *Flows* orderly, ſome 4 Days before the *Full Moon*, and *Change*, and as long after (the ordinary *Spring Tides* Riſing ſome 14 or 15 Foot upright, and all the reſt proportionably, as in other places) But afterwards, ſome four Days before the *Quarter Moons*, and as long after, there is conſtantly a great and ſingular *Variation*. For then, (a *Southerly Moon* making there the *Full Sea*) the Courſe of the *Tide* being Eaſtward when it begins to *flow*, which is about $9\frac{1}{2}$ of the Clock, not only continues ſo till about $3\frac{1}{2}$ in the Afternoon, that it be *High-water*, but after it begins to Ebb, the *Current* Runs on ſtill *Eaſtward*, during the whole *Ebb*; ſo that it runs *Eaſtward* 12 Hours together, that is, all Day long, from about $9\frac{1}{2}$ in the Morning, till about $9\frac{1}{2}$ at Night. But then, when the Night *Tide* begins to *Flow*, the *Current* Turns and runs *Weſtward* all Night, during both *Flood* and *Ebb*, for ſome 12 Hours more, as it did Eaſtward the Day before. And thus the *Reciprocations* continue, one *Flood* and *Ebb*, running 12 Hours *Eaſtward*, and other 12 Hours *Weſtward*, till four Days before the *New* and *Full Moon*; and then they reſume their ordinary *Regular Courſe* as before, Running Eaſt, during the 6 Hours of *Flood*; and Weſt, during the 6 of *Ebb*. And this I ob-

ſerved curiouſly, during my abode upon the place, which was in the Month of *Auguſt*, as I remember.

But the Gentleman, to whom the Iſland belongs at preſent, and diverſe of his Brothers and Friends, knowing and diſcreet Perſons, and expert in all ſuch parts of Sea-matters, did aſſure me, that whereas between the *Vernal* and *Autumnal Equinoxes*, that is, for 6 Months together, the Courſe of *Irregular Tides* about the *Quarter Moons*, is to run all Day, that is 12 Hours, as from about $9\frac{1}{2}$ to $9\frac{1}{2}$, $10\frac{1}{4}$ to $10\frac{1}{4}$, *&c.* *Eaſtward*, and all Night, that is 12 hours more, *Weſtward*; during the other 6 Months, from the *Autumnal* to the *Vernal Æquinox*, the *Current* runs all Day *Weſtward*, and all night *Eaſtward*.

At Tunqueen; *by Mr.* Fr. Davenport. n. 162. p. 677.

XI. 1. During my ſtay at *Batſha* having (without intermiſſion) Obſerv'd the *Daily Courſe* of the *Tides*, my Advice is, that upon the ſeveral following days of the *Moon*'s Age in every particular Month of the Year, no *Engliſh* Commander ſhould upon any occaſion whatſoever adventure over this *Bar*, unleſs he have a *Pilot* from the Shoar, who undertakes to bring him in; or that he hath only charge of ſome ſmall Bark or Junk, that draws no more than 8 or 9 foot Water.

In the $\left.\begin{matrix}1\\7\end{matrix}\right\}$ *Moons*, from the $\left\{\begin{matrix}3\\17\end{matrix}\right.$ to the $\left.\begin{matrix}7\\21\end{matrix}\right\}$ days of the *Moon's Age* Excluſively.

In the $\left.\begin{matrix}2\\8\end{matrix}\right\}$ *Moons*, from the $\left\{\begin{matrix}1\\14\end{matrix}\right.$ to the $\left.\begin{matrix}5\\18\end{matrix}\right\}$ days of the *Moon*'s *age* Excluſively,

and from the 27 to the 1*ſt* of the $\left.\begin{matrix}3\\9\end{matrix}\right\}$ *Moon's* Excluſively.

In the $\left.\begin{matrix}3\\9\end{matrix}\right\}$ *Moons*, from the $\left\{\begin{matrix}11\\25\end{matrix}\right.$ to the $\left.\begin{matrix}15\\29\end{matrix}\right\}$ days of the *Moon's Age* Excluſively.

In the $\left.\begin{matrix}4\\10\end{matrix}\right\}$ *Moons*, from the $\left\{\begin{matrix}9\\23\end{matrix}\right.$ to the $\left.\begin{matrix}13\\27\end{matrix}\right\}$ days of the *Moon's Age* Excluſively.

In the $\left.\begin{matrix}5\\11\end{matrix}\right\}$ *Moons*, from the $\left\{\begin{matrix}7\\21\end{matrix}\right.$ to the $\left.\begin{matrix}11\\25\end{matrix}\right\}$ days of the *Moon's Age* Excluſively.

In the $\left.\begin{matrix}6\\12\end{matrix}\right\}$ *Moons*, from the $\left\{\begin{matrix}5\\19\end{matrix}\right.$ to the $\left.\begin{matrix}9\\23\end{matrix}\right\}$ days of the *Moon's Age* Excluſively.

And excepting on theſe 6 days above mentioned in every reſpective *Moon*, he may ſafely adventure over the *Bar* any day, provided always that he miſtake not the time of the *Tide*, but come over at *Half Flood* or better, though he may take notice that the beſt *Tides* will be about 6 or 7 days after the Water's firſt beginning to *Increaſe*, and the Firſt days of the Water's *Increaſe* are,

In

In the 1 7	*Moons*, on the	5 19	days	of the *Moon's Age.*
In the 2 8	*Moons*, on the	3 16	days	
In the 3 9	*Moons*, on the	13 27	days	
In the 4 10	*Moons*, on the	11 25	days	
In the 5 11	*Moons*, on the	9 23	days	
In the 6 12	*Moons*, on the	7 21	days	

The *Bar* it ſelf being about a mile and a half in Length, and no where, except in it's firſt entrance, exceeding half a mile in Breadth, is very even, but yet affords conſiderably differing *Soundings* in the ſame Age and Time of the *Tides*, according to the ſeaſon of the Year, and, which ſeems to be ſomewhat ſtrange, hath the *Higheſt Tides* in the *Northerly Monſoon*, as I have been informed by thoſe who are ſeemingly beſt able to give an account thereof; and I muſt needs ſay, that the Trial *I* made on the *Bar* in *July* 1678 did accord with what *I* underſtood from ſeveral of the Fiſher men, and others as to that *Month*, which induced me to enter this Information, that coming over at *half Flood* (except on the days aforementioned as Dangerous to come over in) there will be found according to the Age of the *Tides*,

In the 3 4 5	*Moons*,	from 16 to 21	feet Water.
In the 6 7 8	*Moons*,	from 19 to 24	feet;
In the 9 10 11	*Moons*,	from 21 to 27	feet;
In the 12 1 2	*Moons*,	from 17 to 22	feet.

Always the *Higher* the *Flood* the *Lower* the *Ebb*, ſo that according to the Strength of the *Tides* at *Low-Water* the *Soundings* are from 6 to 13 feet.

On the *firſt* and *ſecond* days of the Water's *Increaſe* the *Influxes* are very ſmall and uncertain, but afterwards the *Tides* for 13 days are Conſtant in their Courſe, one *Flood* and one *Ebbing* being compleated in 24 hours time, equally ſharing the ſpace of a *Lunar* Circuition of the Earth between them, and every *Flood* beginning neareſt ¾ of an hour later than the Precedent *Flood*, and

alſo

alſo conſiderably Increaſing in the Height of the *Tide* every day from the *Third* unto the *6th* and *7th* days of the Waters Age, on which two days the *Flood* runs very High: But on the 8*th* day (which may be accounted the laſt of the *Spring Tides*) the Waters begin gradually to *Decreaſe* again, retaining the ſame orderly difference of time in each *Tide*, until the next following *Firſt* day of the Water's *Increaſe*, when during two days unſettledneſs, there is a Shifting of the *Tides* in reſpect of the beginning of the *Flood* and *Ebb*, after which ſaid Shifting, a Conſtancy in their Inverted Courſe, is again retained in the above mentioned order for 13 days following; as for Example,

On the 25 and 26 days of the 4*th Moon* (4*th* and 5*th* of *June* 1678, ☽ in the latter end of *Aries*) being the *Firſt* days of the Waters *Increaſe*, the *Influxes* were very ſmall, (there happening on the 26 a falling back of the *Tides* about 13 hours): But from the 27*th* (*June* 6. which was the *Third* day of the Water's *Increaſe* after the *Laſt Quarter*, unto the 9 day of the 5*th Moon's Age* (*June* 18. 1678. ☽ in ♎ 20.) I noted a very Conſtant Courſe in the *Tides*, every *Flood* Beginning with the *Riſing* of the *Moon* and Ending at it's *Setting* the following *Ebb* in like manner continuing during the time of the *Moon*'s Abſence from this Hemiſphere. But on the ſaid 9*th* day of the 5*th Moon's Age* (*June* 18. 1678) being the *Firſt* day of the Water's *Increaſe*, their motion was ſcarcely perceptible; on the 10 day there was another falling back of the *Tides* neareſt 13 hours, and on the 11*th* day, (which was the 3*d* day of the Water's *Increaſe*, after the *Firſt Quarter* of the *Moon's Age*) the Flood having as I ſaid) ſhifted the preceeding day, took its turn to Begin at the *Moon's Setting* and End at its *Riſing*, and accordingly the *Tides* ſucceſſively following aſſumed and kept a conſtant Regularity, the *Tides* being at *Higheſt* the 16*th* of the *Moon*, (1678. *June* 24. ☾ in middle of ♑) which was the 7*th* of the Water's Age, until the 23 of the ſaid *Moon's Age* (*July* 1. 1678.) on which (being the *Firſt* day of the Water's *Increaſe*) the *Influx* was again ſcarcely diſcernable for its ſmalneſs.

N. B. This *Bar* of *Tunking* is about 110 *Deg.* of *Longitude* to the Eaſt of *London*, and in the *Lat.* 20°. 50'.

On the 24*th* Day the *Tides* fall back (as I had found it twice before to have done on the ſame days of the Water's Age,) neareſt 13 hours, by which means the *Flood* on the 25*th* day (which was the 3*d* day of the Water's *Increaſe* after the *Laſt Quarter* of the *Moon*) now again commenced with the *Riſing Moon*, whereby it hath fallen out always to be *High Water* between Noon and the following Midnight every day during my ſtay here. (☾ *Laſt Quarter* 22 days, ☾ *Firſt Quarter* 8 days)

So that it may paſs into a Corollary, *viz.* In the 4*th* 5*th* and 6*th* Changes of the *Moon* from the 3*d* day of the Water's Age after the *Laſt Quarter*, to the 3d day of the Water's Age after the *Firſt Quarter* of the following *Moon*, the Water begins to *Flow* when the *Moon Riſeth*, and to *Ebb* again when it *Setteth* in the Horizon, and the contrary to the *third* day of their Age after the *Laſt Quarter*, excluding always their Motion on the two Firſt days of the Waters *Increaſe*, becauſe of its ſmalneſs and Uncertainty.

I am informed by the Inhabitants hereabouts, that this may hold for a Rule from the 2*d* to the end of the 7*th Moon*, and that the Converſe thereof holds true in the other 6 *Months* of the Year, *viz.* from the 8*th* to the end of the *Firſt Moon*: According to which the *Tides* will fall out to be at the Higheſt in the *Evening* for 6 *Months* ſucceſſively, and the other half Year in the *Morning*; that is to ſay between *Midnight* and the following *Noons*. And though I cannot aver the truth of it, yet I find that the *Tide* laſt Year in the 11*th Moon*, which occaſionally upon the Ship *Eagle's* departure hence *I* took ſome notice of, did fall out not diſagreeing with what they affirm: And *I* am yet the rather induced to believe that in every Annual Revolution, there may be ſuch a conſtancy in this different motion of the *Tide* appropriated to each Moiety of the Year, becauſe that during my ——— days ſtay at *Batſha*, *I* have found the Predictions of the Natives Confirmed by my own Obſervations of the *Tides* falling out to be High Water always between *Noon* and the ſucceeding *Midnight*, occaſioned by the aforeſaid Falling-back at the end of 15 days; ſo that on every *Third* day of the Water's *Increaſe*, the *Flood* Begins at the hour whereon the day before it Ended.

To prevent miſtakes in the accompt of the *Moons*, it may be ſufficient to inform thoſe who uſe this *Port*, that the *Firſt Change* of the *Moon* after the 15*th* day of *January Old ſtile*, is reckoned for the *Beginning* of the *Year*, and that *Moon* being accompted the *Firſt*, the reſt follow in order until the Expiration of the 12*th* which compleats their Year, except only in their *Leap Years*, and then they have 13 *Moons*, taking in one extraordinary to make up the deficiency of the *Moon's Epact* in their accompt, in which Years the *Firſt* day of their *New Years Moon* falls out before the ſaid 15 day of *January*, as it did this Year 1678 upon the 12 being *Leap Year* with them; ſo that they reckoned *Two Months* for *One* this Year, (that is to ſay the 2*d* and 3*d Moons*, after their *New Years Day*) they called 2*d Moons*, for otherways this preſent *Moon* which Changed in *July* (the 8*th*) would have been the 7*th*, whereas now they Count it but the 6*th Moon*, and accordingly do the *Tides* fall out. But this *Leap Year* being paſt, the *Firſt Moon* in the Year muſt be reckoned to begin on the *Change* next following the 15th of *January*, and all the other *Changes* counted ſucceſſively as before ſaid until the Intervention of another *Leap-Year*.

2. The Effect of the *Moon* upon the Waters, in the production of the *Tides* in this *Port* of *Tunking*, is the more wonderful and ſurpriſing, in that it ſeems different in all its circumſtances from the General Rule, whereby the *Motion* of the *Sea* is regulated in all other parts of the World *I* have yet heard of. For *firſt*, each *Flux* is of about 12 hours Duration, and its correſpondent *Reflux*, as long; ſo that there is but one *High Water* in 24 hours. Then there are in each *Month*, two *Intermiſſions* of the *Tides*, about 14 days aſunder, when there is no ſenſible *Flood* or Riſing of the Waters to be obſerved; but the Sea is in a manner *Stagnant*. *Thirdly*, that the *Increaſe* of the Water has its 14 days Period, between the aforeſaid *Intermiſſions*: And that at 7 days end makes the *Higheſt Tides*, from which time the Water again gradually Abates, and the *Flood* is Weaker till it comes to a *Stagnation*; both *Increaſe* and *Decreaſe* obſerving

A Theory *of the* Tides *at* Tonqueen; *by Mr.* Edm. Halley. *ib. p.* 685.

ving the ſame Rule, in being exceeding Slow in their Beginning and End, and Swift in the Middle. *Laſtly*, (and which is moſt Odd) the *Riſing Moon* in the one half of each Month, makes *High Water*, and the *Setting Moon* in the other half. Thoſe particulars conſider'd together with the *Tables*, ſhewing the Days of the *Water*'s *ſtagnation* in each *Month*, gave me a Light into the Secret of this ſtrange Appearance, ſo as to be able to bring the hitherto Unaccountable Irregularity of theſe *Tides* to a Certain Rule.

And Firſt it appears by the Latter of the two Tables, that the *Intermiſſions* of the *Tides* happen nearly upon thoſe Days, that the Moon enters the Signs of *Aries* and *Libra*; or paſſes the *Æquinoctial*; which divides the *Moon*'s Courſe nearly into two equal parts, as well as the *Sun*'s, and from hence it follows that the *Tropical Moons* in ♋ and ♑, are thoſe which occaſion the Greateſt *Flux* and *Reflux*; and for the Rule of the Change of the Time of *High Water*, which Mr. *Davenport* calls a *Falling Back* of the *Tides*, the Example he hath given us, let us know that the ☾ in *Northern Signs* brings in the *Flood*, whilſt ſhe is above the Horizon, ſo as to make *High Water* at her *Setting*; and on the contrary, that whilſt ſhe is in *Southern Signs*, it *flows* all the Time the *Moon* is below the Horizon, and ſo make *High Water* at her *Riſing*. But it is to be obſerved that though the *Moon* paſs ſwiftly from *South* to *North*, when ſhe is in or near ♈, and from *North* to *South* in or near *Libra*, yet the Motion of the *Sea* which is the Cauſe of this *Tide*, is ſcarce diſcernable for 3 or 4 Days, when the *Moon* paſſes the ſaid *Æquinoctial Points*; whence it appears that though the *Declination* of ☾, or her diſtance from the *Æquinoctial*, be that whereby theſe *Tides* are Regulated, yet the *Increaſe* and *Decreaſe* of the Water is by no means proportionable to that of the *Declination* of ☾; that changing ſwiftly where the *Increaſe* of the Water is obſerved to be moſt ſlow. It ſeems therefore, and I propoſe it as a probable Conjecture, that the *Increaſe* of the Waters ſhould be always proportionate to the *Verſed Sines* of the double Diſtances of the *Moon* from the *Æquinoctial Points*; Upon which *Hypotheſis*, *Fig.* 58. will give an elegant Synopſis of the whole Matter. Let *A B*, be the bottom of the *Bar* of *Tunking*; *C D*, a perpendicular thereto, whereon to meaſure the ſeveral *Depths* of the *Water*; *C* ♈, *C* ♎, the mean *Depth*, which is that whereat the Water is *ſtagnant* upon the *Moon*'s being upon the *Æquinoctial Points*; being commonly about 15 Feet: *C* ♋ *Occid.* the *High Water Mark*, when the *Moon* is in ♋ or ♑, being about 24 Foot. *C* ♑, *occid.* the Height of the *Low Water Mark* when the *Moon* is in ♋ or ♑, being about 6 Foot; ſo that the greateſt Riſe of the Water on the *Tropical Moons* will be about 18 Foot; then dividing ♈ ♋, and ♎ ♑, into two equal parts in *E*, *F*, on thoſe two points, as Centers, deſcribe the two Circles, each of whoſe Radii are four Feet and a half, which being kept between the Compaſſes, naturally divide the ſaid Circles in the Points ♉, ♊; ♋, ♌, *&c.* through the which Points if you draw Lines parallel to the Baſe *A B*, they ſhall cut the Perpendicular *C D*, in the Heights of the *High* and *Low* Water *Marks*, which will be at the entrance of the *Moon* into the ſaid *Signs*. So the greateſt *Depth* of the *High Water*, when the *Moon* enters ♉, ♍, ♌, ♐, is but 17¼ Feet, and the leaſt at *Low Water* 12¾ Feet: But when ſhe enters ♊, ♎, ♑, ♒, the *High*

Water

Water depth is 21¾ Feet, the *Low Water* is 8¼ Feet; as appears by the *Figure*. And this *Hypotheſis* not only agrees with all that Mr. *Davenport* hath obſerved himſelf, or collected from the *Natives*, but hath been found to hold true ſince in the Year 1682, by the Ingenious Captain *Knox*, in his Voyage to this *Port*; ſo that there is no room to doubt of the Truth thereof. 1. By this Method may the *Time* and *Height* of the *Tides* be with ſufficient Certainty computed: But to Philoſophize thereon, and to attempt to aſſign a Reaſon, why the *Moon* ſhould in ſo particular a manner Influence the Waters in this One Place, is a Task too hard for my undertaking, eſpecially when I conſider how little we have been able to eſtabliſh a Genuine and Satisfactory *Theory* of the *Tides*, found upon our own *Coaſts*, of which we have had ſo long Experience.

XII. Mr. *Boyle* having recommended this matter, among others, to a learned Phyſitian that was ſailing into *America*, and furniſhed him with a ſmall *Hydroſtatical Inſtrument*, to obſerve from time to time the differences of *Gravity* he might meet with, This Account was returned him, that he found by the *Glaſs*, the *Sea-water* to Increaſe in Weight the nearer he came to the *Line*, till he arrived at a certain *Degree* of *Latitude*; as he remembers, it was about the 30*th*, after which the Water ſeemed to retain the ſame *ſpecifick Gravity*, till he came to the *Barbadoes*, or *Jamaica*.

The differing Gravities *of* Sea-Water *according to the Climates, by* ----- n. 18. p. 315.

XIII. M. *Hauton* hath now declared his Secret of making *Sea-Water ſweet*. It conſiſts *firſt* in *Precipitation* made with the *Oil* of *Tartar*, which he knows to draw with ſmall Charges. *Next*, he *Diſtills* the *Sea Water*; in which the Furnace taketh up but little room, and is ſo made, that with a very little Wood or Coal he can *Diſtill* 24 *(French) Pots* of Water in a Day; for the Cooling of which he hath this new *Invention*, that inſtead of making the *Worm* paſs through a Veſſel full of Water (as is the ordinary Practice) he maketh it paſs through one Hole, made on purpoſe out of the Ship, and to enter in again through another: So that the Water of the Sea performeth the *Cooling* part; by which means he ſaveth the Room, which the common *Refrigerium* would take up; as alſo the Labour of Changing the Water when the *Worm* hath *Heated* it. But then *Thirdly*, he joins to the two precedent Operations *Filtration*, thereby perfectly to Correct the Malignity of the Water. This *Filtration* is made hy means of a peculiar Earth, which he mixeth and ſtirs with the Diſtilled Water, and at length ſuffers to ſettle at the bottom.

A way to make Sea-Water ſweet; *by M.* Hauton. n. 67. p. 2048, 2050.

He maintains, that his *Diſtilled Sea-water* is altogether ſalubrious. He proveth it *firſt* from Experience, it having been given to Men and Beaſts, without any ill effect at all upon them. *Secondly*, From Reaſon, grounded on this, that that peculiar Earth being mixed with the *Diſtill'd Water*, blunts the Points of the *Volatile Spirits* of the *Salt*, and ſerveth them for Sheaths, if I may ſo ſpeak, taking away their force and *Maligne* ſharpneſs.

XIV. It ſeems Probable to me, that the *Sea-water* was the only Element Created at the *Beginning*, before any *Animal* or *Vegetable* was Created, or the *Sun* it ſelf. But upon the Creation of theſe, the *Freſh Water* had its Riſe Acci-

Sea Water *made* Freſh; *by Dr.* Mart. Liſter. n. 156. p. 493. *De Font. Med.* Angl.

dentally, becauſe it owes its being in great part (as I have elſewhere ſhewn) to the *Vapours* of *Plants*, and the *Breath* of *Animals*; and the *Exhalations* raiſed by the *Sun*. Now that the *Sea-Water* is made *Freſh* by the *Breath* of *Plants* growing in it, I thus demonſtrated: I took a long *Glaſs Body*, and having fill'd it pretty full with *Sea Water*, taken up at *Scarborough*, I put therein common *Sea Weed* (*Alga Marina*) freſh and new gathered, ſome with the Roots Naked, and ſome growing on and adhering to Stones: The *Glaſs Body* being full, I put thereon a *Head* with a *Beek*, and adapted a *Receiver* thereto, all without any *Lute* or cloſing the Joints; from theſe *Plants* did *diſtil* daily (though in a ſmall Quantity) a *Freſh*, very *Sweet*, and *Potable Water*, which hath no *Empegreuma*, or unpleaſant Taſt, as all thoſe *Diſtill'd* by *Fire* neceſſarily have

This I take to be the moſt *Natural*, moſt Eaſie, and moſt ſafe way of having *ſweet Water* from the *Sea*, and which may be of great Uſe, even to ſupply the Neceſſity of *Navigators*. And I do not doubt but there may be found other *Plants* growing in or near the *Sea*, which would yield *Freſh Water* in much greater Quantities.

Wells of Freſh Water *near the* Sea *at* Bermudas; *by Mr.* Rich. Norwood. n. 30. p. 566.

XV. We digg *Wells* of *Freſh Water* ſometimes within 20 Yards of the *Sea*, or leſs, which Riſe and Fall upon the *Flood* and *Ebb*, as the Sea doth; and ſo do moſt of the *Wells* in the Country, though further up (as I am inform'd): Whereſoever they digg *Wells* here, they dig till they come almoſt to a Level with the Superficies of the *Sea*, and then they find either *Freſh Water* or *Salt*. If it be *Freſh*, yet if they dig two or three Foot deeper, or often leſs, they come to *Salt Water*. If it be a Sandy Ground, or a Sandy Crumbling Stone, that the *Water ſoaks* gently through, they find uſually *Freſh Water*; but if they be hard *Limeſtone* Rocks, which the Water cannot *ſoak* through, but paſſeth in Chinks or Cleſts between them, the Water is *Salt* or *Brackiſh*.

To Examine the Freſhneſs *of Water*; *by Mr.* Boyle. n. 197. p. 627.

XVI. 1 When I remembred and conſider'd, that (as I have found by various Trials) diverſe Metalline, and other Mineral Solutions, could be readily *Precipitated*, not only by the *Spirit* of *Salt*, but by *Crude Salt*, whether Dry or *Diſſolved* 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 concealed in *Diſtill'd Water*, or any other propos'd to be Examin'd. To this End I employ'd *ſeveral* Drugs, and thoſe not all prepar'd by *one Menſtruum*. And tho' *two* or *three* of my other Trials had Succeſſes, that I diſliked not when I made them, yet that which at length I pitched 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.

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 Common Dry *Salt*: Into a convenient Quantity, for Example, *two* or *three Spoonfuls*, of this thus Impregnated Liquor, I let fall a fit proportion, for Inſtance 4 or 5 *drops* of a very ſtrong and well Filtrated *Solution* of

well

well-refined *Silver*, Diſſolved 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 appeared a *Whitiſh* Cloud, which, though but ſlowly, Deſcended to the bottom, and ſettled there in a White *Precipitate*. And 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*.

But I Obſerved, 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 happened to appear (for 'tis not abſolutely neceſſary it ſhould) a little Cloudineſs in this *Factitious Liquor*, it was both ſlowlier produced, and much leſs, than that which appear'd in the *Impregnated Water*.

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 allowed to diffuſe it ſelf through a great Quantity of Water, the *Saline* parts are thereby ſo *Diluted* and Weakned that they are no Longer able to ſuſtain the *Mineral Corpuſcles*, they kept ſwimming before, but make with them, and the Water, a confuſed 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-deſervedly) call *Mercurius Vitæ*. 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* (or *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 employed inſtead of that *Silver*, either *Quick-ſilver* Diſſolved 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 *Patentees Water*, compar'd with thoſe it had upon Water Impregnated with a *thouſandth* part of *Salt*, and upon divers Common *Undiſtilled Waters*.

But to return; The Uſefulneſs of this Experiment is not to be Eſtimated 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 Water's, *cæteris paribus*, are the beſt, as well for the Wholeſomeneſs, as divers Oeconomical Uſes, as *Waſhing*, *Brewing &c.* that are freeſt 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 Soyle they have Travers'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 are ordinarily Drunk, even by conſiderable Perſons. And if once you have attentively marked, what change 4 or 5 *drops*, for inſtance, of our Diſcovering Liquor will make in *two* or *three*, or ſome other ſmall determinate Number, of *Spoonfulls* (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 propoſed to him, have a Greater, an Equal, or a Leſſer degree of *Freſhneſs* or *Saltneſs*, 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 *Saltneſs* 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 Human 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 *Saltneſs* 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 quenched in *Pump-Water*, from that which the like Extinction in *Spring-Water*, or *River-Water* would give them.

I might add on this occaſion, That, whereas Experience has informed ſeveral Perſons, who have conſulted it, that divers *Medicinal Waters*, that are preſumed to own their Virtues 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

copiously or no. This I have tried upon more than one of our *English Mineral Waters*, and thereby found in a trice, that one that is reputed of another Nature, contained pretty store of *Saline* matter; and that another (which is still for ought I have learned, of an unexamin'd and unknown Nature) is *Impregnated* with a surprising Plenty of *Saltish* Substance. But how and with what Cautions our *Precipitant*, may be most usefully employ'd, about the *Examen* of *Medicinal* and other *Mineral Waters*, belongs not to this Place. 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 *Human Blood*, and other Bodies belonging to what the *Chymists* call the *Animal Kingdom*.

I have not, for certain Reasons, ascribed 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 retained 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 *Distill'd 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 *Salt*, being dispersed through 2000, and another time that being *Dissolved* in 3000 times it's Weight of the same kind of Liquor, so inconsiderable a proportion of *Salt* was plainly discoverable by our *Precipitant*.

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 Unwholesome; yet *I* shall answer more directly to the Objection, by saying, that to manifest it's not being well grounded, *I* took above 1000 *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 shaked it into the Water, *I* let fall into a Portion of this unequally composed Mixture, some *drops* of our *Solution* of *Silver*, which presently began to *Precipitate* in a Whitish Form; insomuch that, for ought appeared to the Eye, this Trial succeeded better, than if the *Water* had been Impregnated with but 1000*th 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 2000 *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.

much more. So that *one Grain* of *Spirit* of *Salt* had a manifeſt Operation though not quite ſo conſpicuous as the former, upon above 3000 *Grains* of *Water*, whoſe immunity from *Common Salt* we tryed apart. 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 9 *Grains* Weight.

The like Trial *I* made by ſubſtituting above 1000 *Grains* of *Rain water*, in the Room of the like Quantity of *Diſtill'd water*.

It is the Opinion of ſome *Seamen*, 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 ſupplyed with as much *Saltneſs*, whether *Corporeal* or *Spirituous*, as ſhall be required, 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 account of the *Sun's Heat*, or that of the *Subterraneal 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-Armoniack*; upon which account *I* made a Trial that inform'd me, that if 5 or 6 *Drops* of Strong *Spirit* of *Urine* (whoſe drops *I* obſerv'd to be but ſmall) were ſhaken into 1000 *Grains* at Leaſt of *Diſtill'd* or *Rain-water*, impregnated but with *one* of *Salt*, our *Precipitant* would make a Diſcovery of ſome *Saltiſhneſs* in the Liquor. And it were neither to be admired nor cenſured, if the *Patentees water* ſhould ſometimes ſhew 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* are generally allow'd to be freely Potable, but even thoſe that Nature herſelf *Diſtills* are not always quite devoid of *Saltneſs*.

For *I* have found *Rain Water*, that *I* caus'd carefully to be 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 Reſidence, which with a little of our *Solution* afforded a far more ſuddenly made and copious *Precipitate*, than had been produc'd with the like quantity 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 Curioſity s 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*.

It has been ſurmiſed by ſome, that even a moderate Action of the *Fire* upon *Water*, will make it *Brackiſh* and *Putrifie*. But that the *Patentees Water* is not *Brackiſh*, appears by the foregoing Trials; and that it is more free from Saltneſs, than moſt of the Waters Men do without ſcruple Drink: And that it

may

may keep ſweet longer than is neceſſary in a Ship, that can from tim to time, within a few Days, ſupply it ſelf with *Freſh* out of the *Sea*, may be gathered from theſe two things; The *Firſt* is, That I cauſed a Pint of it to be *Hermetically ſeal'd* in a Vial, whereof I left, by gueſs, about a third part empty, and having about *ſix Weeks* after, held this Veſſel againſt the Light, I found the Water to be Clear and Limpid; tho' *I* did not judge it had depoſited ſo much as the tenth part of a *Grain* of *Feculency*. And having opened 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* is, that *I* have kept a Bottle of it in the ſame unſtopt Veſſel near 8 *Months*, and yet it continues *Sweet* and well *Condition'd*. And if that which is call'd *Crudity* in *Water* does conſiſt, (as probably it oftentimes does) in certain groſs Particles that are mingled with the purely Aqueous ones, it is 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 amongſt 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 *unwholſomeneſs* of diverſe Waters, proceed, not only, or perhaps not ſo much, from bare *Crudity* as from a great quantity of groſſer Particles, that are not eaſie 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 concealed 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*.

Perhaps it was upon ſome ſuch Reaſons, that the laſt *Great D.* of *Tuſcany*, when he drank *Water*, preferr'd for *wholſomeneſs*, 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 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*, more frequently by reaſon of *Crudity*, are not only unfit, or (at beſt) leſs fit for divers Oeconomical Uſes, as *Waſhing*, *Boiling* of ſome Meats, *&c.* But are very *Unwholſome*; ſometime to a Degree, that makes them Miſchievous to whole Communities, and perhaps Nations. I remember I have ſeen a notable Inſtance of this in thoſe huge and unſightly *Tumors* about the Throat, which are obſerved by Travellers to be exceeding common, among thoſe that inhabit the lower Tracts of Ground that lie between

the

the *Rhætian*, *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 *Portugueze* 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 of them "free. Nay, which is far more, where he ſpeaks of the *African* Kingdom (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 25 they begin to be *Dropſical*, ſo that 'tis a great wonder if "any among them Live above 40 Years.

Theſe People might (probably) 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 ſeperated, and its *Brackiſhneſs* deſtroy'd by the *Fire*, as its Action is regulated and help'd by their Invention.

The Experiment mention'd in this Paper was try'd at a *Meeting* of the *R. S. Feb.* 17. $169\frac{1}{2}$. by Dr. *Sloane*, 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.

By Dr. Hook. *ib. p.* 639.

2. At a *Meeting* of the *R. S. March* 2. $169\frac{1}{2}$, Dr. *Hook* read a Lecture concerning a 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 produced the Apparatus which he had prepared to Exhibit the ſame before the Perſons then preſent.

The Method of doing which Operation was by means of a large *Poiſe* of *Glaſs*, ſomewhat of the ſhape of a *Bolt-head*, the *Ball* of which, *B*, was about 3 *Inches* Diameter, but the *Stem* or Neck thereof, *C C*, was not above $\frac{1}{24}$ 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*, *A*, which was very Tender, and being not overcharg'd 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, covered with the Water to a certain Mark or Diviſion made on the ſmall Neck, at *D*, it was ſo counterpoiſed by ſome ſmall Weights put into the oppoſite Scale of the Ballance, *F*. Then the weight of the *Water* contained in the Ciſtern or Veſſel, *E E*, into which the Poiſe was Immerſed (being firſt known) a 2000*th* part of its 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

Neck Emerged out of the Water ſo *Seaſoned*, than did before the 2000*th* 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 diverſe Alterations much more curious, namely to the 1760000th part of its *Weight*.

XVII. There is an Odd *Spring* in the Dioceſs of *Paderborn* in *Weſtphalia*, which loſes it ſelf *twice* in 24 *Hours*; coming always after 6 *Hours* back again with a great Noiſe, and ſo forcibly as to drive 3 *Mills* not far from its *Source*. The Inhabitants call it the *Bolderborn*, as if you ſhould ſay the *Boyſterous Spring*.

An Ebbing Well *in* Weſtphalia; *by*..... n. 7. p. 127.

XVIII. *Lay-Well* (near *Torbay*) is about 6 *Foot* long, and 5 *Foot* broad, and near 6 *Inches* deep, which *Ebbs* and *Flows* very often *every Hour*, viſibly enough. 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*, (in *July* 1693.) I think it *flowed* ſomewhat quicker than I found it did on my *ſecond* Obſervation, toward the End of *Auguſt* following; 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 performed its *Flux* and *Reflux* in little more then a *Minutes* time, yet *I* obſerved it would ſtand at its loweſt *Ebb* ſometimes two or three *Minutes*; ſo that it *Ebbed* and *Flowed* by my Watch about ſixteen times in an *Hour*, and ſome times *I* have been told, 20. 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* and found them between 5 and 6 *Inches* diſtant; not of Perpendicular Depth, but as it ſpread it ſelf 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*.

An Ebbing Well *near* Torbay; *by* Dr. Will. Oliver. n. 204. p. 909, 910.

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, in ſo much that from *Brixam* to the top of the Hill is about a *Mile* and *half*; and 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*.

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; they alſo uſe it in *Fevers* as their ordinary *Diet-drink* which ſucceeds mighty well.

The Zirchnitzer Sea *in* Carniola *described; by Dr.* Brown. n. 54. p. 1083. n. 109. p. 194.

XIX. 1. Having croſs'd the River *Dravus*, and paſſed Mount *Luibel* in the *Carnick Alpes*, by that noble Paſſage cut through the Rocks, and Vaulted like that of *Pauſilype* near *Naples*, *I* went to *Brounizza*, two Leagues from whence, and beyond the Hills, is the *Zirchnitzer Sea*, receiving that Name from *Zirchnitz*, a Town of about 300 Houſes.

This *Lake* is near two German Miles long, and one broad. On the South ſide thereof lies a great Forreſt, and on the North ſide the Country is flat; but the whole Valley is encompaſſed with High Hills, at ſome little diſtance from it. But *I* ſaw no *Snow* upon them, tho' upon other Mountains in the Country, *I* obſerved *Snow* in *June*. Upon Hills on the ſide of Great Lakes, the *Snow* lies not ſo long as upon Hills more diſtant.

This *Lake* is well fill'd with Water for the greateſt part of the Year; but in the Month of *June* it ſinketh under ground, not only by percolation or falling through the Pores of the Earth, but retireth under ground through many great *Holes* at the bottom of it; the little, if any, that remains in the Hilly or Rocky part, is Evaporated: And in the Month of *September* it *Returns* by the ſame, and in a ſhort time covers the Tract of Earth again, but *I* cannot determine the ſpace of time to a Day. This *Return* and *Aſcent* is ſo ſpeedy, and it mounteth at the *Holes* with ſuch violence, that it ſprings out of the Ground to the height of a Pike. The Water that *ſpouts* ſeems ſomewhat Clear in the Air, but being ſpread about, looks as formerly in the *Lake*.

The *Holes* generally are ſtony, not in ſoft or looſe Earth; yet in one or two places the Earth hath been known to ſink, and fall in, particularly near a Village call'd *Sea-dorf*. They are of different largeneſs and Figure; ſome Perpendicular, at the beginning; and then Oblique; others oblique at firſt; ſcarce two exactly alike. Such *Holes I* have ſeen in other parts of *Carniola* and in other Countries alſo. We have a Hole called *Elden hole*, not made by Art, but naturally, in the Mountains in the *Peak-Country* of *Derbyſhire*, above 80 *Fathoms* deep. The great *Holes* are the ſame every Year; but poſſibly part of the Water may ſometimes find or make new Paſſages through the Crevices and Cribrous parts of the Field.

When the Water goeth firſt away, they ſee it in theſe Holes for a while, but afterwards it deſcends lower out of their ſight.

This piece of ground in the time of the *Retirement* and Abſence of the *Water*, is not Unfruitful, but by a ſpeedy and plentiful production of *Graſs*, yieldeth not only a preſent Suſtenance for the Beaſts of the Field, but a good Proviſion of Hay for the Cattle in Winter.

The *Lake* is not only thus filled with *Water*, but every year well ſtored with *Fiſh*. The Prince of *Eckenberg* is Lord of it, and of much Country thereabout: But upon the *Retiring* of the *Water* all have liberty to *fiſh*; and the *Fiſhermen*, ſtanding up to the waſte at the *Holes* before mentioned, intercept the paſſage of the Fiſh, and take a very great number of them, which otherwiſe would be ſecure for ſome Months under the Earth, and not fail to return in *September*. But at that time the Prince will not permit them to make any ſuch attempt.

The *Fiſh* of this *Lake* have a cloſer Habitation than thoſe of any other I know; for they paſs ſome Months under the *Earth*, and a good part of the Winter under *Ice*. I could not learn that there were any *Otters* in this *Lake*,

(which

which otherwiſe muſt probably have taken the ſame courſe with the *Fiſh*;) not that there were any remarkable Extraneous ſubſtances, any Vegetables, or unknown Fiſhes brought up by the Water, but thoſe which come up are of the ſame kind with thoſe which Deſcend.

The Bottom of the *Lake* is not even, nor near about the ſame Depth, but ſometimes two foot, and then ſuddenly twenty yards deep. And becauſe the *Fiſh* haunt the deep places more then the Shallows; they have given Names to the ſeven chiefeſt Cavities or Valleys in the *Lake*.

The Water is not always at the ſame Height, but ſomewhat differing according unto Rains, Snows, or Drought; and they are ſenſible of its height by the tops of the Hills in it, and its ſpeading towards *Zirchnitz*; but it alters not very much till it begins to go away.

No *River* enters it, but only inconſiderable *Rivolets* on the South and Eaſt-ſide; nor hath it any other diſcharge known, but by the *Holes*.

There are alſo diverſe *Caverns* and deep places in the Country of *Carniola* even where there is no Water.

Between *Sea-dorf* and *Nider-dorf*, the Ground ſometimes *ſinks* in ſeveral places upon the ſudden Retiring of the *Lake*; and the aforeſaid Prince of *Eckenberg* was once ſo curious, as to deſcend into one *Hole*, through which he paſſed under a Hill, and came out on the other ſide; as I was informed by M. *Andreas Wiſer*, the preſent Judge of *Zirchnitz*, and alſo by *Johannes Wiſer*, who hath formerly held the ſame place.

The Country is High about the *Lake*, but the *Lake* is not High in reſpect of the Country near it, but low.

The *Snow* falls not till after the *Lake* is *Return'd*.

This *Lake* probably may hold dependance of, and communication with ſome ſubterraneous great *Lake*, or Magazine of Water belonging to theſe *Hilly Regions*, which when full, and running over, may vent it ſelf with Force and Plenty into this Field, and when ſcant of Water, Abſorb and Drink in the ſame again; the Water of the *Lake* returning but from whence it came, having no *River* running out of it, whereby to be diſcharged.

I went alſo to a noted Stone, commonly called the *Fiſhers-Stone*, which hath ſomewhat of the uſe of the *Nileſcope-Pillar* at *Grand Cairo*. It is a large Stone upon one of the Hills, or elevated parts of the Field, which whenſoever it appears above Water, the Fiſher-men being upon the *Lake*, take notice of it, and know thereby, that in a few Days the Water will *Retire* under ground. For after the *filling* of the *Lake* in *September*, the Water never Decreaſeth ſo low again, as to let the *Fiſherſtone* appear, till it begins to *Retire* under ground.

2. This *Lake* was by the Antients call'd *Lugea Palus*, by the Moderns *Lacus Lugeus*, tho' at preſent its Latin Name be *Lacus Cirknicenſis*, in High-dutch *Zirchniſerſee*, and in our *Carniolan* Tongue *Zirkniſco Jeſero*. Why it was ſo called of old, is unknown or very uncertain; but the Original of the preſent Name is more ſure, it being derived from the adjacent Town of *Cirknits*; and that had its Name from a Chappel of the *Virgin Mary*, which at firſt ſtood alone, but now the Town is built round it. This Chappel was no great Edifice at firſt, and therefore was called the *little Chappel*, which in the Language

By M. J. Weichard Valvaſor. n. 191. p. 411.

of the Country is *Zirkviza*; whence the Lake was named *Zirkvisko Jeſero*, or the *Chappel Lake*, but now by abuſe *u* being changed into *n Zirknisko Jeſero*.

It is diſtant from the Capital City of the Province *Labac*, ſix German Miles; it is a good German Mile long, or better than 4000 Geometrical Paces, and is about half as much in Breadth. Its ordinary Depth is 10 Cubits, its leaſt 5 or 6, rarely 3, but its greateſt is 16 Cubits. It is every where ſurrounded with Woody Mountains, which on the South and Weſt ſide are very High, and 3 Miles broad, running far in length into the *Turkiſh* Country, and afford nothing but Horrid Stony Deſarts, overgrown with Trees. On the North and Eaſt ſide, there is between the Mountains and the *Lake*, a ſmall Territory, which tho' narrow, is nevertheleſs Pleaſant, and is inhabited by one Town, 3 Caſtles, and 9 Villages, and adorned with twenty Churches; as may
Fig. 60. be ſeen in the *Map*, which was drawn by my ſelf upon the place, with all poſſible care.

In the Mountain call'd *Javornik*, ſtanding near the *Lake*, there are two *Holes*, or exceeding deep Precipices, in which many thouſand wild *Pidgeons* rooſt all the Winter; entring in *Autumn*, and coming out with the firſt of the *Spring*: What they live upon in theſe Caverns is unknown, but I take it to be the *Nitrous* Sand. In another Hole call'd *Slivenza*, 'tis the Belief of the Country People, that the *Witches* hold their Aſſemblies, becauſe that ſeveral times Lights like *Ignes fatui* are obſerved there. On the top of this Hill is a *Hole* of an unknown Depth, out of which there often breath out noxious *Steams*, ſuppoſed to occaſion Tempeſts of *Thunder*, and *Lightning* and *Hail*; and for this Reaſon the Prieſt of *Zirknits* every *Whitſon-Monday* goes to the *Hole* in *Proceſſion*, and uſes over it a certain form of *Exorciſme*.

There run into this *Lake* continually 8 *Rivulets*. The two leaſt are call'd *Bellebrech* and *Treſenz*; the 3*d* is the Fountain *Oberch*, out of which abundance of Water guſhes with great force; the 4*th* 5*th* and 6*th* call'd *Steberziza*, *Lipſinziza* and *Seronſchiza*, may for their bigneſs deſerve the Name of *Rivers*, the 7*th* *Martinſchiza* breaks out at a Cleft in the Rock: The *laſt* call'd *Cirknizer bach* is a pretty large River.

Now this *Lake* being every where ſurrounded with Mountains, and no where running over, Nature has given it two Viſible Channels or Stony Caverns, call'd *Velka Karlouza* and *Mala-Karlouza*, by which the Water runs under the Mountain; and a 3*d* concealed ſubterraneous Paſſage, which without doubt communicates with the other two under ground (as I ſhall hereafter prove). Theſe having run half a German Mile, come out at the other ſide of
Fig. 61. the Mountain, near the *Chappel* of St. *Cantian* (as I have faithfully drawn it) in a Deſart place; at a *Stony Cave A*; and become the River called by the Inhabitants *Jeſero*, that is *the Lake*. This River *Jeſero* marked *B*, is reaſonably bigg, and having run half a quarter of a mile enters a wide *Stony Cavern I*, running ſlowly under the Hill for the ſpace of a good Muſquet-ſhot; then coming out again on the other ſide, after it has run thro' a ſmall Platt *m m*; it Enters a 3*d* *Cavern* or *Grotto C*; wherein having paſſed 50 paces, one may ſay *Siſte Viator*, *ne plus ultra*, for it runs no longer peaceably as before, but with

great

great Noiſe and Roaring falls down a very much inclined Channel of Stone, ſo that neither I nor any elſe durſt follow it farther. In *June* 1678. *I* went my ſelf in a ſmall Fiſher-boat under the Mountain, through the *Cave I*, and entred the *Grotto C*, till *I* came to the aforeſaid *Falls*, without any danger or trouble, the paſſage being wide enough.

It muſt be noted, that the Valley wherein this River *Jeſero* runs, is exceeding ſteep, but the Plat of Ground *m m*, is plain and ſtony, of an Oval Form, and is ſurrounded with (as it were) a very High Rampart *K K K*, ſo ſteep that it would be impoſſible for a Cat to climb out of it, unleſs at one place, whereat a Man may make a Shift to go up and down, tho' not without peril of his Life; the Way being in ſome places not above three or four inches, and no where above 6 inches wide. In the Year 1684, *I* went down here in Company with a *French* Gentleman, but the Water being up and we wanting a Boat, we could not go under the Hill, nor enter the *Grotto C*; ſo we returned, and with great difficulty deſcended by a Steep and narrow Paſſage at *D*, and came to a *Cave* bigger than any Church, through which the River *Jeſero* runs. Here we found ſeveral *Figures* of Stone, the Workmanſhip of Nature, and ſtrange *Holes* and *Caverns* in the Earth; but by reaſon the River was then up, we could go no farther. At other times when the Water is down, one may go with lighted Torches a great Way under ground; and it is ſaid there are here very odd *Figures* formed by the Petrified Water: Among the reſt one reſembling a *Weaver* at Work, of which the Country People want not their Superſtitious Traditions.

But to return to our *Lake*; I ſay that about the Feaſt of St. *James's-Tide* and ſometimes not till *Auguſt*, the Water runs away and it is *Dry*: But it *Fills* again and moſt commonly in *October* or *November*, yet ſo as not to obſerve any certain time; for ſome times it has been *Dry* twice or thrice in a Year: As in the Year 1685, it was *Dry* in *January*. Again the Water began to Draw off, on the 15 of *Auguſt. St. N.* and it was quite Clear by the 8*th* of *September*; and this preſent Year 1687, it has been thrice *Empty*, which makes the *Fiſhing* very poor and inconſiderable. Sometimes again, tho' but ſeldom, it has happened to be three or four Years together *Full* of Water, and then is the beſt of the *Fiſhing*. But it never yet was obſerved that this *Lake* was *Dry* for a whole Year together.

The Right of *Fiſhing* in this *Lake*, upon certain Terms agreed on, does at this time belong to the *Lordſhips* or *Caſtles* following, 1. to *Haaſperg*, 2. *Steegberg*, 3. *Laas*, 4. *Schneeperg*. 5. *Aveſperg*, 6. to *Sitticium*, which is a Monaſtry of *Ciſtertian Monks*.

There are 3 *Iſlands* in this *Lake*, *viz. Mala-Goriza* and *Velka Goriza*, which are uninhabited; The 3*d* is a very pretty *Iſland* called *Vornek*, that is reaſonably big, having upon it a Village of 4 houſes called *Ottock*; above this Town upon a little Eminence ſtands a Church, which is no ſmall Ornament. Thoſe that live on it have Fields, Meadows, Paſtures, Wood, Gardens and Orchards, and all things neceſſary for Life.

There is alſo a very fine *Peninſula* all covered with Wood, called *Dorvaſek*. When the *Lake* is up, and one comes in a Boat between the Iſland *Vornek* and

this.

this *Peninſula*, the farther part of the *Lake*, lying under the Mountain, very well retembles a curious Port for Shipping. At the farther end when the Water Draws off, there appears Rowes of Stakes, a Signe that there hath been formerly a *Bridge*, and therefore it is at this day called the *Old Bridge*.

In this *Lake* there are many *Pitts* in the ſhape of Baſons or Cauldrons, which are not all of the ſame depth or breadth; the breadth of them being from 20 to 60 Cubits more or leſs, and the depth from 8 to 20 Cubits. In the bottom of *Pitts* are ſeveral *Holes*, at which the Water and Fiſhes enter, when the *Lake Ebbs* away.

The principal *Pitts* in which they *Fiſh*, are 18, ſituated and named as is repreſented in the Map. They are called *Maljoberch*, *Velkjoberch*, *Kamine*, *Sueiuskajamma*, *Vodonos*, *Louretſchka*, *Kralouduor*, *Reſcheto*, *Ribeskajamma* Fig. 60. *Rethje*, *Sittarza*, *Lipanza*, *Gebno*, *Kotcu*, *Ainz*, *Zeſlenza*, *Pounigk*, and *Leviſhe*. Beſides theſe there are ſeveral other leſſer *Pitts* of no Note, becauſe there is no ſuch *Fiſhing* in them as in thoſe but now mentioned.

In the Months of *June*, *July* and *Auguſt*, when this *Lake* begins to Draw off, it grows quite *Dry* in 25 days, if no great Rains Intervene. And the aforeſaid 18 Pitts are all Emptied the one after the other, in a certain and never failing Order of Time.

When the *Lake* begins to Sink, which appears by a certain *Stone*, which they obſerve, the Inhabitants of the Town called *Oberdorff* or *Seedorf*, give notice thereof to all the Neighbouring Fiſhermen, that are appointed by the ſeveral *Lords* having Right in this *Fiſhing*. The People of this Town have Orders not only to watch the Falling away of the Water; but likewiſe to take care that no Body preſume to *Fiſh* in the *Lake* when it is *Full* of Water; that being forbidden: So that theſe are, as it were the *Keepers* of the *Lake*.

1. The *firſt Pitt* called *Maljoberch*, is not properly a *Pitt* like a Cauldron, but only a Depreſſion of the Bottom without any *Holes* in it: But there grows much Graſs and Weeds, and many *Fiſh* are Catched therein: Three days after the Water begins to *Ebb*, this *Pitt* is Emptied: Then the Pariſh Clark of *Seedorf* gives notice thereof by Tolling a Bell, and all the Inhabitants of the Town, Old and Young, Men and Women, lay aſide all other Buſineſs and go to *Fiſhing*, ſtark Naked as ever they were born, without any regard to Modeſty or Shame.

The *Fiſh* they Catch they divide in halves, one part they give to the Prince of *Eggenberg*, as the Lord of the *Mannour*, the other half is their own.

2. The Pitt *Velkjoberch* is emptied the 3*d* day after *Maljoberch*, the manner and Right of *Fiſhing* as in that.

3. Four hours after this, the Pitt *Kamine* begins to empty; here they generally *Fiſh* with a Trawle, as in ſeveral other *Pitts* of leſſer Note, having firſt purchaſed leave of the aforeſaid *Lord* of the *Mannour*. Here, as likewiſe in the Pit.

4. *Sueiuskajamma* (which ſinks one hour after *Kamine*) is much Fiſh caught, and abundance of large *Crabs*, but they are lean and of no good Taſt.

5. The *fifth Pitt Vodonos*, dries 5 days after *Kamine*. In this and the other *Pitts* which follow they *Fiſh* with a long Net or Sayne. Herein they can have

no

no more than 5 or 6 Hawl's, by reaſon of the great *Swiftneſs* wherewith the Water runs away at the *Holes* in the bottom, (which is ſuch that a Horſe can hardly keep pace with it) and carries away the *Fiſh* with great Violence under the Earth. Sometimes when Fiſhermen are not nimble, they can ſcarce get two Hawl's before the Water be gone; to prevent which they have a Mark near this Pitt, *viz.* the *Stone Ribeskekamen*, that is the *Fiſher's Stone*, which as ſoon as it begins to appear upon the Receſs of the Water, gives notice that it's time to begin the *Fiſhing*.

6. The Pitt *Louretſchka* is evacuated a day and a half after *Vodonos*, the *Fiſhing* is after the ſame manner, and the ſame Caution neceſſary, becauſe of the *ſuddain Receſs* of the Water.

7. The Water leaves the Pitt *Kraloudour* 12 hours after *Louretſchka*; and 3 days after that,

8. The Pitt *Reſcheto*. In this latter, in the Year 1685, after the *Lake* had been ſome *Years* without being *Dry*, there were taken at the firſt Hawl, 21 *Carts* of *Fiſh*, at the 2*d*. 17, and at the 3*d*. 9, as I have been credibly informed by thoſe that were preſent.

9. The Pit *Ribeskajamma* falls *Dry* at the ſame time with *Reſcheto*, which is that next to it. In this *Pit* they *Fiſh* under ground, which is a Curioſity not unpleaſant, and differing from all the reſt. For there is in the bottom a great Hole in the *Stone*, by which Men may eaſily go down with Lighted Torches, as into a deep Ciſtern; and there is under a large *Cavern* like a Vault, the Bottom or Pavement whereof is as it were a Sieve full of *little Holes*, whereby the Water runs away leaving the *Fiſh* Dry, where they are Caught.

10. The Pit *Rethje* is empty two Hours after *Ribeskajamma*, and is of no great Conſequence for *Fiſh*: An Hour after this, the Pitt 11 *Sittarza*, and in 5 or 6 Hours more 12. *Lipanza* falls *Dry*.

13. The 3*d* day after *Reſcheto* the Pitt *Gebno* is Evacuated; in this they rarely *Fiſh* with *Nets*, but let fall Dry, and the *Holes* in the Bottom being ſo ſmall, that they exceed not the ſize of a Man's Arm, all the great *Fiſh* are left behind in the Pit.

14. Two days after *Gebno* the Pit *Koteu* becomes *Dry*: In this they ſometimes take the *Fiſh* as in the former, but the *Holes* being greater let bigger Fiſhes paſs.

15. The Pit *Ainz* empties 4 or 5 Hours after *Koteu*: In this they ſeldom (unleſs they cannot help it) let the Water run away without uſing their Nets, as in *Gebno*; becauſe of one great *Hole* in the Bottom whereby many great *Fiſhes* may eſcape.

16. The Pit *Zeſtenza* ſinks three Hours after *Ainz*; in this they always *Fiſh* with *Nets*. As in

17. *Pounigk*, which is emptied the next Day after *Koteu*.

18. The laſt Pitt called *Leuiſche* is Evacuated the third Day after *Pounigk*, that is the 25th Day from the beginning of the *Receſs* of the Water of the Lake, ſo that in 25 Days the *Fiſhing* of this *Lake* is over. In this laſt Pit about 17 Years ſince, I am certainly informed, that there fell a Flaſh of *Lightning* about the time of *fiſhing*, which ſtunned a great Multitude of large Fiſhes,

ſo

ſo as that they filled 28 *Carts* with them: (By a *Cart* is meant as much as one Horſe can draw). Theſe *Fiſh* are not properly *Thunderſtruck*, but only *ſtunned* with the Violence and Sulfureous Vapour of the *Lightning*, which makes them Riſe and Swim as Dead upon the Top of the Water; but if they be taken up and put in *Freſh Water*, they ſoon recover, otherwiſe they Die. This is no uncommon Accident in this *Lake*.

The *Fiſhing* being thus ended, a Sign is given by tolling the Bell in the *Chappel* of St. *John Baptiſt*, near the Town of *Cirknitz*. Upon which all the Inhabitants of the Neighbouring Villages and of *Cirknitz*, without regard either to Age or Sex, go for the moſt part ſtark *Naked*, into the *Lake*, and look for *Fiſh* among the Weeds and Sedge, and in the ſmaller *Pitts*. And many creep into the Subterraneous *Caverns* and Paſſages, and find ſtore of large *Fiſhes* there. They having full Liberty to ſearch all over the *Lake*, excepting in the Pitts *Pianze*, *Narte*, and *Velkjoberch*. This Barbarous and Immodeſt Cuſtom of going *Naked*, has been often attempted to be reclaimed by the *Carthuſian Monks*, but all in vain, for ſo prevalent is a Habit of vicious Practices over good Precepts, that they have not yet been able to perſwade them ſo much as to cover their Secrets.

There are beſides theſe ſome other Pitts in the *Lake*, as *Skednenza*, *Mala* and *Velkabobnarza*, in which they *fiſh* likewiſe, as alſo in *Mala karlouza* and *Velka-karlouza*: In both theſe they go far under ground with lighted Torches, and find *Fiſh*, but theſe *Pitts* are of no great value. In *Velka-bobnarza* one may go in at great *Holes*, and deſcend many Fathoms under ground. Theſe two Names *Velka* and *Mala-bobnarza*, ſignifie in the *Carniolan* Tongue, the *Greater* and *Leſſer Drummer*; nor is it without Reaſon that theſe Pitts are ſo called; for when it *Thunders* and *Lightens*, there is heard in theſe two Pitts, as it were, the Sound of many *Drums* beating, which *Anno* 1685, I heard with my own Ears; it *Thundring* 3 times ſucceſſively, and the Sound of *Drums* anſwering accordingly.

The two Pitts *Narte* and *Pianze*, are never emptied, but always remain *Fenny*, when the reſt of the *Lake* is quite *Dry*. It is believed that in theſe *Pitts* the Fiſh lay their Spawn, and therefore it is prohibited to Fiſh in them. In them is an incredible Number of *Horſeleeches*, which according to the vulgar Opinion, underſtand certain Words; for that upon repeating them, they will come in great Parties towards him that repeats them, whereas if he be ſilent, very few of them will touch him. Theſe *Horſe leeches* often ſtick upon the People in the fiſhing time, (ſome of them being diſperſed all over the *Lake*) and the Method they take to get them off, is to get ſome other Perſon to piſs upon the *Leech*, which makes it let go its hold; and this without any reſpect to Modeſty, is practiſed as well upon the *Women* as Men.

There are in the Mountain nigh the *Lake*, but ſomething Higher than it, two great and Terrible ſtony *Caves*, the one called *Urainajamma*, the other *Sekadulze*, which tho' far diſtant one from the other, have yet the ſame effect, *viz.* When it *Thunders* and *Lightens*, theſe two *Caves* do *Emit Water* with a wonderful and incredible force, and with it ſometimes a great quantity of *Ducks*, with ſome *Fiſh*, which I my ſelf obſerved in *October* 1685, not without

but great danger of my Life. I took my Horſe and rid croſs the *Lake* as far as the Iſland *Vornek*, in company with two old experienced Fiſher-men; when ſuddenly the *Cavern* in the Mountain *Slivenza* began to breath forth miſty Vapours, forming a Cloud. Upon which my Fiſher-men adviſed me to make haſte, for without doubt thoſe Clouds would produce a Tempeſt. They had ſcarce ſaid ſo, when it began to *Lighten* and *Thunder* dreadfully; and I had difficulty to perſwade them to accompany me as far as the Pitt *Velkabobnarza*, being deſirous to examine what is ſaid of it, that when it *Thunders* the Sound of many *Drummers* is heard in it. This I found three times to ſucceed as reported, and then with all the ſpeed we could, we haſted to the Iſland *Velkagoriza*, not being able to go farther, becauſe the Water was in many Places grown out of our depth, where two Hours before we had paſſed dry. Here we got one of the little Fiſher Boats, which when the *Lake* is dry, lie diſperſed here and there on the bottom; and having got in my Horſe, we began our Voyage, but had the ill luck to overſet our Boat, and ſo were obliged to ſwim for't, and with much to do arriv'd ſafe on the other Shore. Then we could ſee from the other ſide that the Water guſhed with great Impetus out of the Cave *Sekadulze*, being caſt three or four Fathoms, as if it were forced by a *Fire-Engine*, and ſeveral *blind Ducks* were thrown out by the Water. It is not to be wondred that the *Lake* fills ſo faſt, for conſidering the Violence wherewith the Water ruſhes, it is as much as a great River; this Cave *Sekadulze*, being a Fathom wide, and higher than a Man. It is look'd upon as a dangerous thing to enter into this *Cave*, becauſe the Water comes ſo all on a ſudden, that if it ſhould chance to come it is impoſſible to eſcape it.

When it *Rains* moderately, the Water *Spouts* with great Violence two or three Fathoms perpendicularly, out of the Pitts, *Koteu* and *Zeſlenza*. It comes likewiſe forceably out of the Spring *Treſenz*, as likewiſe out of *Velkioberch*, bringing with it at this latter abundance of *Fiſh*, and ſome *Ducks*. But when it *Rains* very hard and long together, eſpecially with *Thunder*, then the Water breaks out with very great Force, not only from all the aforeſaid *Pitts*, *Holes* and *Caves*, but likewiſe at ſeveral thouſand other little *Holes* (which are all over the bottom of the *Lake*, and which when the *Lake* is *drie*, drink up the Waters of the 8 *Rivulets* that run into it) *ſpirting* ſeveral Fathoms high, from ſome perpendicularly, from others obliquely, ſo that there is not a pleaſanter ſight than this. And out of the Pitts, *Vodonos*, *Reſcheto*, and ſome others, having great *Holes* at the bottom, there comes with the Water a great quantity of *Fiſh*. In caſe of great *Rains*, the 8 *Rivulets* are likewiſe much encreaſed, ſo that all things concurring, this *Lake* in 24 Hours time, will from quite *Dry* be *Full* of Water, and ſometimes in 18 Hours; tho' at other times it has been known to be three Weeks in *filling*. But it is a conſtant Obſervation, that *Thunder* and *Lightning* help much to *fill* it ſpeedily.

This *Lake* being thus by turns *wet* and *dry*, ſerves the Inhabitants for many purpoſes. For *Firſt*, while it is *full* of Water, it draws to it ſeveral ſorts of *Wild-Geeſe* and *Ducks*, and other *Water-Fowl*, as *Herons*, *Swans*, and the like, which may be ſhot, and are very good Meat.

Next, as ſoon as the *Lake* is *Emptied*, they pluck up the *Ruſhes* and *Weeds*, which make excellent Litter for Cattle. 3. Twenty days after it is fully *dry*, they do cut a great quantity of *Hay* upon it. 4. After the *Hay* is in, they *Plow* it and ſow *Millet*, which ſometimes by the too ſudden coming of the Water is deſtroyed: But it generally comes to Maturity. 5. While the *Millet* is on the Ground, they catch a great Number of *Quails*. 6. The *Millet* being in, there is good *Paſture* for Cattle. 7. When the *Lake* is *dry*, there is great Variety of *Hunting*; there coming out of Neighbouring Woods and Mountains, plenty of *Hares*, *Foxes*, *Deer*, *Swine*, *Bears*, *&c.* ſo ſoon as the Water is gone. 8. When it is full one may *fiſh* in it. 9. In Winter time it will be ſo firmly *Frozen*, as to bear all ſorts of Carriages, and is a great convenience to the People to fetch their Wood and other Neceſſaries. *Laſtly*, At the time when the Water goes away, it yields great abundance of *Fiſh*, as has been already ſaid. And that which is moſt Wonderful is, That all this comes to paſs in the ſame place, and the ſame Year, *Viz.* If the *Lake* be early *Dry*, and it fill not too ſoon; but it is to be noted, that the the *Hay* does not grow, nor is the *Millet* ſown all over the *Lake*, but only in the more fertile places

There are only theſe ſorts of *Fiſh* taken in this *Lake*, which are very well taſted. They are the *Muſtela Fluviatilis* or *Eel-pout*, ſome of them weighing two or three Pounds; 2. *Tench*, ſome of them weighing ſix or ſeven Pounds; and *Thirdly*, Pikes in very great plenty, of ten, twenty, thirty, and ſome of forty Pound Weight; in the Bellies of theſe it is common to find whole *Ducks*; *Crabbs* are found no where but in the *Pitts Kamine* and *Sueinskajamma*: They are large but ill taſted

The *Cauſe* or rather *Modus* of all theſe wonderful *Phænomena* in the *Lake* of *Zirchnitz* is, according to my Opinion and Speculations, as followeth; there is under the Bottom of the *Lake*, another ſubterraneous one, with which it communicates by the ſeveral *Holes* deſcribed. There are alſo one or more *Lakes* under the Mountain *Javornik*, but whoſe Surface is higher than that of the *Lake* of *Zirknitz*. This upper *Lake* is poſſibly fed by ſome of thoſe many Rivers, which in this Country bury themſelves under Ground, and has a Paſſage ſufficient to carry the Waters they ordinarily bring unto it: But when it *Rains*, eſpecially in *Thunder Showers*, which are the moſt haſty, the Water is precipitated with great Violence down the ſteep Valleys, in which are the Channels of theſe *Rivulets*; ſo that the Water in this *Lake* being encreaſed by the ſudden coming in of the *Rains*, faſter than it can empty, *ſwells* preſently; and finding ſeveral *Holes* or *Caverns* in the Mountain Higher than its ordinary Surface, it runs over by them both into the *Subterraneous Lake* under that of *Cirknitz*, (into which the Water comes up by the ſeveral *Holes* or *Pitts* in the Bottom thereof) as likewiſe by viſible Paſſages above Ground, ſuch as *Urainajamma*, *Sekadulze*, and *Treſenz*.

That ſome of theſe Paſſages bring *Fiſh*, ſome *Ducks* and *Fiſh*, others only *Water*, ſeems to depend on the poſition of the Inward Mouths of theſe *Subterraneous Channels*; for if they be ſo conſtituted, as to draw off the Water from the Surface of the *Upper Lake* on which the *Ducks* ſwim, they muſt needs be

be drawn away by the Stream into theſe *Caverns*, and come out with the Water: But if ſo that the Channels open into the *Upper Lake*, under the Surface of the Water, and from thence aſcend Obliquely for ſome ſpace, before they come to deſcend, then the Water they carry is drawn from below the Surface, and conſequently can bring with it no *Ducks*, but only *Fiſh*. Thoſe *Pitts* which yield only *Water*, may well be ſuppoſed to be fed by Paſſages too narrow to let the *Fiſh* paſs, tho' their multitude may make the Quantity of Water they emit to be very conſiderable.

The Manner of the *falling away* of the *Water* or *Emptying* of the *Lake*, I thus explain. After a long Drought or want of *Rain*, all the Springs that feed the *Upper Lake* under *Javornik* are much diminiſhed; ſo that wanting freſh Supplies, it ceaſes to run over by the ſeveral Channels but now mention'd: Hence the Lake of *Zirknitz*, and that under it, are fed only by the Eight *Rivulets* that always fall into them, and then the Water draws off faſter than it comes in, both by the Channels of *Mala* and *Velka-karlonza*, as alſo by a concealed Subterraneous Paſſage out of the *Under Lake*, which latter alone is able to tranſmit more Water than the ſaid 8 *Rivulets* afford. Conſequently the *Lake* muſt *Sink*, and that in a certain proportion of time, depending on the quantity of Water to be Evacuated, compared with the Exceſs of that that Runs out above that that Enters it, in the ſame time. 1. Thoſe *Pitts* that are Higher are ſooneſt *Dry*, the Lower lateſt, and ſo come to be Emptied in the Order above deſcribed, and when the *Lake* is all *Dry*, then the ſaid *Rivulets* ſoak by ſeveral little *Holes* in the bottom, into the *Under Lake*, and all their Water is carried away by the aforeſaid *Subterraneous Paſſage*.

That there is ſuch a Paſſage is very Evident, and that it Communicates under Ground with the Channels of *Mala* and *Velka-Karlonza*, coming out with them as has been already ſaid, near St. *Cantian* at a Rocky *Cave*, and making the River *Jeſero*: For when the *Lake* of *Zirknitz* is very full, and Runs out of both *Velka* and *Mala-Karlonza*, the River *Jeſero* at St. *Cantian* Overflows, and Runs with great Violence; when it only Runs out at *Mala-Karlonza* (which is ſomewhat lower than the other) then the Water of *Jeſero* is much leſs rapid; but when the *Lake* is ſo fallen, that it runs out at neither of the two, the River *Jeſero* is ſtill leſs, but runs with a conſiderable Stream, till two Days after the *Lake* has been *Dry*; after which, the ſaid River becomes little, voiding no more Water then the *Lake* receives from the 8 Rivers that Run into it: By which it is clearly proved, that this *Subterraneous Paſſage* does meet with the Channels of *Velka* and *Mala-Karlonza*, and needs no farther Illuſtration.

Hence it appears, why this *Lake* ſometimes is twice or thrice Dry in a Year, at other times continues full for three or four Years together, but was never known to be *Dry* for a whole Years time; for it falls *Dry* at any time when there falls but little Rain in a long ſpace of time; and in Rainy Years it continues always full; but it never happens in this Country, that there is a Drought for a whole Year together.

The *Ducks* I have ſo often mention'd, and which are caſt out with the Water, are generated in the *Lake* under the Mountain *Javornick*; when they firſt come out, they *Swim* well; but are ſtark blind, and have no *Feathers* on them, or but few, and therefore are eaſily caught; but in 14 Days time they get *Feathers*, and recover their *Sight* yet ſooner, and afterwards *fly* away in Flocks. They are Black, only white on the Fore-head, their Bodies not big, reſembling ordinary *Wild-Ducks*, and are of a good Taſte, but too Fat, having near as much Fat as Lean.

I kill'd ſome of them as ſoon as they had been caſt out at *Sekadulze*, and opening their Bodies, I found in them much *Sand*; and in ſome few, ſmall *Fiſhes*; in others green ſtuff like Graſs or Herbs; which was the more ſtrange, becauſe I never found any green thing growing in any of our *Subterraneous Grottoes* or *Lakes* in *Carniola*; I tryed alſo to procure ſome of the *Fiſh* at the time of their being caſt out, to open them and ſee what they live upon, but notwithſtanding all my endeavour, I could not get any of them to ſatisfy my Curioſity withal.

Almoſt every Year, at a *Hole* in the Mountain called *Storſeg*, about half a German Mile from the *Lake* of *Zirknitz*, near the Town of *Laas*, whenever there happen great Floods of Rain, this ſort of *Ducks* is caſt out in great abundance, by the Water Guſhing out with much force. I conceive that this Cavern *Storſeg* is another Paſſage out of the ſame *Lake* under *Javernick*, that overflows and fills up our *Lake* of *Zirknitz*; but this being ſomewhat Higher, it never runs out unleſs the ſaid *Lake* be more than ordinary ſwelled by the violence of the *Rains*. The *caſting* out of great Numbers of *Ducks* here, is ſo common, that it is lookt upon as no Rarity.

It may ſeem ſtrange and hard to believe, that there ſhould be ſuch *Subterraneous Lakes* and *Channels* as we here ſuppoſe; but beſides that, without them it would be impoſſible to account for all theſe ſeveral Effects which are moſt true, and which I my ſelf have obſerved: There is a moſt Notable Inſtance of the like things, found in the *Subterranean Cavern* called the *Grotto Podpetſchio*.

Fig. 3. This *Grotto* is in *Carniola* in the Pariſh of *Guetenfeld*, diſtant four German Miles from the City *Labac*. *a*, is a *Hole* or Entrance into the Rocky Mountain; *b*, is a great *Cavern* in the Mountain, capable to hold above a Hundred Horſe-men; *i*, *k*, is a Channel big enough for a Man to paſs by, as far as the Lake *o*, out of which Lake the Inhabitants hereabouts draw all their Water, (having none nearer) and fetch it with lighted Torches. Into this Lake *o*, the Water runs with a great Stream by the Channel *l*, and out of this Lake it falls down a Precipice into a great *Cavern*, with ſo much noiſe, that the diſcharge of a Piſtol would not be heard here. There is likewiſe another Channel *m*, which tends upwards obliquely, and leads to the great Lake *n*, whoſe length and breadth are hitherto undiſcovered; I look'd about it with many Lights, and could ſee nothing but Water, and throwing Stones ſeveral ways as far as I could, I heard them all fall in the Water: And I found the depth of it near the Bank to be ten Cubits, and doubt not but it is much deeper in the Middle.

The

The Country People told me, that this Channel *l*, affords always an equal quantity of Water, or elſe is quite Dry; and that ſometimes it will ceaſe to run in a Moment, and continue Dry for ſome Weeks, and then on a ſuddain it will run again with great force, ſo as the Noiſe thereof frequently frights the People as they come for Water.

Out of the Cave *b*, there is another Channel *c*, which is divided into three others *d*, *e*, *f*. This Channel *f*, tends obliquely downwards, till it comes to a running Water in *g*, from whence one may go on to *h*, where looking thro' a little *Hole*, one may ſee another little *Lake*.

All the Channels I have mentioned, are formed in a very hard Rock, and are ſmooth or poliſhed, as if cut by Mens Hands; Theſe may be ſeen by any one that will go with lighted Torches; and there are many ſuch in which I have not been.

If any one would carry a Boat to the Lake *n*, and would row upon it, I doubt not but he might find ſeveral curious things. I believe this *Subterraneous Lake* to be a German Mile long: For from this *Grotto Podpetſchio*, at a Miles diſtance, there is a Village called *Kumpale*, whoſe Inhabitants have no other Water, than what they fetch out of a *Hole* in the Rock, going with lighted Torches, by a large Channel, to a great *Lake* under ground. I meaſured with good Geometrical Inſtruments, ſuch as Miners uſe, the Level of theſe two *Lakes* of *Podpetſchio* and *Kumpale*, and found them to be in one *Horizon*; and this I did twice, both when the Channel *l*, at *Podpetſchio* Run, and when it did not Run. When it began to Run, I found that the Lake *n*, was two Cubits Higher than it had been before; when it ceaſed to Run I came again on purpoſe to obſerve it, and found that then alſo, the other *Lake* at *Kumpale* was in the ſame *Level*; from whence it is moſt certain, that theſe two, are only one continued *Subterranean Lake*.

XX. The *Lake* of *Geneva*, which is one of the moſt pleaſant Places of the World, lies like a *Croiſſant* of Water, one Extremity whereof is 18 Leagues diſtant from the other, and the Banks of which are gently raiſed to ſome Heights, then to Collines, at length to ſtupendious Mountains; which yet are not ſo linked to one another, but that they leave betwixt them Interſtices of 15 or 20 Leagues Proſpects, checkered by Meadows, Corn-Fields, Orchards, Vines, Forreſts of Firr-Trees, Snow lying on the ſides of the Rocks. All thoſe Objects, which at a Diſtance are confounded, and ſeem to make but one, have near Hand their ſeveral Beauties. That Point where *Geneva* ſtands, is ſomewhat longer and more extended than the other. This *Croiſſant* where 'tis largeſt, which is from *Morges* to *Thonon*, is about 5 good Leagues over.

The Lake *of* Geneva; *by* ..... n. 86. p. 504.

The *Water* of this *Lake* is very good to drink, and ever ſo Limpid, that even in the rolling of the Waves, which ſometimes go high enough, the Water is not troubled but along the Banks. And if one do attentively look down from the Caſtle of *Chilon*, or from any of the Neighbouring Heights, into the Bottom of the *Lake*, he may ſee high Mountains under the Water. And the Water is ſo Deep before *Veuvay*, that the Sounding Line at the end of 400 *Fathoms*, ſeems, becauſe it will not ſtay, to touch upon ſomething

Slippery.

Slippery. 'Tis held to be 500 *Fathoms* deep before *Roole*; and 'tis affirm'd, that near this great *Depth* there may be ſeen a kind of Iſle under Water.

The *Rhone* enters at one of the Points of the *Croiſſant* into the *Lake*, and iſſueth out at the other; but with this Difference, that whereas he comes in Dirty and Miry, he ever goes out ſo Pure and Clear, that under the Bridge of *Geneva*, where the Water is deep 25 Feet in Summer, you may well diſcern the ſmalleſt Stones at the Bottom. And the ſame Water, which in this Place appears of a *Saphyrine Blew* in the Shade of the Houſes, appears altogether *Green*, nor is ſo Tranſparent, when the Sun Shines on it.

Having heard the Sentiments of the Curious of *Lauſanne* and *Geneva*, and the Opinions of the moſt knowing Fiſhermen, that are there in great Number, and eſpecially at *Coupet*, I believe with the Latter, that although the *Rhone* entering into the *Lake* loſeth its Violence, yet doth he ſtill keep ſome ſenſible *Motion* in ſome Places, and every where Obſervable, and that no *Trouts* are taken any where in this *Lake* but in this *Current* of the *Rhone*.

The *Water* of this *Lake* commonly begins to *Encreaſe* about the end of *January*, or the Beginning of *February*, and continues to do ſo unto the 20*th*. of *July*, and often unto the very Month of *Auguſt*; and then it inſenſibly *Decreaſeth*, ſo that the Water is leſs high in Winter than Summer, by 12 or 15 Feet. About this *Increaſe* of the Water there are different Opinions; 'Tis true, they all believe in general, that the principal Cauſe of the *Increaſe* of the Water is the melting of the Snow, and of the Mountainous Ice, that is in the Winter formed of the Waters of the Springs, and Torrents which the Froſt fixeth. This is ſo true, that when there is much Snow in Winter, the Waters are very High the enſuing Summer. But when great Rains chance to fall in *January*, then the Snow, not yet being well hardned, Melteth on a ſudden altogether: And when this Melting is not ſo violent, all the Snow, that will melt, melts at the end of *May* or at the Beginning of *June*; ſo that, there remaining but the Stock of Ice for entertaining the *Increaſe* of the Water unto the Month of *Auguſt*, ſome have thence been induced to aſſign other Cauſes.

At the Iſſuing out of the Bars, that form *Geneva* on the ſide of the *Lake*, are ſeen in the Water two or three huge *Flints* ſtanding out of the Water, the chief of which they call *Niton*: And the Tradition is, that it formerly was an Altar conſecrated to *Neptune*, there being alſo a place cut out in the middle, which they take to have been the place for the Sacrifice. On this *Flint* 7 or 8 Perſons can ſit; and ſometimes, when the Waters are very low, there are found about it Knives, and Needles, as thick as Bodkins of Tweeſes, and much longer; both of Braſs, well enough made, and eſteemed for to have ſerved for the Sacrifices.

This *Lake* in Serene and Calm Weather appears ſometimes, and that even before Sun Riſing, as if it were made of divers pieces Differently Coloured; part of it being Browner than the reſt: Which ſeems to be cauſed by a Breath of Wind paſſing thorow the Water, coming either from the Bottom of the *Lake* or from above; though others think this gentle Agitation to proceed from ſome

Springs

Fig. 45.

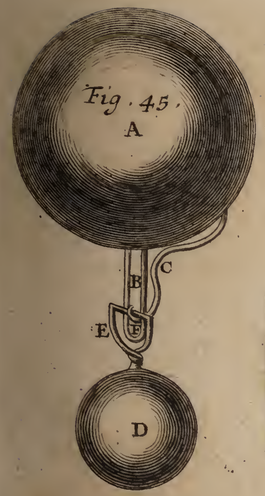

Fig. 46.

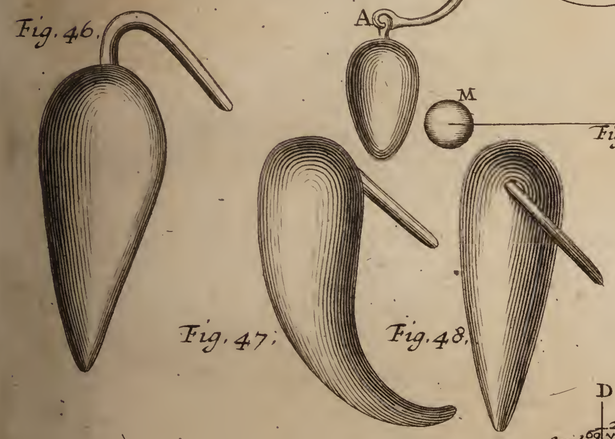

Fig. 47.

Fig. 48.

Fig. 49.

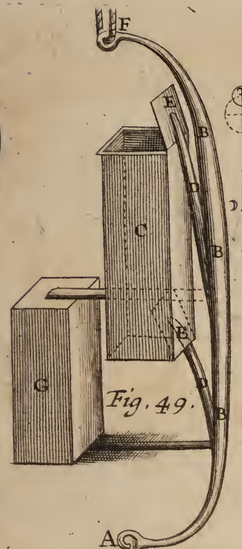

Fig. 52.

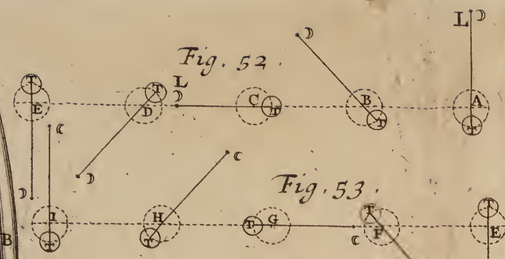

Fig. 53.

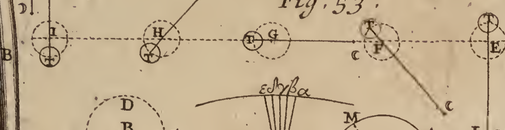

Fig. 51.

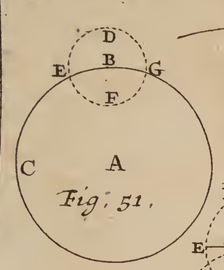

Fig. 54.

Fig. 55.

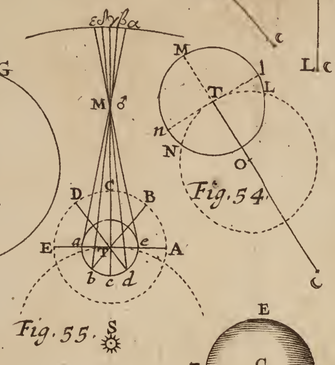

Fig. 56.

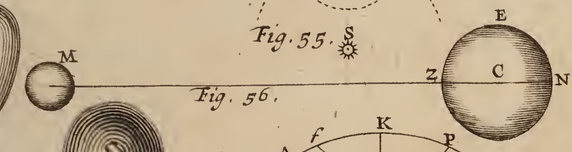

Fig. 57.

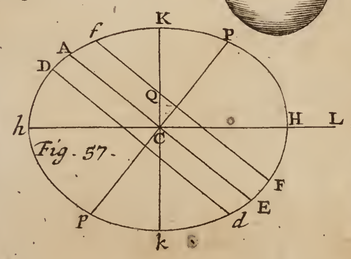

Fig. 50.

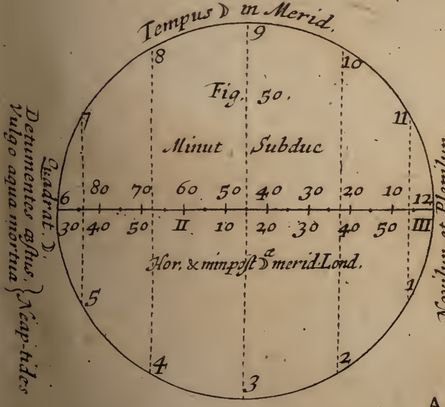

Fig. 58.

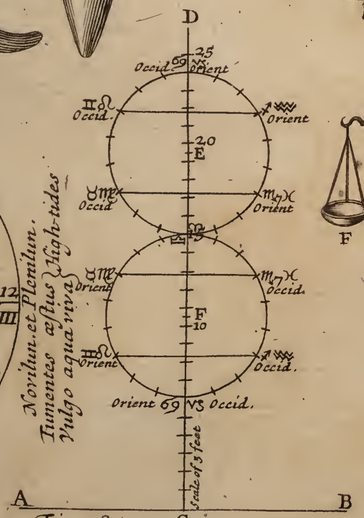

Fig. 59.

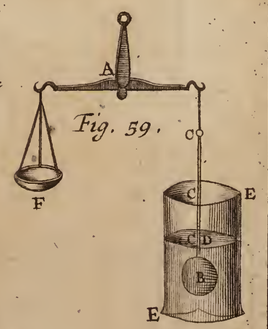

Fig. 60.

Fig. 61.

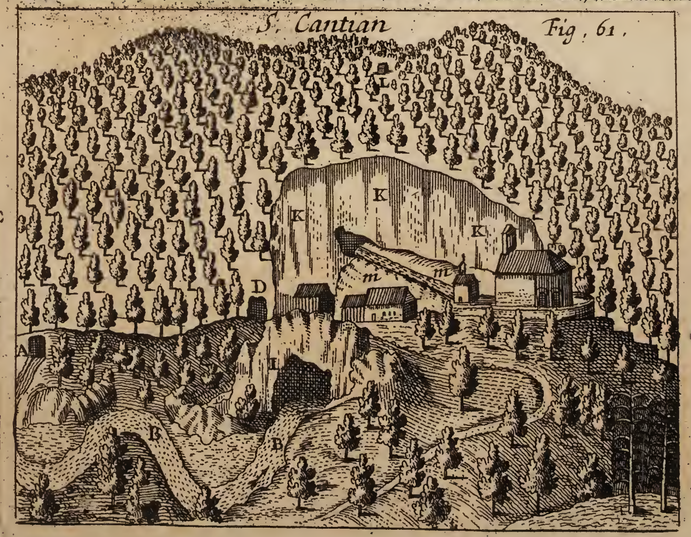

Plate 4.
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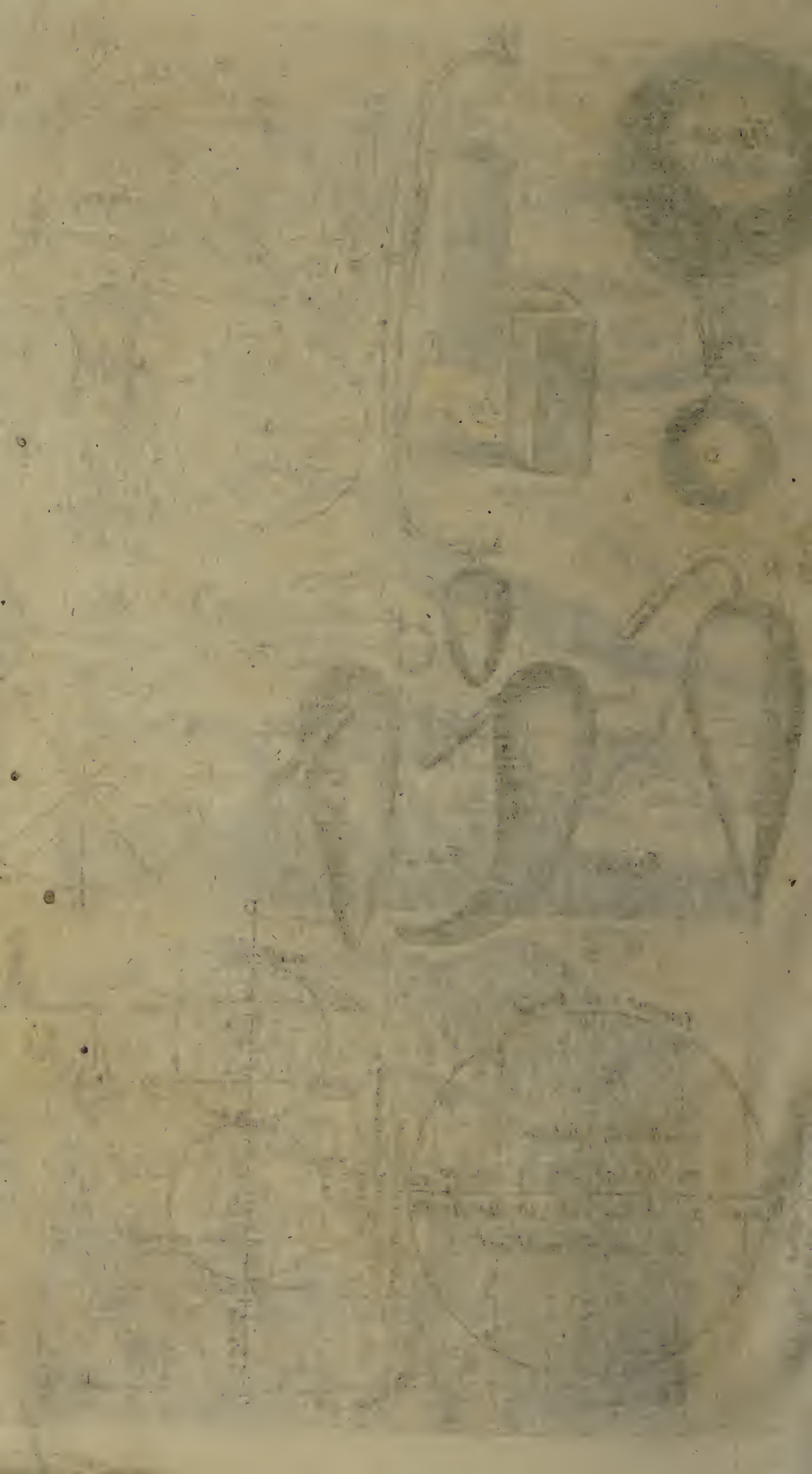
The Plan of the Grotto Podpetſchio

Fig. 62.



Springs that are at the Bottom, making the Water Shiver above. But that part of the Water, that is not moved, appears as Even and Smooth as a Looking-Glaſs, or like Water traced by a Ship. And as for the *Colours*, they are in my Opinion, an Effect of the Neighbouring Mountains, the different Images of which, being confounded in the Water, make an appearance of very *Pale Colours*.

After that the *Rhone* is entered into the *Lake*, he retakes not his impetuous Courſe before a Quarter of a Miles diſtance from its coming forth again, that is, above *Geneva*. And the nearer he comes to that Town, the more his Bed becomes narrow, and conſequently his Courſe more Rapid. Yet this Rapidneſs hath been in our times once Surmounted by *Wind*, and once by *Water*.

In the Winter of the Year 1645. there aroſe in the Morning about 9 a Clock ſo furious a *Wind*, that not only it uncovered the Houſes, but alſo laid dry the Bed of the *Rhone* above the Bridges, ſo that many, in the view of all the Town, croſſed quite over it (to the little Iſland) dry Foot, and one of the Sons of M. *D' Aubigny* took up ſome Medals, which he found in his Way. This paſſage was free during an Hours time; at the end of which the River retook its Courſe. At that Seaſon the Water being very Low, and a Weſt wind, to arrive at *Geneva*, being preſſed by the high Mountains, that bring it upon the Town as by the Noſe of a Pair of Bellows, it came to paſs, that that Wind did Violently bear upon the Water near the Bars, keeping ſuſpended the Water that was beyond, and thoſe Waters that were beneath running away downwards by a Declivity, and under the Shelter of the Houſes. Whilſt I was Scrupling at this Relation, they brought me *Gallaſius* his Commentary upon *Exodus*, Printed 1560; where 'tis recorded, that the like Accident had fallen out at *Geneva* at the time when that Miniſter Lived there, a South-Weſt Wind having made the *Rhone* to Recoil into the *Lake*, and many People having thereupon paſſed over Dry for an Hours time.

Concerning the other Accident; you may remember that the River *Arve*, which is a kind of Torrent, falls into the *Rhone*, about 1000 paces beneath *Geneva*. In the Month of *December* in the Year 1652. the ſaid *Arve* did ſo extraordinarily Swell, that not only it over-run its Banks with Impetuoſity, but alſo interrupted the Courſe of the *Rhone*, and forced it to re-enter into the *Lake* for the Space of 14 Hours.

This *Lake* doth very much abound with *Fiſh*, which have as 'twere Cantoniz'd themſelves, and divided the *Lake* amongſt them. The *Trouts* are not to be found there, but, as hath been already mentioned, in the *Current* of the *Rhone*; the *Carps* have taken up their Quarter towards *Veuvay*; the *Pikes* and *Pearches* have alſo their Habitations a part: But ſome other *Fiſh* that are but Paſſengers, not living conſtantly in the *Lake*, ſpread themſelves almoſt every where indifferently. The great *Trouts* paſs out of the *Lake* for 4 Months of the Summer, and are taken in Autumn when they are returning thither. The *Fiſhing* is farmed out at *Geneva*; and there are Conſervatories, where many of theſe big *Trouts* are kept, among which there are ſome that weigh *fifty Pounds*.

Some-

Sometimes they catch *Pikes* there of 80 *Pounds* Weight; and a *Pound* Weight at *Geneva* you know to be 18 *Ounces*.

In the Months of *July* and *Auguſt* they Fiſh for the *Fry* of *Pearches*, at a time when they are no bigger than the ſmalleſt taggs. Theſe are a very Delicious Diſh there called *Mille Cantons*.

The Lake Avernus; *by Dr.* Tancred Robinſon. n. 172. p. 1038.

XXI. I have ſeen many *Water-Fowl* Feeding upon and Flying over the Lake *Avernus*, reported by many of our own, as well as forreign Writers, to *Kill* Birds at a diſtance. I obſerved ſeveral *Land Fowl* alſo to Fly over that *Lake*, without the leaſt Diſturbance, from all ſides, and ends. But peradventure the *Poyſonous Steams* (if there are any peculiar to that *Lake*,) ſometimes Vaniſh, and Return again; or elſe may be alter'd by new *Effluviums* intermingled with them.

The Lake of Mexico; *by* .... n. 130. p. 758.

XXII. The *Lake* of *Mexico* hath this of extraordinary, and perhaps peculiar, that part of its Water is *Sweet*, and the other part *Salt*; which make it believed to be derived from two Sources, whereof the one holds *Sweet* Water, the other comes from ſome Mineral and *Saline Earth* found in the Hills through which this Water paſſeth, and is Impregnated with the *Salt* which is diſſolved in its Courſe: Or if it have no peculiar Source, it muſt be, that that which makes part of the *Lake Salt*, is the Bottom or the Earth under the Water, being in that place full of *Salt*; which is confirmed by Experience, much *Salt* being made of it every Day, of which that City drives a great Trade with remote Parts, even the *Philippines* themſelves, whither it is Tranſported in conſiderable Quantities. That part of the *Lake* which is *Sweet*, is Still and Quiet; the *Salt* part is Agitated and moved according as the Winds blow. The *Sweet* Water is very good and Wholeſome, breeding plenty of little Fiſhes; that which is Moved is *Bitter-Salt*, breeding no Fiſh at all. The *Sweet* Water is Higher than the other, and falls into it. The Water of the *Salt* part is 7 Leagues Long, and as many *Leagues* Broad, and hath above 22 *Leagues* in Compaſs; that of the *Sweet* Water is near as bigg; and the whole *Lake* contains about 50 *Leagues* in Compaſs.

An Inland Sea near Dantzick, *Yielding in Summer a* Poiſonous ſubſtance; *by* M. Kirky. n. 83. p. 4069.

XXIII. Near a ſmall Village call'd *Tuckum*, $2\frac{1}{2}$ *German Miles* diſtant from *Dantzick* Weſtward, there is an *Inland-Sea* (made by the meeting of 3 Rivulets, ſome Springs from the adjoyning Hillocks, and the Deſcending Rain and Snow-water,) of about half a *German Mile* long and an eighth part of ſuch a *Mile* broad. The *Soil* of the ground round about ſeems to be Sand mixt with Clay. Its Shore generally Sandy, as is its Bottom alſo. Its Depth where Deepeſt, four Fathoms; but for the moſt part but one, or one Fathom and a half. 'Tis ſtored with Wholeſome and Delicate Fiſh, as *Pearch*, *Roch*, *Eels*, *&c.* and Famed for a ſmall Fiſh much eſteemed here, and not much unlike a *Pearch*, only not ſo party-Coloured, and having a larger Head proportionable to its Body, called the *Cole-pearch*. The Water *Sweet* and *Wholeſome*; but only in the three Summer Months, *June*, *July*, and *Auguſt*, it becomes every Year,

Year, during the dry Weather, *Green* in the middle with an *Hairy Efflorescence*; which *Green Substance*, being by some violent Wind forced ashore, and with the Water drunk by any Cattle, Dog, or Poultry, causeth Certain and *Suddain Death*; whereas at the same time, that a knowing and Ingenious Person (who first acquainted me with it,) saw three Dogs Killed with it, the Horses that were ridden into the Water beyond the place, where this *Green Substance* Floated, drunk without any Hurt; and that also, during the same Season, the Water in the Streams, that Flow from it, are *Wholesome*.

Some Extraordinary Lakes *in* Scotland; *by Sr.* George Mackenzy. n. 114. p. 307.

XXIV. 1. There is a little *Lake* in *Straherrick* on the Lord *Lovel's* Lands, which never *Freezes* all over (even in the most vehement *Frosts*) before *February*; but one Night's *Frost* thereafter will *Freeze* it all over, and two Nights then will make the Ice of a very considerable thickness. I have heard of two others *Lakes*, one of which, is on Lands belonging to my self, called *Loch Monar*, of a pretty Largeness, which steddily keeps the same Method. There is another little *Lake* in *Straglash* at *Glencanich* on Lands belonging to one *Chissolm*; the *Lake* lies in a bottom 'twixt the Tops of a very High Hill, so that the bottom it self is very High. This *Lake* never wants *Ice* on it in the middle, even in the Hottest Summer, though it *Thaws* near the Edges: And this *Ice* is found on it, though the Sun, by the reason of the Reflexion from the Hills, in that Country is very Hot, and *Lakes* lying as High in the Neighbourhood have no such Phænomenon. 'Tis observable also, that about the Borders of this *Lake* the Grass keeps a continual *Verdure*, as if it were in a constant Spring, and Feeds and Fattens Beasts more in a Week than any other Grass doth in a Fortnight.

Our famous *Lake Ness* never *Freezes*; but on the contrary in the Violentest *Frosts*, the greater Clouds of *Steams* do arise from it. And I remember, that at two several times, I being at *Inverness*, walking in the Evenings along the Bridge over the River *Ness*, a *Mist* of those *Steams* coming from the *Lake* and falling down to us over the River (for there was no *Mist* in any place thereabout but on this *Lake* and River only,) our Hair became all White, like the Whiteness of a hoar Frost, but it was Soft and Warm; and this was in the midst of Summer and in Warm Evenings. Dr. *George Mackenzy* (who lives at *Inverness*) told me, that he Observes *Rosemary*, though uncovered, to continue in the Gardens about that *Lake*'s side, notwithstanding the last Winter's long and Violent *Frosts*; whereas a far less Violent Winter ordinarily kills all the *Rosemary* which is in Gardens that lie in Warmer places, and at the Sea-side: And though I live near it, and in a better Soil and warmer Situation, yet any *Winter*, more than ordinary Cold, Kills my *Rosemary*, though covered over with Straw and Litter. This he attributes (and, I think on good ground) to the Warmth occasioned by those *Steams* that frequently arise from that *Lake*.

In *Glevely* at a place called *Achigniglium*, there is a little Rivulet, which so turns *Holly* into a *Greenish Stone*, that they ordinarily make Moulds of it for casting of Balls for Fusees; and Tinkers that work in Brass make both their Moulds and Melting Potts of it; and Women their round ᛋ harls for Spinning. May it not be, that by the long Infusion in *Water*, descending from Hills, which

perhaps abound in Marle, capable to be reſolved into ſmall particles by the conſtant waſhing of the Water, may it not be, I ſay, that theſe little Particles do Intrude into the Cleanſed Pores of the *Holly*, and ſo make up that *Soft Stone*? And any thing Ligneous remaining of the very hard Timber, being all Incruſtated with this Marle, may it not thereby be guarded from the *Action* of the *Fire*?

By *Mr.* Ja. Fraſer. n. 254. p. 230.

2. The Lake *Neſs*, according to Highland Tradition and Bards, has its Name from one *Nyſus* an *Iriſh Hero* that fix'd a Colony in *Stratharig*, with *Dornadillo* his Wife. The Promontory, upon which he had his Reſidence, is to this Day call'd *Doun Dearnill*; and he being the firſt that ever offered to ſet out Boat or Barges upon this Lake, it is after him called *Loch-Neſs*. It is 24 Miles in Length, and in moſt places two in Breadth. One *George Scot*, tried 500 *Fathoms*, and Capt. *Orton* a whole Barrel of Plum-line, but found *no Bottom*. The Banks of this *Lake* aſcend high and Mountainous, with Woods. The *Lake* never *Freezes*, which is imputed to the many great Springs and Fountains in it; the only Fiſh in it is *Salmon*. This *Lake Neſs* diſcharges it ſelf in a River of the ſame Name, ſix Miles in Length, which runs ſlowly yet never *Freezes*, but ſtill *Smoaks* with *Froſt*: And from this *Smoak* is ſpread a Fog over all the adjacent Country.

On the ſide of *Loch Neſs* ſtands the famous Caſtle of *Urqhart* upon a Rock; the great Ditch round it was for the moſt part cut out of the Rock, and received the Water of the *Lake*. This Caſtle conſiſted of 7 great Towers, and 'tis ſaid was built by the *Cuminees*, but had its Overthrow by King *Edward* the *firſt* of *England*; and nothing remains now but one Tower to the Eaſt.

To the Weſtward of this Caſtle about 4 Miles, upon the ſide of *Loch Neſs*, ſtands that great Mountain *Meal fuor vouny*, of a round, neat, high Shape; it will be two Miles of Perpendicular Height from the *Lake*. Upon the very Top of this Hill there is a *Lake* of Cold *Freſh Water*, about 30 Fathom in Length and ſix broad, no Courſe or Stream running to it or from it. I plum'd with 100 *Fatham* of ſmall Line but could find no Bottom. It is always Equally Full, and never *Freezes*.

About 23 Miles Weſt from the End of the River of *Neſs*, there is a Forreſt called *Affaruck*, in which there is a Mountain call'd *Glenin-Tea*; and on the North ſide, under the Shade of a great ſloping Rock, ſtands a *Lake* of *Freſh Water*, call'd *Lochan Wyn*, or *Green Lake*, 18 Foot in Diameter, about a Fathom Deep. This *Lake* is always cover'd with *Ice*, Summer and Winter.

Lough Neagh *in* Ireland; *by Mr.* Will. Molyneux. n. 158. p. 552.

XXV. 1. It is generally agreed by all the Inhabitants thereabouts, that *Lough Neagh* has a *Petrifying* Quality: But that no Wood will *Petrify* in it, except *Holly*. It is alſo aſſerted with ſome probability, that the *Earth* about the *Lough* has this *Petrifying Quality*: For I am certainly informed, that a Gentleman of the Country about this *Lough*, a little before the Rebellion, cut down ſome Timber for building, and amongſt others cut down a large *Holly* Tree, but

but being diverted by the Rebellion from building, his Timber lay on the Ground in the place where it was fell'd, upon the Banks of the *Lough*, all the Miſerable time of the War, till at laſt the Kingdom being ſettl'd, the Gentleman went to look for his Timber, and found the other Timber overgrown with Moſs, and the *Holly Petrify'd*, tho' the Water of the *Lough* had never reach'd it.

And perhaps the *Holly* it ſelf, that grows upon the Banks of this Lough, may be more apt to be *Petrify'd*, than the ſame Wood growing other where; and brought thither, and put into the *Lough*, for certainly if the *Ground* has this Quality, this is very likely to follow.

That what we call *Lough Neagh Stone* was once *Wood*, is moſt probable on theſe accounts *Firſt*, It will not ſtir with *Acids*. 2. It will *Burn* and *Flame*; and the *Smoak* of it ſmells like the *Smoak* of *Wood*. 3. When Burnt it betrays the very *Grain* of *Wood*, with the other Veſſels belonging to *Vegetables*. 4. I have many of them of various degrees of *Petrifcation*; ſome that have clearly loſt the *Colour* of *Wood*, and are become perfectly *Black*, and very *Hard*; others that are not ſo *Black* nor *Hard*; but one more eſpecially was ſent me about a Year ago, which is a Parallelepiped, of about 4 Inches long, and an Inch thick, cut, I ſuppoſe, whilſt *Wood* in that ſhape purpoſely, whoſe *outward Coat* is very *Black*, and ſmooth, but this is meerly ſuperficial, for being cleft longwiſe through the middle, (which it ſuffered far more eaſily than that which is more throughly *Petrify'd)* I there diſcovered the whole *Body* perfectly of the *Colour* and *Grain* of *Holly*, for I can ſcrape it with my Nail; but what was moſt ſurprizing in *it* was, the diſcovery of the *Pith*, as plainly and as perfectly diſtinct in Colour and Texture from the reſt (but it alſo was *Petrify'd*) as it could poſſibly have been ſeen in the *Natural Wood*.

I never have ſeen nor could hear of any part of the *Stone* in the leaſt reſembling *Iron*.

I have uſed ſome endeavours to procure a piece of this *Lough Neagh Stone* to which the *Wood* was yet faſtened, but I never could attain it, tho' ſome aſſert they have ſeen pieces two or three Foot long, with about eight or ten Inches of *Stone* and the reſt *Wood*. Tho' I am apt to believe this may be ſtretching the matter too far, for I conceive that that Humour that *Petrifies* one part, when it begins to operate, Inſinuates it ſelf ſoon throughout the whole Body.

'Tis obſerved that this *Petrifying Quality* is not equally Diffuſed throughout the Whole *Lough* (which is about 15 or 16 Miles long, and 8 or 9 Miles broad in all places) but is moſt ſtrong about that part where the *Black Water* (a River ſo called) empties it ſelf into this *Lough*, that is about the South Weſt Corner; as likewiſe it is ſaid to be more ſtrong about the Edges of the *Lough*, than further into the Water.

I have found upon Trial, that this *Stone* is not *Magnetical*, for it will not ſtir a *Needle*, or *Steel-filings*, neither will it apply to the *Magnet*, in *Powder* or *Calcined*. n. 166. p. 820.

Upon further Trial I find, that though it will not apply to the *Magnet Crude*,

yet being *Calcined* it applies moſt briskly: The occaſion of my former Error being, that I did not *Calcine* it long enough.

By Mr. Edward Smith. n. 174. p. 1103.

2. No Experiment, or Obſervation yet made, (that I can hear of) can prove that this *Lough* has really the Quality of *Petrifying Wood*; or that the *Water* does any way help or promote the *Petrification.* On the Contrary a Neighbouring Gentleman of good Credit and Worth, about 19 Years ago, ſtuck two *Holly Stakes* (a Wood which all agree will ſooneſt *Petrifie* in this *Lough*) in two ſeveral Places of the *Lough*, near that place where the upper *Band* enters into it; and that part of the *Stake*, which for ſo long time has been waſhed by the Water, remains there without any Alteration, or the leaſt Advance towards *Petrification.* It is reported indeed that the *Water* has this Virtue, eſpecially about thoſe Places, where the *Black Water* diſcharges it ſelf into the *Lake:* But it ſeems evident from the very Nature of Liquid Bodies, that any Vertue received in one part muſt neceſſarily be Diffuſed through the whole, at leaſt in ſome Degree; and therefore there is good Reaſon to believe, that the *Water* is wholly *deſtitute* of this *Petrifying* Quality.

But that this Vertue is Certainly, if not Only, in the *Ground* or *Soil* I judge for theſe Reaſons; that there are many *Stones* turned up daily, eſpecially at their breaking *up* new Ground, which we cannot in any Probability think were brought thither: They are often found at two Miles Diſtance from the *Lough*, ſeldom further, in great Numbers, and very Deep in the *Ground*; and a Gentleman (on whoſe Credit I receiv'd the Information) ſaw a Stump of a *Tree* digged out of the *Ground* at a ſmall diſtance from the *Lough*, which by handling of it he found to be *Petrify'd:* He aſſured me the *Roots* and all were *Stone*, and altogether like thoſe *Stones* that are ordinarily found, and go by the Name of *Lough-Neagh-Stones.* This Gentleman was of Opinion theſe were *Lapides ſui Generis*, 'till this Obſervation convinced Him. And that theſe *Stones* were once *Wood* is, I think, very certain, for they ſhew the plain *Veſtigia* of *Wood*; they likewiſe *Burn*; *Cleave*; *Filings* of this *Stone* thrown into the Fire emit a *Fragrant Smell*; and they *cut* kindly with a Knife, though not ſo eaſily as other *Wood.*

That not only *Holly*, but alſo other *Wood* has been *Petrify'd* about this *Lough*, and in the *Soil* adjacent, I have ſufficient Grounds to conjecture on this Account; becauſe ſome Fiſhermen, being Tenants of a Gentleman from whom I had this Relation, told him, they had found buried in the *Mud* of this *Lough* great *Trees*, with all their *Roots* and *Branches Petrify'd*; and ſome of that bigneſs, that they believed they could ſcarcely be drawn by a Teem of Oxen. They broke off ſeveral Branches as bigg as a Man's Leg, and many bigger, but could not move the great Trunk. By this Bulk of it, I gueſs it to be *Oak*, no Trees in that Country, theſe excepted, growing to that prodigious bigneſs; at leaſt 'tis certain that *Holly* never grows to that Bigneſs.

Two Gentlemen of the North told me, that they themſelves had ſeen the ſame Body *partly Wood* and *partly Stone:* But the only Reaſon for thinking ſo, being the Diverſity of Colours, which might well enough proceed from ſeveral Degrees of *Petrification*, we may probably think them deceived;

ceived; for they made no Experiments on that part which they Reputed *Wood*.

The *Bark* is never found *Petrify'd*, as I am informed by a diligent Inquirer, but often ſomething Rotten about the *Stone* anſwerable to the *Bark*.

XXVI. A Gentleman tells me, That he hath met with a place in *England*, where, though there be no *Petrifying Spring* (for that I particularly asked) *Wood* is turned into *Stone* in the *Sandy Earth* it ſelf, after a better manner than by any *Water* I have yet ſeen. I find it to be a very odd Subſtance, wonderfully *Hard* and *Fix'd*. Here is a certain *Stone*, that is thought to be *Petrified Bone*, being in ſhape like a *Bone*, with the marrow taken out; but with a fit *Menſtruum*, *I* found that *I* could eaſily *Diſſolve* it, like other Soft Stones. And poſſibly it may prove as fit as *Oſteocolla*, for the ſame Medicinal Uſes.

Petrifications; *by Mr.* Rob. Boyle. n. 6. p. 101.

XXVII. From the But of a growing *Elm* near *Wadley* (a mile from *Farrington* in *Berks*) one of the ſpreading Claws having been formerly cutt off with an Axe, that part of the But, from whence the ſame was ſevered, being about $1\frac{1}{2}$ foot above ground, and inward within the Trunk of the Tree, hath contracted a *Petrifyed Cruſt*, about the thickneſs of a Shilling all over the *Woody part* within the *Bark*; the marks of the Axe alſo remaining very conſpicuous with this *Petrify'd Cruſt* upon it.

By Mr. Phi. Packer. n. 19. p. 329.

XXVIII. We have ſome *Waters* in *Scotland* that *Petrify*. Upon the North ſide of the *Firth* of *Forth*, ſome 8 Miles from the City, there is a Cove cloſe upon the Sea, the Roof of which is covered with a *Stalagmites* a Foot deep, like the Fringe of a Bed; the upper Coat is of a Sea-Colour, the Juice is as white as the *Sal Prunellæ*; the *Water* which Droppeth from it, if it touch the Skin, maketh it *Smart*. Near to this ſame Cove, is a piece of an hollow Rock, which within, from the Top to the Bottom, is full of ſo many Orders of *Columns*, reſembling the Pipes of a Church Organ, and ſome of different Figures; I broke a ſmall one and found it ſomewhat *Hollow* in the middle. All the *Ground* in this place is full of *Lime ſtone*.

Petrifying Waters *in* Scotland, *by Sr.* Rob. Sibbald. n. 222. p. 321.

XXIX. As I Travell'd over *Stanemoore* in *Yorkſhire*, I obſerv'd the River *Greatah* (a River about half as big as *Charwell* at *Oxford*) Run *under Ground* for about a Mile, ſo that we paſſed over it dry foot. The Paſſage *under Ground* is but Narrow; ſo that in *Winter* when the Streams are High, it keeps the Channel *above Ground*.

The River Greatah *Running under Ground*; *by Mr.* Hugh Todd. n. 163. p. 729.

XXX. At ſome Leagues Diſtance from *Gottenburgh* in *Sweden* that River Ruſhes down from a Prodigious high *Precipice* into a deep *Pit* with a Terrible Noiſe, and ſuch a mighty Force that the Maſts (which are floated down this River to *Gottenburg*) uſually turn Topſy-turvy in their Fall, and do often Fly to pieces when daſhed againſt the Surface of the Water in the *Pit*. This occurs if the Maſt fall Sideways upon the Water; But if they fall Endways, they Dive ſo far under Water that (according to my Information) they Riſe not again

A Cataract *in* Gottenburg *River*; *by Mr.* Gourdon. n. 266. p. 691.

again for ¼ Hour; others ½ Hour; several ¾ of an Hour; and some a whole Hour and upwards. The *Lake* or *Pit* into which they Fall, has been often Sounded with a Line of some *Hundred Fathoms* Long, but never could they find any *Ground*.

River-Water Recover'd *after* Stinking; *by* ..: .:.. n. 127. p. 652.

XXXI. Though it be commonly reputed Peculiar to the *Thames-Water* alone, upon *Stinking* to be recoverable or *Potable* again; I can affirm upon my own knowledge, that *Water* taken aboard at *New-London* in *New-England*, though in 8 days time it *Stunk* intolerably, yet when we came to *Virginia*, it *Recovered* so perfectly, that I made no Scruple to *Drink* of it in Harbour, even when we had Fresh Water newly brought from Shore; nor could I easily perceive, it had any Relicks of its late *Corruption*.

Inundations *in* Gascoyne; *by* M. :... *Ph. Col.* n. 1. p. 9.

XXXII. 1. In the Beginning of *July* 1678. after some gentle Rainy Days, which had not Swelled the Waters of the *Garonne* more than usual, one Night this River *Swelled* all at once so mightily, that all the Bridges and Mills above *Tolouse* were carried away by it. In the *Plains* which were below this Town, the Inhabitants, who had built in places which by long Experience they had found safe enough from any former *Inundations*, were by this Surprised; some were Drowned together with their Cattle; others had not saved themselves but by Climbing of Trees, and getting to the Tops of Houses; and some others who were looking after their Cattle in the Field, warned by the *Noise* which this Horrible and Furious Torrent of Water (Rowling towards them with a Swiftness like that of the Sea) [in *Britaigne* he means] made at a Distance, could not scape without being Overtaken, though they fled with much Precipitation: This nevertheless did not last many Hours with this Violence.

At the same time exactly, the two Rivers only of *Adour* and *Gaue*, which fall from the *Pyrænean Hills*, as well as the *Garonne*, and some other little Rivers of *Gascoyne*, which have their Source in the *Plain*, as the *Gimone*, the *Saue*, and the *Rat*, Overflowed after the same manner, and caused the same Devastations. But this Accident happen'd not at all to the *Aude*, the *Ariege*, or the *Arise*, which come from the *Mountains* of *Foix*, only that they had more of the same than those of the *Conserunt*, the *Comminge*, and the *Bigorre*.

M. *Martell* (by the order of M. *Foucault*) hath searched after the Cause of this *Deluge*, being assur'd that it must have had one very Extraordinary: For all who had seen the Circumstances agreed, that it had *Rain'd* indeed, but that the Rain was neither so great, nor lasted so long, as to swell the Rivers to that Excess, or to Melt the *Snows* of the Mountains.

But the *Nature* of these *Waters*, and the manner of their Flowing from the Mountains, confirm'd him perfectly in his Sentiments. For, 1. The Inhabitants of the *Lower Pyrænean* observ'd, that the Water flowed with Violence from the Entrails of the *Mountains*, about which there were open'd several Channels, which forming so many furious Torrents tore up the Trees, the Earth, and great Rocks, in such narrow places where they found not a passage large enough.

nough. The Water alſo which *Spouted* from all the ſides of the Mountain in innumerable *Jets*, which laſted all the time of the greateſt Over-flowing, had the *Taſt* of *Minerals*.

2. In ſome of the Paſſages, the Waters were *Stinking* (as when one Stirs the *Mud* at the Bottom of the *Mineral Water*) in ſuch ſort that the Cattle refuſed to Drink of it, which was more particularly taken notice of at *Lomber*, in the Overflowing of the *Saue* (which is one of the Rivers) where the Horſes were 8 Hours Thirſty before they would endure to Drink it.

3 The Biſhop of *Lombez* having a deſire to cleanſe his Gardens, which the *Saue* paſſing thorow by many Channels by this Overflowing, had fill'd with Sand and Mud; thoſe which entered them felt an *Itching*, like to that which one feels when one Baths in *Salt Water*, or Waſhes ones ſelf with ſome ſtrong *Lixivial*. This *Itching* could not be produc'd by either *Rain* or *Snow Water*, but by ſome *Mineral Juice*, either *Vitriolick* or *Aluminous*, which the Waters had Diſſolved in the *Bowels* of the *Mountains*, and had carried along with it in paſſing out through thoſe numerous Crannies.

For theſe Reaſons M. *Martel* Believes the true Cauſe of this *Overflowing* to be nothing elſe but *Subterraneous Waters*. And to explain the Means of this *Irruption*, he ſuppoſes that there is in the Earth a great Number of *Baſons*, *Cavities*, or great *Receptacles* of a vaſt Extent full of Water, from which by divers iſſues into lower paſſages there gets and runs out Water enough to furniſh that which runs above the Earth, during the Seaſons that it Rains little or nothing.

One cannot well doubt of the Truth of this Suppoſition if he conſiders. 1. That in *Mines* as well as in *Pits*, the more one diggs the more abundance of Water is met with. 2. That there are *Rivers* that the *Earth Swallows*, as that of *Guadalquivir* in *Spain*, and others that *Guſh* out of it compleat Rivers. 3. That there are *Gulphs* in divers parts of the *Sea*. 4. That there are *Lakes* without Bottoms, conſonant to what *P. Kircher* remarks in his *Mundus Subterraneus*, which *Diminiſh* not at all, and yet receive little or nothing of Water from above. Such as are in the ſame *Pyrænean* Mountains the *Lake* of *Berwale*, of *Barboiau*, and St. *Pé*. 5. And to Conclude, That there are found in Caves vaſt *Subterraneous Lakes*; as amongſt others, that in a Cave near *Grenoble*, of which *Francis* the *firſt* had the Curioſity to deſire to know the Extent, having cauſed a Boat to be made for this Purpoſe. Hence we muſt conclude, that the *Inner parts* of the *Earth* are like a Spunge Dipped in Water, and ſoaked on every ſide; or like our Body filled with differing Veſſels which are the Canals, through which the Blood is communicated to the whole Body.

This being ſo, 'tis not at all difficult to underſtand how the Earth thus conſtituted may ſuffer, in proceſs of Time, great *Changes* within its Bowels, as well as on its Superficies, where the parts of Mountains and vaſtly great Rocks Separating and Tumbling down, Cruſh ſometimes whole Towns, as it happen'd in the Year 1618. to the Town of *Pleurs*, in the *Valtolen*, by the fall of a Rock which hung over that Town. This Matter is more eaſily to be done in the Bowels of the Earth, becauſe the Waters or *Subterraneous Rivers* do ſoak,

and

and by Degrees undermine the parts of the Earth which uphold the heavieſt Mountains: Whence it muſt neceſſarily follow, that theſe ſame Mountains muſt Sink down in Proportion to the Maſs they have loſt. And 'tis certain, that ſomewhat like this happened in theſe *Mountains*: For the People which inhabited thoſe parts, have ſeen the Earth Cleft in divers places. And have obſerved alſo, that in ſome Places there have happen'd *Founderings* of the *Earth* for a very conſiderable Extent, one part of the Mountain being Separated, Sunk down, which appeared by the profound Clefts many Feet deep, but of little Breadth. So this Maſs of the Mountain in its Settling all at once upon the Water of the Gulphs or *Subterraneous Lakes*, which are under the higheſt *Pyræneaη* Mounts, in all the extent they take up from *Le Foix* even to *Bern*, do force the Water to *Guſh* out all together with great Violence to the ſame Quantity with the Bulk of that part of the Mountain which is Settled in the *Subterraneous Lakes*, which is the Cauſe of this Prodigious Overflowing.

But that which will not ſuffer me to doubt at all but that there was ſome ſuch *Subterraneous* Tumbling down, is this, that three Months after this furious *Inundation*, that is to ſay, about the end of *September*, there happen'd a *Second Overflowing* in ſome Places near to thoſe where the firſt happen'd, which made alſo great Spoil, particularly that which came from the River of *Arriege*. And 'twas then Remarkable, That a Fountain that runs from a Rock upon the *Lot*, near the *Cahors*, conſiderable for the Abundance of it's Water which turns three Mills at its very Source, became all *Red*, which was never ſeen before in the Memory of Man.

Some Effects of Vitriolate Waters; *by Mr.* J. Beaumont. *Ph. Coll.* n. 2. p. 6.

2. One *Will. Dally*, an able Miner, being employed at *Week* in *Gloceſterſhire*, about 2 Miles from *Kenyſham*, to renew an *Old Work* which was about 6 Fathom deep, and was more than half full of Water, he drew what he could out with a Bucket, and then he went down into the *Mine* to clear out the remainder. Having ſtood in the Water ſome Days his Legs began to *Itch* extreamly, and *Swell'd* very much, and at length broke out into *Sores*. I enquired of him how the *Ore* lay in it's Mine, and he told me the Vein of *Ore* grew in the middle of a Vein of *Sulphur* (as he call'd it) that is, *Marchaſites*, which was about a Yard wide; from this I eaſily gathered, that the *Waters* in the Mine, having ſtood a long time on that large Bed of *Marchaſites*, was ſtrongly impregnated with the *Vitriolate Salts*, which abound in them, and was the Cauſe of the *Itching* and *Swelling* of his Legs.

An Inundation *in* Ireland; *by Dr.* Hook. *Ph. Col.* n. 2. p. 1.

XXXIII. *Jun.* 26 1680. An *Inundation* happen'd not far from *Londonderry* in *Ireland*, more Monſtrous than that in *Gaſcoyne*. 'Tis ſuſpected that both proceeded from ſome extraordinary Change in the *Subterraneous Caverns* of thoſe Hills from whence the Water guſhed, very few Mountains being without them.

Inundations *in* Yorkſhire; *by Mr.* R. P. n. 245. p. 382.

XXXIV. 1. The Inhabitants of *Kettlewell* and *Starbotton*, in *Craven* in the County of *York*, ſuffer'd a very great Loſs in *June* 1686. by a ſuddain *Overflow* of *Water*. The Towns are ſituate under a great *Hill* on the Eaſt and Weſt; the Countrey is very *Mountainous* and *Rocky*. The Deſcent of *Rain*

was

was after a Thunder-Clap, for about the continuance of an Hour, and half with extraordinary Violence, and by ſeveral Eye-Witneſſes the *Rock* on the Eaſt ſide Opened Viſibly, and Water they beheld thence into the Air the height of an ordinary Church-Steeple; ſo that the *Current* of Water came down the Hill into the reſpective Towns, as in one entire Body, and with a *Breaſt* as if it would have Drowned the whole Towns, Several Houſes were quite Demoliſhed, and not a Stone left; others Gravell'd to the Chamber-Windows; ſome Inhabitants driven, until this Day, from their Habitations, the Current of the Water running through their Houſes; mighty Rocks Deſcended from the Mountains into the Valley, and there lie immoveable; many fair Meadows covered with Sand and Stones, that the Worth of the Soil will not Regain the ſame; Houſhold Goods taken away into the great River of *Wharfe*, and ſo loſt, beſides many Quick Goods. The Loſs reputed to be many Thouſand Pounds; many Families quite Ruined, others in part only.

There have been *two* other *Floods* ſince the *firſt*, though not ſo great and dangerous. The *Becks*, or *Currents* of *Water*, which run through theſe Towns were ſo Gravell'd up by the *firſt Flood*, that the Paſſage is much altered, and cannot be *Regain'd*; though there have been many Hundreds of Men ſet to do it.

2. *Mar.* 22. 169⅚ At half an Hour after 12 a Clock, being Calm but a little *Rainy* Weather, the River which paſſeth by the plain Ground of *Noordwyck*, did in the ſpace of a Quarter of an Hour *Swell* to that Height, that the Sugar-Mill, the Sugar-Work, and almoſt all the ſaid Ground was thereby Ruined, the moſt part of the Sugar Canes being rooted or torn out of the Ground by the Violence of the *Torrent*. We cannot Imagine whence ſo ſudden a *Swelling* of this River has been cauſed, while the *Rain* not being very hard, could not be of that Effect; for in ſuch Caſe it ſhould have continued longer; for about 12 a Clock, when the Company's Servants aſſembled for their Dinner, the Water of the River was at it's ordinary Height, and before they had half Dined all the Country was *Overflown* by the Water, *viz.* one Foot higher than 2 Years ago by Reaſon of the *Hurricane*, when we had ſo Violent a Storm as ever was heard of. And at one a Clock all the extraordinary Water was Gone, and the River again at it's Ordinary Height. There has been no *Earthquake* that could Cauſe it, neither was there any ſuch thing in other *Rivers*.

In Mauricius Iſland; *by M.* Roel of Diedati. n. 242. p. 268.

XXXV. In order to compare the Quantity of *Rain* with the Quantity of Water running away in *Springs* and *Rivers*, it is neceſſary to meaſure theſe two ſorts of *Water*. Thoſe that make Profeſſion of governing and conveying *Spring-Waters*, ſay that a Cubick Inch of Water yields in 24 Hours 144 *Muids*, (the name of a *French* Meaſure, holding 280 *French Pints*;) others ſay, it yields but 70 of that Meaſure.

The Origine *of* Fountains *and* Rivers; *by* M..... n. 119. p. 447.

But I have Reaſon to believe, that it yields 83 of this Meaſure, and follow thoſe that ſay, that a Veſſel of two Foot deep, long, and broad, holds one *Muid* of Water.

And therefore if a *Conſervatory* ſhould hold 3378 *Muids* of *Water*, it would furniſh for a whole Year a ſufficient Quantity to make an *Inch* of Water run conſtantly. As for the Meaſure of *Rain Water*, I have found by Obſervations that from *Oct.* 1668 to *Oct.* 1669, there had fallen ſo much of it as mounted to the *Height* of 18 *Inches* 7 *Lines*; and from the ſame Month 1670 to the ſame Month 1671, there happen'd only ſo much as came to the *Height* of $8\frac{1}{2}$ *Inches*; and from *Jan.* 1673 to *Jan.* 1674 to the Height of $27\frac{1}{2}$ Inches. Of which, taking the Medium, we have 19 *Inches* and $2\frac{1}{3}$ *Lines*.

This ſuppoſed, let us Eſtimate ſome *River*, as it runs from it's very Source to a Place where ſome Rivolet enters into it, and ſee, whether the *Rain Water* that falls about the Courſe thereof, if it were put into a *Conſervatory*, would be ſufficient to make it Run a whole Year. In order to this I have conſidered the *Seine* which from its Source to *Ainay le Duc* is about 3 Leagues long, and the ſides of it's Courſe extend themſelves on the Right Hand and the Left about 2 Leagues on each ſide, where there are other little Rivers that run another way: And, ſince that thoſe Rivolets need Water to maintain them as well as the *Seine*, I will count but half that ſpace of the ſides, and ſay, that the Place where the *Seine* paſſes, hath from its Source to *Ainay le Duc* three Miles long and two Miles large. Whereupon I ſay further, if a *Conſervatory* were made for this bigneſs, it would be 6 ſquare Leagues in Surface, which being reduced to Fathoms, would make 31245144 Fathoms in Surface. In this *Conſervatory* Imagine that during a whole Year there has fallen *Rain* to the *Height* of 19 *Inches* $2\frac{1}{3}$ *Lines*, as was ſaid before. This Height of 19 *Inches* and $2\frac{1}{3}$ *Lines* gives 280899942 *Muids* of *Water*, or there about, according to the Meaſure ſuppos'd.

All this Water thus Collected is that Stock which is to ſerve to make this *River* run for a whole Year, from its Source to the Place before Named, and which muſt alſo ſerve to ſupply other Occaſions and Loſſes, ſuch as are the *Feeding* of *Trees*, *Herbs*, *Vapours*, and extraordinary *Swellings* of the *River* whilſt it *Rains*, and *Deviations* of the *Water* running another Way.

Concerning the Meaſure or Eſtimate of the Water of this River, it would be difficult to find it juſt and preciſe, and to determine what Quantity it furniſhes. Yet ſo far as I was able to judge, it can have no more than 1000 or 1200 *Inches* of Water always running, compenſating the leſſer Quantity it hath at its Source with the greater it hath towards *Ainay le Duc*: The which I ſo judge by the Compariſon I make of theſe Waters with thoſe of the River of the *Gobelins*, in the Condition wherein it is towards *Verſailles*, where it hath 50 *Inches* of Water, according to the Meaſure taken of it. So that I eſteem, it will be enough to allow twenty four or twenty five times as much to our River. For the Channel of it is to be 4 or 5 Fathoms large, and for Depth it is but Shallow; it Carries no Boats, and ſerves only to Float down ſome looſe Billets.

Theſe Particulars being thus ſuppos'd, I ſay, that 1200 *Inches* of *Water* do furniſh in 24 Hours 99600 *Muids* of Water after the Rate of 83 *Muids* to an *Inch*, that is 36453600 for a whole Year. And therefore taking this Quanti-

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ty of 36½ *Millions* from the 280 *Millions* that falls into the *Conservatory* above described, there will remain yet above 188 *Millions* of *Muids*, which amounts to almost 5 times as much, and which serves to furnish for the *Losses Diminutions*, and other *Wastes*, above taken notice of. So that there needs but the *6th* part of the *Rain* and *Snow-water* that falls in a Year, to run continually through the whole Year.

Now if these *Rain Waters* are sufficient to make one *River* run, they may also suffice for all the rest in Proportion; considering especially, *first*, what remains for *Waste*, which is superabundant; and *Secondly*, what little space I allow to both sides of the River's Course, which is but of one League on each side. For Rivers are not commonly two Leagues near one another.

It may be Objected, that there are Countries where it *Rains* but *Seldom*, and somewhere it *Rains not at all*, and yet there are *considerable Rivers*. But I answer, that the *Rivers* of those Countries, where it *Rains but Seldom*, do not run continually, being only big in Winter, but in Summer almost quite dryed up. The Reason of both which Effects is, that they being nigh some high Mountains whence they come, the *Snow* that falls in Abundance on those Hills, and is *Melted* afterwards, is able, as long as that Water lasts, to make them run abundantly in Winter, leaving them Dry when it ceases in Summer.

As for the Countries where it *Rains not at all*, there are but few of them in the World. The *Torrid Zone* (where that may be more true than any where else) is a Climate abundantly Moistned with *Rains* twice a Year, and it may be more than these Northern Countries, at least in greater Plenty at certain Seasons. But if there should be any Countries where *no Rain at all* should Fall, that will not hinder the Running of Rivers there, because they may have their Sources in other Countries where it *Rains*, as the *Nile* in *Ægypt* where it *Rains not*.

XXXVI. 1. About 2 Leagues from *Paderborn*, is a Treble Spring call'd *Metborn*, which has 3 Streams, two whereof are not above one Foot and an half distant from one another, and yet of so differing qualities, that whereas one of them is Limpid, Blewish, Lukewarm, Bubling and holding *Sal Armoniack*, *Ochra*, *Iron*, *Vitriol*, *Allum*, *Sulphur*, *Nitre*, *Orpiment*, used against *Epilepsies*, bad *Spleens*, and the *Worms*; the other is Ice Cold, Turbid and Whitish, much Stronger in *Tast*, and Heavier than the former, holding much *Orpiment*, *Salt*, *Iron*, *Nitre*, and some *Sal-Armoniack*, *Allum* and *Vitriol*; of this all Birds observed to Drink of it do *Dye*; which I have also privately Experimented by taking some of it home, and giving it to Hens, after I had given them Oats, Barly, and Bread Crums: For, soon after they had Drunk of it, they became Giddy, Reeled and Tumbled upon their Backs, with Convulsion Fitts, and so Dyed with a great extension of their Leggs Giving them common *Salt* immediately after they had Drunk they Dyed not so soon; giving them *Vinegar* they Dyed not at all, but 7 or 8 days after were troubled with the *Pipp* Those that Dyed being opened, their *Lungs* were found quite Shrivelled together. Yet some Men that are troubled with *Worms*, taking a little Quan-

Mineral Springs, *about* Paderborn *in* Germany; *by* .... n. 7. p. 133.

tity of it, and diluting it in common Water, have been obſerved by this means to kill the *Worms* in their *Bellies*, ſo that a great Number of *Worms* came from them; whereupon though they are Sick, yet they Dye not. As to the 3*d* Stream that lies lower than the other two, about 20 paces diſtant from them, it is of a Greeniſh Colour, very Clear, and of a Sour Sweet Taſt, Pleaſing enough. It hath about a middle *Weight* between the other two, whence we gueſs, that it is mixed of them both, meeting there together; to confirm which we have mixed equal Quantities of theſe two, with an addition of a little common Well-water, and have found that they, being ſtirr'd together and permitted to Settle, made a Water juſt of the ſame *Colour* and *Taſt* of the 3*d* Stream.

At Baſel; *by* ... *ib. p.* 134.

2. At *Baſel*, the *Spring* running in the *Gerbergaſſe* (or *Tanners Street*) from St. *Leonard's Hill*, is of a Blewiſh Colour, and ſomewhat Troubled, holding *Copper*, *Bitumen*, and *Antimony*, about 3 parts of the *firſt*, one of the 2*d* and two of the *Laſt*; as have been examined by Skillful Perſons. Our *Tanners* do water their Skins in it; and being a well Taſted and Wholeſome Water, it is both much *Drunk* and uſed to *Bath* in.

There are two others, called *Randulphs Well*, and *Brun Zam Brunnen*, very Obſervable: The *former* of them having a *Camphory* and Drying Quality, and uſed againſt *Hydropical* Diſtempers; the *latter* containing ſome *Sulphur*, *Salt Peter* and *Gold*, and being an excellent Water to *Drink*.

Near Yeoville *in* Somerſetſhire; *by Dr.* J. Beal. n. 18. p. 323. n. 20. p. 359.

3. Mr. *Philips* of *Montague* has in his Paſtures of *Socke*, about 3 Miles from *Yeovill*, a large Pool to which *Pigeons* reſort, but the *Cattle* will not Drink of it, no not in extream want of Water. To the *Taſt* it is not only *Brackiſh*, but hath other Loathſome Taſts. In a Venice Glaſs it looked Greeniſh and Clear, juſt like the moſt Greeniſh Cyder as ſoon as it is perfectly Clarified. I boil'd a Pint of it in a Poſnet of Bell Mettal, and ſuddenly it yielded a thick Froth, having ſomewhat of a *Vitriolate Taſt*. Suffering the Water to be Boyled all away, it left much of the ſame on the ſides and bottom of the Poſnet.

On Malvern Hill *in* Herefordſhire; *by Dr.* J. Beal. n. 20. p. 358. n. 57. p. 1161.

4. There is a Spring near the Top of *Malvern Hill*, having a long and old Fame for *Healing* of *Eyes*: And about a Furlong lower is another *Healing Spring*. When I was for ſome Years moleſted with *Tetters* on the back of one and ſometimes of both my Hands, notwithſtanding all endeavours of my very friendly and Skilfull Phyſitians, I had ſpeedy Healing from a Neighbouring *Spring* of far leſs Fame. Yet this Spring Healed very old and Ulcerous Sores on the Legs of a poor Fellow, which had been Poiſoned by Irons in the Goal, after other Chirurgery had been hopeleſs. And by many Trials upon my Hands and the *Tetters*, I was perſwaded, that in long *Droughts* and laſting *Dry Froſts*, thoſe Waters were more effectually and more ſpeedily *Healing*, than at other times. I held this Water in my Mouth till it was warm, and perchance ſomewhat intermingled with Faſting Spittle, and ſo dropping it upon the *Tetter*, I there could ſee it immediately gather a very thin *Skin* upon the Raw Fleſh, not unlike that which is ſeen to gather upon Milk over a Gentle Fire. This *Skin* would have ſmall Holes in it, through which a Moiſture did iſſue

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in ſmall Drops, which being Wiped away, and the Water continued to be Dropp'd warm out of the Mouth, the Holes would diminiſh, and at laſt be all quite Healed up.

For the *Eye Waters*, I conceived them more ſtrongly *Terſive*, and Clearing the *Eyes*; and they had a Rough Smartneſs, as if they carried Sand or Gravel into the *Eye*.

5. I think the Waters we call *Chalybeate*, and particularly this at *Farrington*, to be impregnated principally from the *Vitriol*, or *Salt* of *Iron*, which is very Volatile; ſo that little of it can be found by Evaporation of a great quantity, or from the Precipitated Sediment. I put 4 Ounces of ordinary clear Water into a Glaſs, and impregnated it with a known proportion of *Gall*: Then by degrees I let fall into it the *Salt* of *Iron*, until I found it thereby as deeply Tinged Red, as the ſame quantity of *Farrington-Waters* would be by the ſame proportion of *Gall*: The quantity of the *Salt* of *Iron* that performed this, was near two *Grains* This Water, ſo Tinged, Taſted and Smelled juſt as the natural Water from the Spring with Gall did: If I added a greater proportion of *Salt*, it would make it Nauſeous and *Emetical*.

At Farrington *in* Dorſetſhire; *by Dr.* Highmore. n. 56. p. 1130.

It begins to be in high Eſteem for extraordinary Cures of the *Scorbute*, *Aſthma*, *&c.* It hath [as I have found upon Trial] a larger proportion of the *Mineralls*, than *Aſtrap-water*; but the force holds not, if *Removed* from the *Spring-head*.

n. 51. p. 1039.

6. About a Mile and half out of *Durham*, on the North-Eaſt-ſide near *Butterby*, is lately diſcovered a *Medicinal Spring*, which is this Year much frequented, and may be of great benefit to the Country. It was found out by Workmen that dug in that place for Coal. When they were 12 Fathom and an half deep, they diſcovered this Treaſure of *Natural Phyſick*. They then tryed the Rock about 100 Yards off; where they loſt themſelves much about the ſame Depth; and inſtead of *Coal* diſcovered a *Spring* of excellent clear Water, which iſſues out at the Hole which their Inſtruments made.

In the Biſhoprick *of* Durham, *by Mr.* Hugh Todd. n. 163. p. 727.

7 At *Lancarim* in *Glamorganſhire* is a *Medicated Spring*, much frequented from ſeveral Counties, time out of Mind, for the *King's Evil*. There is a Rill of about an Ell broad between two Collines, covered with Wood; about 12 Yards from this *Spring*, the Rill falls from a Rock 8 or 9 Foot high, which makes a grateful Noiſe; the *Spring* (which is exceeding *Clear*) comes out of a pure *White Marle*; tho' I thought there had been no *White Marle* in *Wales*, for the Earth is *Red*. A *Graduate Doctor* hereabout imputes the Virtue of this *Spring* to the *Lime Stone*, and ſays one of the chief Ingredients of the Doctors for the *King's Evil*, is *Lime water*.

In Glamorganſhire; *by Mr.* Aubry. n. 233. p. 727.

8 I had a *Mineral Water* ſent me, not long ſince, by Mr. *Duncan* (a Surgeon) from *Eglingham* in *Northumberland*. *I* found it turned almoſt quite *Black* with *Galls*, though it had been brought at leaſt 30 Miles by Land-Carriage. After *I* had ſlowly, in a Glaſs, Evaporated more than one half of this Water, it ſtill retained the ſame *Atramentous* Quality, and ſtruck yet as Deep with Galls as ever; and at laſt it yielded me a Real and Genuine *Vitriol*. *I* ſay nothing of the *Ocre* which this Water let fall in very great Plenty, that being a thing common to all *Atramentous* Waters.

At Eglingham *in* Northumberland; *by Dr.* Cay. n. 245. p. 365.

I was ſurprized at this Phænomenon: For *I* could not bring my ſelf to think it poſſible, that the *Pyrites*, lying conſtantly under *Water*, ſhould ever yield *Vitriol*; and I knew of nothing elſe (at leaſt in *England*) that I could expect it from. But having lately an Opportunity to viſit this *Notable Well*, *I* found our mighty Rarity, our *Vitriol-Water*, to be only on old *Drift* made for the Draining of a Row of old-wrought *Coal Pits* a little above, and *I* inform'd my ſelf from ſome old Men, that had formerly wrought in theſe Pits, that there was Plenty of the *Pyrites* there, by them call'd, *Braſs Lumps*; and that this *Drift* was ſometimes Dry, and ſometimes ran with a plentiful Stream; which is as fair and full an Account how this Water comes to have *Vitriol* in it, as any one need to deſire.

At St. Amand *near* Tournay; *by M.* Geoffry. n. 247. p. 430.

9. There has been found a *Mineral Water*, call'd St. *Amand's Water*, which has been very much in uſe the laſt Summer and Autumn, in all ſorts of Sickneſſes, rather for it's Novelty, than for its great and extraordinary Properties. It is call'd St. *Amand's Water*, becauſe its *Spring* is in the Land depending on the *Abby* of the ſame Name, of the Order of St. *Benedict*, in the Dioceſe of *Tournay* in *Flanders*; but the *Fountain* is call'd particularly, *La Fountaine du Bouillon*, for the impetuous *Boyling* of that Springing Water.

This *Fountain* is ſituated in a Shallow and Marſhy Ground; the Baſon of the Spring is 450 Foot ſquare, there is in the Bottom of that Baſon the *Mud* of 20 Foot deep; beyond that they find the *Sand*, which ſometimes is very moving and at ſome other times is very firm. Very often this *Fountain* caſts up a great Quantity of *Sand:* And laſt Year in a little Time it caſt up more than 16 Cart Loads of it, by the which all the Baſon was border'd.

There is to be found 3 ſorts of *Earth*; the firſt and Superficial is *black*, and Burns as Turf, with the ſame Smell; the ſecond is *White*; and the 3d has the ſame *Colour* as the *Slate*. Theſe two laſt ſorts of *Earth* do give, by *Lixivium*, a *Salt* like *Sal Gemmæ*.

This St. *Amand's Water* in its *Spring* is Clear and *Luke Warm*, and appears much Hotter at Night and in the Morning, than the reſt of the Day. It has the *Smell* and *Taſte* like Standing Water. If it is expoſed to the Air it loſes its *Smell* and *Taſte* in a ſhort time. By that Facility to loſe its *Taſte* and *Smell*, one may judge that it has a *Sulphur* very *Volatile*; and for that great *Volatility* and *Subtility* it is almoſt impoſſible to make any Experiments upon it.

This *Mineral Water* has the ſame *Weight* as the *Seine* River Water. It altered not the Colour of the *Sirrup* of *Violets*, nor the *Tincture* of *Turne Sol*, *Lime Water*, the *Oyl* of *Tartar*, the *Volatile Spirit* of *Sal Armoniack* and *Hart's Horn* have *Whited* that Water, and have made in it a light *Coagulum*.

This Water, mixt with the *Diſſolution* of *Armoniack Salt*, has not given any *Smell*. It has not alter'd the *Infuſion* of *Galls*. Mingled with the *Solution* of *Vitriol*, has troubled it a little, and has given a *Greeniſh* Colour, and at length it Precipitated a *Yellow* Powder.

Acid

Acid Spirits have not *Fermented* at firſt with that Water, but afterward it has made ſome little Bubbles, which remained to the ſide of the Glaſſes wherein were contained the Liquors.

I have *Diſtilled* 5 Pints of that Water; the *Diſtill'd* Water has not had any *Taſte* nor *Smell*, and it has not Changed the *Tincture* of *Turne Sol*, neither the *Lime Water*. There remained from that 5 *Pints* (or 160 *Ounces*) 70 *Gr.* of *Reſidue*; the which, by *Lixivium* has given to me 55 *Gr.* of Grey Earth, and 15 *Grains* of *white Salt*, almoſt like *Sal Gemmæ*.

The *Reſidue* of the Evaporated Water put upon the Burning Coals, has not caſt any *Smoak*, neither has made any *Detonation*; the *Spirit* of *Nitre* poured upon it, has very much *Fermented*; the *Spirit* of *Wine* has not extracted any *Tincture* from that *Reſidue*.

One may conclude by all theſe Experiments, that this *Water* has not any *Acidity*, it participates not of *Vitriol* nor of *Alum*; and there is in it but a little Quantity of the *White Earth*, and leſs alſo of *Salt* very like *Sea Salt*

They are the Parts of *Earth* and *Salt*, which ſhew themſelves in the Mixture of the *Lime-Water*, *&c.* of *Fix'd* or *Volatile Alcalis*.

They are the ſame Parts which begin that light *Fermentation* in the Mixture of *Acid Spirits*; but that *Fermentation* is imperfect becauſe of the little Quantity of the *Earth*, which is Drown'd in ſo great a Quantity of Liquor; in Effect when the Water is *Evaporated*, the *Acid Spirits* do *Ferment* very much with the *Reſidue*.

It appears by the *Smell* of that Water, that it contains a *Sulphur* very *Subtile*, which diſſipates it ſelf very eaſily, and which is not ſenſible in the Experiments. 'Tis nevertheleſs to be attributed to that *Sulphur*, the principal Effects which they do attribute to that *Mineral Water*, as of helping in the *Palſy*, *&c.* in other ſorts of Diſtempers where the *Nervous Gender* is attack'd; in *Short-Breath*, and in all Affections of the *Lungs*; and of Remedying many other Infirmities which are cauſed by the *Sharp Ferments*, the which are ſweetned by that Water. For the other Properties of it, as of *Purging*, of taking away *Obſtructions*, of Tempering the *Hot Intrals*, *&c.* it may have the ſame Effects with common Water being drunk abundantly.

One may Drink many Glaſſes of this Water beginning by 4, 6 or 8 every Morning, and augmenting till 12, 18, 20 or more, according as the Stomack is able to ſupport it. This Water *Paſſes* readily by *Urine*, and many Perſons are *Purged* by it. Sometimes one may mix with it ſome *Diuretick Salt*, to make it *Paſs* more freely, and for rendring it more *De-obſtructive*. At other times one may put ſome *Manna* or other things for making it more *Purgative*. One may Waſh alſo in the *Mud* of that *Fountain*, according to Neceſſity.

XXXVII. I have obſerved a *Spring*, that in all the Extream *Froſts*, that have been theſe 10 Years, hath yielded a ſmall Stream, which running over a large Tract of Paſture, keeps all the Banks and Borders *Green*, and free from

A Spring *that is never* Frozen; *by Dr.* J. Beale. n. 56. p. 1169.

from *Freezing*, Diſſolving the *Snow*, and *Smoaking* all the way where it runs.

The Baths *in* Somerſetſhire; *by Mr.* Joſ. Glanvill: n. 49. p. 977.

XXXVIII. 1. The Country round *Bath* is very Hilly and Uneven; but the Hills lye in order; they are generally Rocky and Steep from South-Weſt and by Weſt, to North-Eaſt and by North: The whole Tract of the Country, within 5 and 7 *Miles*, abounds with *Coal-mines*, more or leſs. But there are no other conſiderable *Mines* that *I* can hear of, nearer than *Mendip*, which is 10 *Miles* hence, excepting ſome of *Lead* at *Berry* in *Gloceſterſhire*, which lyes upon the North of this place, about 4 or 5 *Miles* diſtant.

2. The Hills for the moſt part afford a *Free-ſtone*; and on the North Weſt of *Lansdown* (which hath that Situation to the Town, and is juſt above it) the Stones digged there, are a ſort of Hard ſtone, commonly call'd a *Lyas*, blue and white, Poliſhable.

3. The *Town* and *Baths* are of very great *Antiquity*. Beſides what I find in very ancient Chronicles to that purpoſe, one of our great Antiquaries (Mr. *P.*) aſſerts, that theſe *Baths* were 800 Years *before Chriſt*: Which if ſo would give occaſion to enquire, how conſiſtent with it that Hypotheſis, concerning the Cauſe of the *Heat* of theſe *Waters*, may be, which makes it to be the *Fermentation* of Minerals *in fieri*; and whether it be likely, that the Minerals through which theſe Waters paſs, ſhould be in that ſtate of *Imperfection* ſo many Hundred Years. But this other Opinion ſeems to me very Probable which ſuppoſeth the *Cauſe* of the *Heat* to be, that two Streams having Run through and Imbibed certain ſorts of Different Minerals, Meet at laſt and *Mingle* their Liquors, from which *Commixture* ariſes a Great *Fermentation* that Cauſes *Heat*; like as we ſee it is in *Vitriol* and *Tartar*, which when *Mingled* beget an *Intenſe Heat* and *Ebullition*.

4. It is affirmed here, that the *Town* for the moſt part is built upon a *Quagmire*, though the places all about it are very Firm ground. Some Workmen, that have been employed in digging, have found a *Mire* 10 foot deep: Without the North gate, the higheſt place of the Town, at *Seaven*. The Earth between is a kind of *Rubbiſh*; ſometimes they find *pitching* a man's length underground, and paſſages for the Water to paſs 7 or 8 foot down they have met with *Oyſter-ſhels*.

5. The Town and Country circumjacent, generally abound with *Cold Springs*: And in ſome places the *Hot* and *Cold* ariſe very near each other; in one place, within two Yards, and in others, within 8 or 9 of the Main *Baths*.

6. The *Guides* of the *Croſs-Bath* inform me, that when there is a great Weſt Wind abroad, ſtanding by the *Springs* they feel a Cold Air ariſing from beneath: If the Wind be at Eaſt and the Morning cloſe with a little miſling Rain, the *Croſs Bath* is ſo *Hot* as ſcarce to be endured, when the *King*'s and *Hot Baths*, are *Colder* than uſual. In other Winds let the Weather be how it will, this *Bath* is Temperate. The *Springs* that *Bubble* moſt are *Coldeſt*. The *Croſs-Bath* fills in 16 hours, both in Winter and Summer, without any difference

difference from Heat or Cold, Flouds or Drought; That of the *Kings* in 12 or 14 hours.

7. A Man may better (ordinarily) endure 4 hours Bathing in the *Croſs Bath*, than 1½ in the others. In the *Queen's Bath* (which hath no *Springs* of its own; but comes all out of the *King's*) they have found under a flat ſtone, which upon occaſion was taken up, a Tunnel, and a Yielding *Mud* in and under it, into which they thruſt a Pike, but could feel no bottom. In the *Kings Bath* there is a Spring ſo *Hot*, that it is ſcarce Sufferable, ſo that they are fain to turn much of it away, for fear of inflaming the *Bath*. The *Hotteſt Spring* will not harden an Egge.

8. The *Bath Water* does not paſs through the Body like other *Mineral Waters*; but if you put in *Salt* it *Purgeth* preſently. Upon *Settlement* it affords a *black Mudd*, uſeful in *Aches*, applyed by way of *Cataplaſme*; to ſome more ſucceſsful than the very Waters. The like it *Depoſits* upon *Diſtillation*, and no other. Nor hath any more been diſcovered upon all the *Chymical* Examinations, that have come to our knowledge. One Dr. *Aſtendoff* found, that the Colour of the *Salt*, drawn from the *King's* and *Hot-Bath*, was *Yellow*; that which was extracted from the *Croſs-Bath*, *White*. This Dr. Concluded, that the *Croſs Bath* had more of *Allum* and *Niter*, than the *Hottter Baths*, which abound more with *Sulphur*. And yet that *Bath* looſens *Shrunk Sinews*, by which it ſhould ſeem it abounds not much with *Allum*. It is Harſher to the Taſt than the other *Baths*, and Soaks the Hands more.

9. A Man cannot *Drink* half the quantity of Strong Drinks in the *Bath*, that he can *out* of it; but if he hath Drunk before to exceſs, it allays much, and is a great refreſhment to the Body. The *Bath* provoketh *Urine*.

10. They are very uſeful in *Diſeaſes* of the *Head*, as *Palſies*, *Epilepſies*, and *Convulſions*; In *Cuticular Diſeaſes*, *Leproſies*, *Itches* and *Scabbs*; in all *Obſtructions* of the *Bowels*, as *Spleen*, *Liver*, and *Meſentery*, and the *Schirroſity* and Hardneſs of thoſe parts; in moſt *Diſeaſes* of *Women*; in the *Scurvy* and *Stone:* As to which laſt while I am Writing, an Alderman of the City aſſures me, that his Wife, who had been exceedingly troubled with the *Stone*, went into the *Croſs-Bath* for it, and *Voided* there ſeveral *Stones* as bigg as thoſe of *Olives*, and was never troubled with that diſtemper after. The *Bath* is alſo good in *Cold Gouts*, as they call them.

The ſame Alderman tells me, that it gives him preſent Eaſe, when he is troubled with the Fits of it. He uſes to go in, as ſoon as the fit takes him; which then goes off preſently, and returns not in a conſiderable time after: He puts his Feet upon the *Hotteſt Springs* in the *King's Bath*.

But it hath a contrary Effect in *Hot Gouts*; and ſome who are troubled with that Diſtemper tell me, that the *Bath* puts them into a Fit if they go into it without Preparation; or if they have the Fit before, it inflames it more, and ſends it about the Body, and diſables the Joynt ſo, that there is no Treading on it for the preſent. Further, the *Bath* is effectual in the *Diſeaſes* of *Children*, particularly the *Rickets*, removing the Humours that proceed from it without fail. 'Tis alſo good for *Women* that are apt to *Miſcarry*, if us'd moderately.

The *Bath-guides* go in, when they are ready to *Lye down*; and other *Women* of the Town uſe it ordinarily throughout their Time, and are never obſerved to *Miſcarry*. It facilitates *Deliverance*. Beſides is very effectual for the Streightning of *Broken Bones*, and good in all *Cold* and *Moiſt Diſtempers* and *Weakneſs* of *Nerves*, *Stupefactions*, *Relaxations*, and Violent *Pains*: In all which it gives Eaſe, except the *Lues Venerea*, for in that (except the Malignity be overcome by the Methods of Phyſick) it Exaſperates the *Pain* more. 'Tis an excellent Remedy to remove the remaining *Weakneſs* in *Gouts*, as hath been remarkably exemplified in Old Men, even to the Age of 83. Years.

11. There is no inſtance of *Cures* performed by it in Former Times, but we have the experience of it in Ours; yea and in ſome others, as in *Dropſies*, *Cachexies*, *Spleen*, *&c.* In which Caſes they were Shy heretofore of uſing the *Bath*, for fear of Confirming thoſe *Obſtructions*, whereas 'tis now found, that their Cure is Facilitated by it.

12. The *Bath guides* live to a very great *Age*, ſometime to near 100 Years; ordinarily, if they are Temperate to 70. There are two at this time above 80, a Man and his Wife.

13. In the *Croſs-Bath* the *Guides* have obſerved a certain *black Fly* with *Sealed Wings*, in the form of a *Lady Cow*, but ſomewhat bigger. They ſay, it ſhoots quick in the Water, and ſometimes Bites. It lives under the Water, and is never found but in very *Hot Weather*: They ſuppoſe it comes up with the *Springs*. It is not to be ſeen elſewhere,

14. The *Croſs Bath* Eats out *Silver* exceedingly; and *I* am told that a Shilling in a Weeks time hath been ſo Eaten by it, that it might be wound about one's Finger. The *Baths* agree (as the Vulgar ſpeak) with *Braſs*, but not with *Iron*: For they will Eat out a Ring of this Metal in 7 Years, when *Braſs* Rings ſeem to Receive no prejudice at all from it.

15. When *Women* have waſht their Hair with the mixture of Beaten Eggs and Oatmeal, this will Poiſon the *Bath* ſo, as to beget a moiſt noiſome *Smell* caſting a *Sea-Green* on the Water, which otherwiſe is very Pure and Limpid. This will Taint the very Walls, and there is no Cleanſing of it, but by Drawing the *Bath*

16. In Summer the *Baths* purge up a *green Scum* on the Top, but in Winter never; but then leave a *Yellow* on the Walls.

17. The Walls that keep in the *Hot Springs* are very Deep ſet, and Large; 10 Foot thick, and 14 deep from the Level of the Street. The *Cement* of the Wall is *Tallow*, *Clay*, *Lime* and *beaten Bricks*. In the Year 1659. the *Hot Bath* (a *Bath* particularly ſo call'd, of equal *Heat* with the *King's Bath*) was much Impaired by the breaking out of a *Spring*, which the Workmen at laſt found again, and Reſtored. In Digging they came to a firm Foundation of *Factitious* Matter, which had Holes in it like a Pumice Stone, through which the Water played; ſo that 'tis like the *Springs* are brought together by *Art*: Which probably was the *Necromancy*, the People of ancient times believed and reported to have contrived and made theſe *Baths*; as in a very ancient *Manuſcript* Chronicle I find theſe Words: *When* Lud Hidibraſs *was Dead*, Bladud *his Son*, *a great*

great Nygromancer (*ſo 'tis there writ*) *was made King, and he Made the Wonder of the* Hot-Bath *by his* Nygromancy; *and he Reign'd* 21 *Years, and after he* Died and Lies at the *New Troy*. And in another old Chronicle 'tis ſaid, *that King*, Bladud *ſent for the* Necromancers *to* Athens *to Effect this great buſineſs*; who 'tis like were no other than cunning Artificers, well Skill'd in *Architecture* and *Mechanicks*.

18. It hath been obſerved, that *Leaves*, like thoſe of *Olives*, come ſometimes out of the Pump of the *Hot Bath*.

2. Theſe *Waters* have been long Famous for the Cure of *Palſy's* and *Barrenneſs*: An Inſtance of Both in one Perſon, I ſhall now give you, A Gentlewoman of about 30 or 32 *Years* of Age, having been *Married* about 10 or 12 Years, and never *with Child*, was ſuddenly ſeiz'd with a *Palſy* on the Left ſide, for which (after 8 or 10 Months Trial of other Means to little Purpoſe,) ſhe was brought to the *Bath*, where (after uſual Preparations, and ſome internal Means,) ſhe continued that *Seaſon*, about 6 Weeks; the Winter coming on ſhe was forced to deſiſt; but (by the Advantage ſhe received, was Encouraged to come very early the next Year, and did continue with us the whole Summer, and recovered, in great Meaſure, the uſe of her Arm and Hand, Leg, and Tongue; and not only ſo, but, in a few Weeks after, ſhe returned to her Husband,) *Conceived* with *Child*, and had (at about a Year and halfs Diſtance between them,) 5 *Children*, following. She ſhew'd me 4 of them Luſty and Strong and well grown for their Age, the 5*th* Dyed. She her ſelf hath no return of a *Palſy* but is *Infirm*, I think *Conſumptive*; ſhe is now about 51 Years Old.

By Dr. Pierce n. 169. p. 944.

XXXIX. At *Baden* a little City in *Auſtria*, 4 German Miles Southward from *Vienna*, ſeated on a Plain but nigh unto a Ridge of Hills, which are the Excurſions of Mount *Cetius*, are convenient *Baths*; two within the Town, five without the Wall, and two beyond a Rivulet called *Swechet*.

Baths *in* Auſtria *and* Hungary; *by Dr. Ed.* Brown n. 59. p. 1044.

The *Duke's Bath* is the largeſt, about 20 feet ſquare, in the middle of an Houſe of the ſame Figure, built over it. The Vapour paſſes through a Tunnel of Wood, at the Top: And the Water is conveyed into the bottom of the *Bath*, at one Corner, through wooden Pipes and Trees, under the Town-Wall, from the *Spring-head*, which Riſeth at a little diſtance Weſtward. The *Springs* of the reſt of the *Baths* Riſe under them, and are let in through Holes of the Plancher, for all the *Baths* are Wainſcotted, the Seats, Sides and Bottoms being made of Fir. The Water for the moſt part is Clear and Tranſparent, yet ſomewhat Blewiſh, and maketh the Skin appear Pale in it, as doth the Smoak of *Brimſtone*. It coloureth Metals (except *Gold*, whoſe Colour it alſo Heightens) turning them Black in a few Minutes. The Coyn of this Country, mixt of Copper and Silver, (having $\frac{7}{15}$ of *Silver*, and $\frac{8}{15}$ of *Copper*) is in a Minutes time turned from a *White* into a dark *Yellow*, and ſoon after becomes *Black*. To the Moſs and Plants which it Waſheth, it gives a fine Green Colour, and leaves often a Scum upon them of a Purple mixt with White. As it runs from the *Spring-head*, it ſomewhat reſembles the *Sulphur River* in the way

way from *Tivoli* to *Rome*, but is not ſo ſtrong or *Stinking*, nor doth it Incruſtate its Banks.

I paſs'd to the *Spring head* (which Riſeth under a Rocky Hill) about the length of 40. Yards, through an Arched paſſage cut in the Rock, which is alſo a *natural-Stove*, (as that of *Tritola* and *Bajæ*) made by the *Hot Bath-Water* running under it. Moſt part of this Cave is Incruſtated with a white ſubſtance, by them called *Salt peter*. At the Mouth of the Cave it becomes Harder and Stony.

I cauſed ſome of the Pipes, through which the *Bath Water* runs, to be opened, and from the upper part of the Pipe, I took ſome quantity of *Fine Sulphur* in *Powder*, ſomewhat like *Flowers* of *Brimſtone*; this being as it were *Sublimed* from the Water, and not Depoſed, being found in the upper part of the Pipe *Oleum Sulph. per Campanam* dropped into this Water, is received into it *quietly*. *Oleum Tart. per Deliquium*, cauſeth an *Ebullition*, as in the making of *Tartarum Vitriolatum*.

The *Second Bath* within the Wall is that of our *Lady*, about 12 foot broad, and 24 long. One end of it is under a Church of the ſame Name. This is fuller of *Sulphur* than the reſt, and more Blue, and leaveth a *Yellow* Flower upon the boards as the others do a white.

The 3*d* is the *New Bath*, out of the Town nigh the Gate.

The 4*th* the *Jew's Bath*, which hath a partition in the middle to ſeperate the *Men* from the *Women*.

The 5*th*, St. *John's Bath*, of a Triangular Form.

The 6*th*, the *Beggars Bath*, always Shallow, ſo as they lye down in it.

The 7*th*, the *Bath* of the *Holy-Croſs*, about 2 Fathoms Square, chiefly for the *Clergy*.

The 8*th*, St. *Peters Bath*, *Greener* than the reſt.

The 9*th*, the *Sower Bath*, ſet about with Stone-balaſtres, and covered with a Cupola and Lanthorn. The Water is very *Clear*: In the *Steam* of this *Bath* I have often coloured Money *Black* without touching the Water; and ſtaying only in the room where the *Bath* is, the Buttons of my Cloaths, and what elſe of Silver the Vapour could come at, were coloured *Yellow* or *guilded*: And yet the Water it ſelf, once *Cold*, changeth not the Colour of Metals, though Boiled in it.

The *Hotteſt* of theſe *Baths* have not the *Heat* of the *Queen's Bath* at *Bath* in *England*. They uſe no *Guides*, as with us, but direct themſelves with a ſhort turn'd Staff.

Manners-dorff, ſeated under an Hill on the Eaſt ſide of the River *Leyta* hath only one *Bath*. It Riſeth under a Church, built over the Spring-head.

The Water of it is *Luke-warm*, and therefore they *boyle* it in great Coppers, when they deſire it *Hotter*, and *Bath* in Tubbs fill'd with this boyling Water. From the Subſtance, which ſticks to the Coppers in boyling, it is collected, that it is Impregnated with *Sulphur*, *Salt-peter* and *Chalk*. This

Water

Water *Coloureth* the *Stones* in it of a fair *green* like a *Turkois*; and the *Steam* of it, which ſticks to the Moſs under the Church, turns into Drops of *Gold* or *Amber*.

Dotis, 2 *Hungarian* Miles from *Comora* in *Hungary* hath alſo *Sulphureous Baths*, ſaid to be *Warm* in Winter. In *March* and *October*, I found their *Warmth* very Remiſs, ſcarce perceivable In *Colour* they are *Blueiſh*, and to Taſt *Acid*. The *Queen's Bath* and the *Great Bath* Riſe in a Marſh, Northward of the Caſtle.

There is another *Bath* in the Governour's Garden within the Town. They are uſed as thoſe of *Manners-dorff*.

At *Banka*, two *Hungarian* Miles from *Freiſtat*, in a Meadow, I took notice of 15 *Baths:* And there have been more, but the River *Waag* eateth away the Banks, and ſwallows up the *Baths*, and into 3 of theſe 15 it hath alſo broke in. The Water of theſe is like to that of *Baden* in *Auſtria*; it leaves a White Sediment upon the Moſs and places it Waſheth, and Tinctureth Metals *Black*. I ſtuck ſome Money into the ground over which the Water paſſeth, that part which was in the ground retained its own Colour, and the other part in the *Bath-Water* acqured a *Coal Black*. Theſe *Baths* are Open, and very Hot.

The *Baths* of *Boinitz* nigh the River *Nitra* in *Hungary*, are of a moderate gentle *Heat*, much beautified by Count *Palfi* Palatine of *Hungary:* And all of them covered under one large roof. The *firſt* is the *Noblemen's Bath*, built of Stone, deſcended into on all ſides by Stone ſtayres. *Four* more there are of Wood, but very handſomely and well Built.

At *Stub'n*, 3 *Hungarian* Miles from *Newſol*, and 2 from *Chremnitz*, near to a Rivolet, are divers *Baths* of great Eſteem. The Water whereof is *Clear*, and *Smells* of *Sulphur*; the *Sediment Green*. It colours the *Wood* over it *Green* and *Black*, but does not change the Colour of *Metals* ſo ſoon as moſt others. I left Money in it a whole Night, which was yet but faintly Coloured. The *Springs* ariſe underneath, and paſs through the Holes in the Plancher of the *Baths*. The *Heat* thereof is anſwerable to the *King's Bath* in *England*. Theſe *Baths* are 7.

The *firſt*, is the *Noblemen's Bath*; the 2*d*, the *Gentlemen's Bath*; the 3*d*, the *Countryman's*; the 4*th*, the *Countrywoman's*; the 5*th*, the *Beggar's Bath*; the 6*th*, for ſuch as are infected with the *Lues Venerea*; the 7*th*, the *Bath* of the *Gypſies*: Of whom there are many in thoſe parts. Theſe *Baths* are in a Plain, encompaſſed on all ſides with Hills; the higheſt unto them are towards the Eaſt; and it is the ſame Ridge of Hills, which on the other ſide are ſo rich in *Metals*.

Glaſs Hitten, an *Hungarian Mile* or about 7 *Engliſh Miles* from *Schemnitz*, hath 5 *Baths*; two of which are Large. It depoſes a *Red Sediment*, and Incruſtates the Wood and Seates of the *Bath* under Water with a Stony ſubſtance; and it Guildeth Silver. But the moſt remarkable of theſe *Baths* is that which is called the *Sweating Bath*, whoſe *Hot Springs* drain through an Hill, and fall into a *Bath*, built to receive them; at one end of which, by Aſcending I went into a *Cave*, which is made a noble *Stove* by the *Heat* of

of these *Thermæ*, and so ordered with Seats, that every one who sits in it, either by chusing a higher or lower Seat, may regulate his *Sweating*, or enjoy what Degree of *Heat* he desireth. This *Cave* as also the sides of the *Bath*, are covered by the continual Dropping of those *Hot Springs* with a Red, White, and Green substance: The Red and Green make the best shew, but the White is used against the *Stone*, and cureth *Ulcers* and sore backs of *Horses*.

Eisen-bach about 4 *English Miles* from Glas Hitten, and 5 or 6 from *Schemnitz*, hath also *Hot-Baths*. I have seen great Trees, placed at the Top or Superficies of the Water in these *Baths*, which have suffered *Petrifaction*. Here are *two* convenient *Baths*, much frequented; and a 3*d* which is made by the Water let out of the Former, called the *Snake's Bath*, from the Number of *Snakes* coming into and delighting in it, when 'tis filled with these Warm Waters.

The *Natural Baths* of *Buda* are esteemed the Noblest of *Europe*, not only in respect of the large and *Hot Springs*, but the Magnificence of their Buildings.

For the *Turks* Bath very much, and, though little curious in most of their private Houses, yet are they very Sumptuous in their Publick Buildings, as their *Chans* or *Caravansara's*, *Mosches*, *Bridges* and *Baths* declare.

There are 8 *Baths* whereof I had opportunity to take notice, during my stay at *Buda*; 3 towards the East and South East part of the City, in the way leading towards *Constantinople*, and 5 towards the West end of the Town in the way towards *Old Offen*, and *Strigonium*.

The *first* is a large open *Bath* at the foot of an high rocky Hill, formerly called *Purgatorium*, whereof the People have some odd and scrupulous Apprehensions.

The 2*d* is covered with a *Cupola*, and stands nigh the same Hill, but more into the Town, and near a place where they use *Tanning*.

The 3*d* is call'd the *Bath* of the *Green Pillars*, though at present they be of a *Red Colour*; and it stands over against the *Caravansara*. The Water is *Hot*, but Tolerable without addition of Cold Water. It is Impregnated with a *Petrifying* juice, which discovers it self on the sides of the *Bath* upon the Spout and other places, and maketh a *Grey Stone*: And the Exhalation from the *Bath*, Reverberated by the *Cupola*, by the Irons extended from one Column to another, and by the Capitals of the Pillars, formeth long *Stones* like Ice-icles, which hang to all the said places; such as may be observed in many *Subterraneous Grotto's*, and particularly in *England* in *Okey hole* in *Somersetshire* and *Pooles-hole* in *Darbyshire*.

The Water is let out at Night when the *Women* have done *Bathing*, who often stay late. The *Bath* is Round, set about with large Pillars supporting a *Cupola*, which hath openings to let out the Steam thereof; and yet the whole room continues to be a *Hot Stove*.

The *Baths* of the West end of the Town are.

1. *Tactalli*, or the *Bath* of the *Table*; a small *Bath* Covered: The Water *white* and of a *Sulphureous Smell*.

They

They *Drink* of this as well as *Bath* in it. What they *Drink*, they receive from a Spout bringing the Water into this place. I delivered a *five Sols* piece to a Turk Bathing in it, to *Guild* for me, which he did in about a Minute by rubbing it between his Fingers, while the Hot Water fell from the Spout upon it.

2. *Barut Degrimene*, or the *Bath* of the *Powder-Mill*. It riſes in an open Pond near the high way, and mixeth with the Freſh Springs, ſo that the Pond is of a Whitiſh colour in one part, and Clear in the other, as alſo Cold and Hot in ſeveral parts. This, conveyed croſs the high way into a *Powder mill*, becomes uſeful in making of *Gun powder*. They conceive here that this *Bath* communicates with the *Sulphureous Springs* at *Dotis* many Miles diſtant.

3. *Cuzzoculige*, the little *Bath* or the *Bath* of the *Saint*; for which name the *Turks* give a Superſtitious reaſon. 'Tis keptby *Turkisk Monks*. The *Bath* where the Springs ariſe, is ſo *Hot* as ſcarce to be endured; but being let out into another Bathing place at ſome diſtance, it becomes Tolerable and fit for uſe This Water hath neither *Colour*, *Smell*, nor *Taſt*, different from *Common Water*, and depoſeth a *Sediment*; only the ſides of the Bath are *Green* and have a *Fungous* ſubſtance all over.

4. *Kaplih*, a very Noble Bath, but part of the Buildings were conſumed this Year (1669) by a great Fire which happen'd in *Buda*; but is by this time repaired by the *Turks*. The Water is very *Hot*, not without a *Petrifying* juice in it. The Buildings about it are Eight Square with a Noble *Bath* in the middle: With a Circle or Trench of Water about it for the better Ornament. On every Side it has a *Nichio* wherein is a Fountain. In the middle of the Antichamber (where they leave their Cloaths) there is alſo a fair Stone Baſon and a Fountain.

5. The *Bath* of *Velibey*; which hath a ſtrong *Sulphureous Smell*, and a *Petrifying* juyce in it; and is ſo *Hot*, that to make it Tolerable it requires the addition of Cold Water. This is the Nobleſt Bath of any. The Anti-chamber very large, the Bath-room capacious, and high Arched and adorned with 5 *Cupola*'s: One a very Fair one, over the great Round Bath in the middle; and one Leſſer, over each of the 4 Corners; where are either Baths or Bath-ſtoves for more private Uſe: In theſe the *Turks* take off the *Hair* of their Bodies by a *Pſilothrum* mixt with *Soap*; it being not their cuſtom, to have any *Hair*, except on their *Beards*, and a Lock on the *Crown* of their *Heads*. Twelve Pillars ſupport the Great *Cupola*, between 8 whereof are Fountains of the *Hot Water*, and between the other are places to ſit down, where the Barbers and Bathmen attend. And each of theſe places have two Ciſterns of Free ſtone, into which are let in Hot Bath water and alſo Cold Water, to be mixed and tempered as every one pleaſeth.

Men Bathe in the Morning, and *Women* in the Afternoon. When any *Man* intends toBathe,having entred the firſt room he finds there diversServants attending, and furniſhing him with a Cloth and Apron. Then he puts off his apparel and having put on the Apron he entereth the 2*d* room, wherein the great Bath is, and Sits on the ſide of the Bath, or between the Pillars nigh a Fountain; where

where the Barber ſtrongly rubbs him with his Hand opened, ſtretching out his Arms, and lifting them up; after which the Party Batheth. Then if he be a Subject of the Grand Signior's, or it be the cuſtom of his Country, he hath his Head ſhaved, and if a young Man, his Beard, except the Upper Lip. Next the Barber rubs his Breaſt, Back, Arms and Legs, with an Hair Cloath, while he either ſitteth or lieth with his Face downward; then waſhes his Head with Soap, and after throws Cold Water upon him all over his Body; and ſo the Party Walks about in the *Steam* of the *Bath for a time.*

Theſe *Baths* are made uſe of two ways, either by entring into the *Water*, or ſitting about the Bath in the *Steam.* For the *Vapour* of the Bath makes the whole Room a *Stove*; and moſt *ſweat* as long as they ſtay in it; and ſome enter not the *Water* at all, but have it Poured upon them, or elſe only continue in the *ſteam* of the *Bath*, which ſufficiently provoketh *Sweat.*

At Aponum *near* Padua; *by Mr.* Dodington. n. 83. p. 4067.

XL Five Miles from *Padua* are the *Waters*, called *Aponenſia*, from a Town call'd *Aponum.* They are actually very *Hot* and *ſtinking*, and yield a great deal of very *fine Salt*; of which the Natives ſerve themſelves in their Ordinary occaſions. The *Salt* is gathered after this manner: The Natives, after Sunſet, ſtir pieces of *Wood* in the Water, and preſently the *Salt* ſticks to them, and comes off in ſmall Flakes, exceeding White, and very Salt; This never loſeth it Savour. The People there, with the ſame Water uſed to waſh their Walls, to render them *Whiter* than ordinary; which it doth even *whiter* than *Lime.* Such Walls conſerve their *Saltneſs* ſome few days only, and then become inſipid, even tho' they ſweat forth a white Excreſcence in thin and light Flakes like *Nitre*, many Years after. But that *Salt*, that is collected from the Stones, Gravel, and Earth, by which the Rivulets deſcending from thoſe Baths, do run, is without any Taſte of *Salt*; though there be no difference in the *Form* or *Colour* from that which is Gathered with the *Wooden* Inſtruments.

Hot Springs and other Mineral Waters *in* Jamaica; *by Sir* Will. Beeſton. n. 220. p. 226.

XLI. In *Jamaica* there is a very *hot Spring* of *Mineral Water*, but the Diſtance and Trouble of getting to it has kept People from trying it till this laſt Month (*viz. March* $169\frac{5}{8}$) when two Perſons, the one very much Macerated with the *Belly ach*, and another with the *Pox*, as is ſuppoſed, went to it, carry'd Cloaths, built a Hut to keep them from the Rain and Sun, and both preſently by *Drinking* and *Bathing*, found ſuch eaſe, that in about 10 Days they returned perfectly Cur'd. It comes out of a Rock in a freſh Current, near to a fine Rivulet of good cool Water, but is ſo *Hot*, they all affirm it ſoon *boils Eggs*; ſome ſay *Craw-fiſh*, *Chickens*, and even a *Turkey*; but perhaps this laſt wants good Confirmation. However it's certain, that near where it comes forth, there is no enduring any part of the Body but it takes off the Skin; it Cures *Ulcers*, and *Contracted Nerves* and *Sinews*; in a few days to a Miracle. Collonel *Beckford* who was given over by the Phyſicians, with *Pains* in his *Bowels* very Acute, that had worn him out, and another for the *Venereal Diſeaſe*, and one for the *Belly-Ach*, went up ſince Collonel *Beckford* is finely recovered, and the other almoſt cured of his *Ulcers*; ſo that the *Water* is beyond doubt, and many are reſorting to it.

It

It has been try'd with *Galls* in my ſight, and it makes the Water in 24 Hours look only like *Canary*, or *Old Hock*. But we have a fine large River runs by the ſides of this Town, which ſerves all the People for Drinking and other Uſes, and was by the *Spaniards* call'd *Rio Cobre*, or the *Copper River*; this now our Curioſity has led us to try with *Galls*, and in one Night the Water turns to a *deep Green*, more enclining to *Black*, deeper Colour'd than any *Emerauld I* ever ſaw, which makes me doubt the *Copper Mines* in it are not enough Digeſted, and that it's unwholſome, but were the *Copper* more Refined and Excellent, it would be a *ſalubrious* Water. *I* have alſo tryed ſeveral Water-Springs and Rivers here abouts, and find them all *Ting'd* with ſome *Metal* or other.

2. We have lately diſcovered two *Hot Springs* in *Jamaica*; one to Windward, which ſeems *ſulphurous*: The other to Leeward, is very *ſalt*, but as *I* am told, does not partake of *Brimſtone*; and both very much magnified for the *Endemick Diſeaſes* of theſe Parts, the *Dry Belly-ach*, *Pains* of the *Nerves*, and *Yaws*. *By Mr.* Robert Tredway. n. 232. p. 712.

XLII. Though the Particles of Water are ſo minute, that we cannot diſcern them with our *Eyes*, yet by *Feeling*, we may diſtinguiſh the Acute and vigorous Particles of *Healing Waters*, from the Languid and hurtful Particles of common Waters. The *Healing* Water will intermingle with their Aſperity's ſuch an agreeable Titillation, as will invite us to Rub in, or Preſs on the cleanſing and Terſive Water; and will, all along, recompence the pain of ſearching the Wound by their Active Frictions, with ſuch ſpeedy Reparations, and ſuch indulgent Degrees of *Sanation*, as mitigates the Torment with ſtore and variety of Pleaſures. Other common Waters, even thoſe of ſome of the Pureſt and moſt Criſtalline Fountains, are almoſt poiſonous, encreaſing *Tetters*, and fomenting *Ulcers*, with an inward and ſullen painfulneſs. This dextrous Water, by a moſt favourable Chyrurgery, ſearches to the bottom of Old and *Cancerous Ulcers*; ſweeps or ſhaves away the Roots of *Tetters* and *Cancers*, and appeaſeth the unnatural Rage; and ſome of theſe *Healing Waters* are benigne, whether we apply them Outwardly, or truſt them inwardly, for the relief of our *Entrails* and *Vitals*. And by theſe remarkable *Indications*, and the Effects *I* have ſeen ſucceeding, *I* have been confirmed of the real Virtue of ſome of the (ſo call'd) *Holy Wells* of oldeſt reputation in *England*; and have diſcovered other *Healing Springs*, whoſe Vertues were not much known, or noted before. *Obſervations concerning* Healing Springs; *by Dr.* J. Beale. n. 57. p. 1155.

Our *Eyes* alſo may be, in ſome Senſe, good Witneſſes of peculiar *Figures* in the Particles of thoſe *Spring Waters*, which are proper for the *Eyes*. They ſeem to ſcoure the *Eyes*, as it were, with ſharp, but very fine Gravel. And by this *Indication* *I* have tryed and found the Springs which are extraordinary for the *Eyes*, and perhaps to Cleanſe *Optick Glaſſes*. About 30 Years ago, in a very Hot and Droughty Summer, there was an *Epidemical* Diſtemper of Mens *Eyes* and *Eye-lids*; *I* found it ſo at *London* and *Weſtminſter*, and almoſt in every Houſe where I came, as I travelled Weſtward on both ſides *Severn*. *Verjuice*, or the Juice of *Crabs* was found the beſt Remedy; and where they knew it not, *I* gave notice of it; and all that try'd it, confeſſed that it was not a very unpleaſant ap-

plication. Their *Eyes* had a fretting Itch; and *Verjuice* proved more agreeable than *Vinegar*, or *White wine*, or any other liquor or Mixture. Some ſuch Tickling Pleaſure, but yet more delicate and tender; there is in ſome *Spring Waters*, which are for the *Eyes* peculiar.

The *Springineſs* of *Wool* more than of *Linnen*, offers another Viſible and Tangible Demonſtration, how the ſtronger and quicker *Springs* of ſome Water more than of other, may conduce more or leſs to *Healing*; or may be more or leſs Noxious, either inwardly taken or outwardly applyed.

I knew one who was ſhot in his Heel with an Arrow, which carried with it a very ſmall ragg of the *Woolen Stocken*: This Ragg not being found by the Chirurgions, though they were then of the beſt Note, the Wound became for a Year or two incurable; and the Pain was ſo intollerable, that it was thought neceſſary to cut off his Foot. At laſt by chance the Rag was found, and taken away, and then the *Cure* was ſoon Perfected. *Woolen* and *Linnen* may have their Turns and Seaſons; the one as a Mechanical Operation for *Heating* by a cloſe and permanent *Friction*; the other as a quiet *Lenitive*. Our tender Skin can hardly bear the inceſſant *ſpringineſs* of *Wool*; in a deep Wound we can leſs endure it. But the *Springs* of ſome *Waters* may be lined with a ſofter Liquor than the Hairy and curled Filaments of *Wool*: And hence we may perceive, how ſome Waters may by their Rolling Particles be the greateſt *Probes*, and yet the ſureſt Searchers, *Cleanſers* and *Healers*. And hence alſo, on the contrary, we may ſee, how ſome Waters, which Cure *Ulcers* and *Cancers* by *Outward* application, may be too buſily Corroſive and Dangerous, if taken *Inwardly*.

I think I may note, that generally all the Springs in *England* that are of very Ancient Eſteem for *Healing*, and were commonly call'd *Holy Wells*; ſuch as St. *Winefrid*'s *Well* in *Flintſhire* (of which I never made Trial, but it carries the greateſt Fame) are all very *Pure*, and yield no kind of *Sediment*. In this our *Hot Baths*, and perhaps ſome few *Mineral Springs* are to be excepted. I muſt yet be more particular.

I know a *Spring*, which the Old People there call their *Holy Well*, on the ſide of a *Low Hill* in an Arable Field, which (beſides the *Healing Qualities*) hath an extraordinary efficacy in clearing the Skin from *Sun-burnings* and *Freckles*; and addeth as much luſtre, as agrees with the finer Art of Concealing Art, and with Modeſty; and after waſhing two or three Mornings it makes the Skin as *ſmooth* as Glaſs. It paſſeth through a Vein of Light Sand, if I may call it Sand; 'tis more like to ſome kind of Blewiſh criſped *Marle*; 'tis ſo Light and Hollow, as if it were freſhly working by ſome *Ferment*; and 'tis full of very ſmall and thin *Laminæ*, ſeeming to be *Metalline* and bright like the pureſt *Silver*, but the Refiners could not find it to be of any value. I was inquiſitive to ſearch it out, whether this Water had the *Beautifying* property from the *Silver-like Lamina*, or rather gave thoſe *Veins* of *Earth* that Tincture and *Ferment*. Only two things I can affirm: 1. I ſaw many *Springs* opened in the Lower Grounds, which ſeemed in all appearance to run from the ſame Head, and had alſo the ſame very bright *Ferment* in their Paſſages, where they were opened, but theſe had nothing of the ſame Property for *Healing*,

ing, or for *Beautifying*; as I found by many Trials, more than daily for ſome Years together. 2. The common Fields adjoyning, had on their Clods and Fallows, ſomewhat of the ſame Glittering much Faded, but enough to Dazle their Eyes that Fixed them on it in a bright *Sun* Shining. May not ſome *Subterranean Steam* give the *Tincture*, both to that Vein of Earth through which it paſſed more freely; and alſo more forcibly to that *Spring*, by a greater reſort, or by ſome advantage it got by the *Aſcent* of the Ground? (And we commonly find theſe *Healing Springs*, either near the Top, or on the Side, or near the Foot of ſome Hill, or Running from the Hill:) And thus the *Steams* Reverberated and daſhed down by the Motion of the Air, and by the Weight of the Atmoſphere, may beget the ſame *Metalline Tincture* in the adjacent Fields. This was far enough from yielding *Sediment*; and it had a Pleaſing *Smoothneſs*; and was very inoffenſive to the *Stomach*; but it ſearched the *Eyes* ſomewhat Smartly, and Cleared them ſpeedily, and was generally commended for many *Healings*, both Inwardly and Outwardly; and was every way much more Pleaſing than Tormenting.

Within two Miles of the ſame, is another of their old *Holy-Wells*, on the Brow of ſuch another Hill in an Arable Field, within half a Mile of the Lofty *Malvern* Hill: This is very kind for the *Eyes*, and hath alſo done many Cures upon *Putrid* and *Fætid Ulcers*, which were many years deplored for Incurable, as I can affirm upon my own knowledge I have ſeen it Tryed often, and always to good Effect; ſometimes conſiderably Wonderful. *Vid. Sup.* §. XXXVI. 4.

Many drink of it, and much extol it for Healings: And I never could hear of any that complained of hurt done by it. It was ſomewhat aſperous, but pleaſing in malignant Ulcers.

But much greater is the Reputation of the *Holly-Wells*, as they call them, on the ſide of *Malvern Hills*, which Hills divide *Worceſterſhire*, from *Herefordſhire*. The Higher Spring is peculiar for the *Eyes*: About a Furlong lower is the *Healing Spring*; This cureth many Maladies and *Cancers*, if applyed before the Strength of Nature be overthrown. I have read in the Monuments belonging to the *Hoſpital* at *Ledbury*, a Town in the way from *Hereford* to thoſe *Springs*, that a Biſhop, ſome Ages paſt, endowed that *Hoſpital* with Revenues, for the entertainment of Diſtreſſed Paſſengers that Travelled to thoſe *Springs* for Relief. 'Tis above 50 Years ſince I heard a Panick Story ſpread all over the City and Country of *Worceſter*, the Phyſicians had Poiſoned thoſe Wells. I am perſwaded, that the ground of this Fable was only this; After more than ordinary Rain for one, two, or three, Years together (as it falls ſometimes in *England*) ſome *Common* Waters, by a part of the ſame or ſome other Channel, do drive to the ſame Aperture and Drown the excellency of the *Healing Water*. In this Droughty Year (1669.) we find, that many excellent Springs have loſt more than half, and ſome more than 4 parts of five of the Waters which they did uſually afford in the ſame Seaſons of the other Moiſter Years; and the remaining Waters have the Stronger Efficacy. Of this Expectation from long *Droughts* I formerly advertis'd you, And 'tis *now Remarkable*, that the better Springs, which are on the *Side* of *Hills*, and on the *Higher* ground, do maintain their *Current* much better, than thoſe which

are in the *Lower Vale*. 'Tis ſo in many places about us here; when the Better Springs had loſt 4 parts of their Current, many of the Lower Springs were quite Dried up. All theſe Waters are purely *Limpid*, Free from all *Sediment*, very *Terſive* and ſearching, moſt Effectual at the *Spring head*.

I omit many other *Healing Waters*, that I may give you a brief touch of ſuch *Mineral*, *Saline*, and *Medical Waters*, as I have found, or heard of in our Neighbourhood; Namely about *Yeavil* in *Somerſetſhire*. I lately heard of two more *Metalline Springs in Dorſetſhire*, beſides that of *Farrington*; Perhaps their Virtues and their Fame are encreaſed by this *Drought*. The *Saline Spring* mentioned by Dr. *Highmore* to be at *Eaſt-Chenock*, is about 3 Miles hence Weſtward. In a very *Droughty* Summer I found it *Strong Brine*. But there is a *Salt Spring* of far greater worth at *Everich*, about 12 Miles hence towards *Shepton Mallet*. The Pool, which yieldeth *Vitriolate Salt*, is in *Sock-Denis*, 3 or 4 Miles from hence Weſtward. 'Tis not a great Pool, nor above 10 foot Square. Whether the *Salt* proceedeth from a *Spring*, or from a *Vein* of *Vitriolate Earth*, I cannot yet determine; but the Mud and Earth about it is as *blew* as any *Roman Vitriol*. In a long laſting and hard *Froſt*, I ſent for a Quart Bottle of the Water, and found it very Thick, and Blackiſh, and it Scented intolerably ſtrong, not much unlike *Gunpowder* newly Inflamed, Cloſe adjoyning into this Town of *Yeavil*, were two *Springs* kind for the *Eyes*; the one in a Paſture, the other within a Bolt-ſhoot in a Field.

Vid. inf. §. XLIV. 2.

Vid. Sup. §. XXX. 3.

The Old People prefer that in the Paſture before the other, as they have it from Elder Tradition, and their pretended Experience: And at this time, the more commended Spring, which is in the Paſture, and on the ſide of a Riſing ground, runs freely; the other is newly Dryed up. 'Tis not every ſlight *Gravelling* of the *Eyes* that ſufficiently *Indicates* an extraordinary *Eye-Water*: Many good Springs have a Degree of *Terſiveneſs*; but that which is extraordinary, hath a *Friction* ſomewhat permanent, and is in the end *Gratifying*. We have alſo, cloſe by our Town, a Spring called *Ruſty well*. Where it breaks out, and where it firſt falls, it Tingeth the Stones of the *Colour* of *Ruſty Iron*, and it hath the *Smell* ſtrongly, (and ſeemeth to *Taſt*) of *Ruſty-Iron*. Yet 'tis as Clear as any Water, and I tryed it for a Month or more in my Study, putting *Corniſh ſlate* and Pebbles to it in a Glaſs; and it gave no *Tincture* at all to the Stones, nor any *Sediment*; ſo that I ſuſpect the *Tincture* to proceed from ſome *Effluvium* mingled with the Water at firſt Opening: But I confide not much in the ſingle and ſhort Trial I made. Some old Men boaſt of many great Cures it hath done.

Our Fore-Fathers and very old Men, ſcarce heard of the Name of the *Scorbute*; 'Tis a ſeaſonable Providence, if, ſince that Diſeaſe is become ſo *Epidemical*, the Remedy ſhould be ſo Obvious and Vulgar, as is pretended to be by ſuch *Ferruginous Springs*.

This breaks out near the Foot of a Lofty Hill, which continues, with ſome leſſer falls, about 3 Miles Weſtward to *Hamden Quarre*, where they dig a hard Freeſtone of a dark yellow Colour. At *Weſt Camel*, 5 Miles hence Northward, is a very Fœtid Black *Spring*, which Tingeth Silver Black immediately; and I am told, that about 10 Miles hence, more Eaſtward, near

Wine-

Wine-Caunton, not many years ago, they Digged for *Cole*, where the Cole men were endangered by a *Fœtid Damp*; And when they aſſayed the *Cole* in the Fire it proved very Noyſom, ſo that they forſook thoſe *Cole-mines*. Perhaps it may be ſerviceable to them that know not how to make an honeſt uſe of *Arſenic* and other *Poyſons*.

Here again, with ſome Timorouſneſs, I propoſe the Inquiry, whether *Subterraneous Steams* might not give the *Dark-Yellow Tincture* to the *Hamden Quarre*, and the property to this Water of *Ruſty well* for the *Fulvous Coloration*: It cannot be expected, that Materials, differing ſo much as Stones ſeem to differ from Water, when perfectly Petrifyed, ſhould retain the very ſame Colour, though both received it from the very ſame *Steams*. The ſame I propoſe for the Blackneſs and Fœtidneſs of the *Spring* in *Weſt-Camel*, and of the *Cole* near *Wine-Caunton*, that both may receive the ſame *Tincture*, and *Odour* from *Subterranean Steames*, which may perhaps be of ſo many kinds, and mixtures, as to cauſe much of the great diverſities of *Metals*, *Minerals*, *Earths*, and *Soyles*; and of ſome minute Differences in the *Colour*, *Taſt*, *Odour*, and *Dreſs* of *Vegetables*; Yea and of the *Furres*, *Haires*, *Wool*, and other little varieties in *Animals* (particularly in *Sheep*) in ſeveral places; more immediately in *Vegetables*, and of *Animals* by Remoter circumſtances; I will not except the *Ethiopick-Hue*, and *Humours* of Men in *Diſtant Climates*, though *Vegetables* and *Animals* do (for the moſt part) retain their *Seminal Properties* in *Diſtant Climates* for many Generations. And perhaps from theſe *Terreſtrial Steames* the *Vegetables* do imperceptibly draw ſome of their *Salts*, and much of their *Nutriment*.

For theſe *Overtures* I will at preſent inſtance no more than thus. The Illuſtrious Mr. *Boyle* hath, methinks, evinced, that the moſt Solid Bodies we know, have their *Atmoſpheres* of *Steams* and *Exhalations*: And whatever the Materials be, which are under our *Terrene Cruſt* towards the Center, whether Fluid, Flaming, or groſs Subſtances, they muſt needs hold an Intercourſe of *Tranſpirations*, and mutually operate by their perpetual Agitations, and Whirlings about: And by the *Vulcano's*, frequent in *Japan*, and in ſeveral other places, and by the *Heats* in Deepeſt *Mines*, and by many other manifeſt Arguments, it appears, that there are always ſtrong *Steams* Aſcending towards the *Surface* of the *Earth*: And, if their *Generative Power*, and other Efficacies were duly examined, and proſecuted to the beſt purpoſes, we might perhaps in time find them to have a greater Virtue, and more uſeful for us, than many of the *Conſtellations* and *Celeſtial Influences*, which make no ſmall Noiſe amongſt *Aſtrologers*.

XLIII. Viſiting the Famous *Boyling Fountain* at *Peroul*, not far from *Montpelier*, I found the Water to *Heave*, and *Boyle* up very furiouſly in ſmall *Bubbles*; which manifeſtly proceeded from a *Vapour* breaking out of the *Earth*; for upon Digging any where near the Ditch, and pouring other Water upon the Dry place newly Dugg, I obſerved in it immediately the ſame *Boyling*, as the Exquiſite Naturaliſt Mr. *Ray* has related in his *Travels*. The like *Bubbling* of Water is alſo found round about *Peroul*, upon the Sea ſhore; and in the *E-*

Obſervations on Boyling Fountains *and* Subterraneous Steams; *by Dr.* Tancred Robinſon. n. 169. p. 922. n. 172. p. 1038.

tang

tang it ſelf. But when I had taken ſome of the Sand and Earth out of the Fountain and Ditch, and put it into Veſſels, pouring the ſame Water upon it, there did not appear the leaſt *Perturbation*, or Alteration thereupon; the Superficies of the Water continuing very ſmooth, Equal and Quiet. And for further ſatisfaction, I ſought out, and diſcovered in ſeveral Dry places of the Ground thereabouts, many little *Ventiducts*, Paſſages or Clefts, where the *Steam* iſſued forth; at the Mouths of theſe Channels or Pipes, placing ſome light Bodies, as *Feathers*, ſmall thin pieces of *Straws*, *Leaves*, *&c.* I found them ſoon Removed away. This *Vapour*, upon the Application of a lighted Candle, or Torch, did not *Flame*, or catch the leaſt Fire; as the Fumes running through
n. 172. p. 1038: a *Boiling Spring* near *Wigan* in *Lancaſhire* do, with which thoſe *Burning Fountains* near *Grenoble* in *Dauphine*, near *Cibinium* or *Hermanſtadt* in *Tranſylvania*, near *Chermay* a Village in *Switzerland*, in the Canton of *Friburg*, and that
n. 169. p. 9. 23. not far from *Cracovia* in *Poland*, do agree in many particulars. Many *Hiſſing* Springs *Bubbling* at the Top, I have found in *Switzerland*, (the beſt watered Country that ever I ſaw) and in many places near the *Rhine*. The like is related by *Varenius* near *Culma*, and by Dr. *Plot* in *England*. There are other *Boyling Waters* of a quite contrary Temper, being actually *Hot* to ſeveral Degrees, ſo as to *boil Eggs*, and many other Things put into them; as thoſe near the *Solfatara*, not far from *Naples*; as alſo upon the top of Mount *Zebio* in the Duke of *Modena*'s Territories, not far from his *Villa* near *Saſſolo*; in the Source of the *Emperour*'s Bath at *Aken*, in the Country of *Juliers*; and in *Japonia*, mentioned by *Varenius*.

From the foregoing Hiſtory, we may take occaſion to reflect a little upon the manifold variety of *Exhalations* prepared in, and flying out from the vaſt *Magazines*, and ſeveral *Reconditories* below, as to their Qualities and Effects; ſome being *Cold* and *Dry*, reſembling Air or Wind, as thoſe near *Peroul*, and in the *Caverns* of Mountains, eſpecially thoſe of *Æolus* and other Hills of *Italy*; as alſo in *Mines* upon the meeting of Water. Others are *Inflamable*, and of a *Bituminous* Nature, though not actually *Warm*, as thoſe near *Wigan* in *Lancaſhire*. There are alſo many *Steams* very *Hot*, *Sulphurous*, and *Saline*; more eſpecially thoſe in the natural *Stoves*, *Sweating-Vaults*, *Grotts*, *Baths*, and the *Vulcano*'s near *Naples*, *Bajæ*, *Cuma*, and *Puzzuolo*, as alſo in ſome of the *Subterraneous Works* at *Rome*. Others there are of an *Arſenical*, and ſuch like venomous Qualities, as in the *Grotto del Cano*, on the Bank of the *Lago Agrano*; in many *Mines*, in *Poyſonous Springs* and *Lakes*.

Now theſe various *Steams* meeting with, and running through Waters, muſt cauſe a great variety of *Phænomena* and Effects in them. Whether this great Diverſity proceeds from the various *Breaths* of the *Pyrites*, and the *Lapis Calcarius*, whilſt under their different States, and Changes, or from other ſorts of *Effluviums*, I dare not determine: But I am apt to believe that there may be
n. 172. p. 1039. Veins of the *Pyrites* near thoſe Places, the *Inflammability* of which *Mineral*
Hid. Inf. Cap. III. hath already been diſcourſed of, and made very clear by Dr. *Liſter*.

An Ingenious Author relating the Hiſtory of a *Burning Fountain* in the *Palatinate* of *Cracovia*, affirms, that upon *evaporating* the Water, a Dark or Pitch-like Subſtance may be Extracted, which cures the moſt *Inveterate Ulcers* in

a very ſhort time; and that the Mud it ſelf is very Powerful againſt *Rheumatick* and *Gouty Pains*, *Palſies*, *Scabs*, *&c.* The Inhabitants of an adjacent Village, drinking much of this *Spring*, do generally *Live* to 100 or 150 Years, which he Attributes to the ſanative Virtue of the Water.

The *Naptha*, or *Bituminous* Subſtance floating upon a Spring at *Pitchford* in *Shropſhire*, and upon *St. Catherine's Fountain* near *Edinburgh*, hath been ſucceſsfully uſed in *Ulcerous* and *Cutaneous* Diſtempers. Many ſuch like Fountains of *Petroleum*, and *Oily Subſtances*, are to be met with up and down; as in the Iſland of *Zant*, very plentifully; near *Gabian* in the Road from *Montpelier* to *Beziers* in *Languedock*; in the *Valtaline*, ſubject to the *Griſons*; at the Foot of Mount *Zebio* in the Dutchy of *Modena*: Not to mention any of the Places written of already by *Varenius*. The Inhabitants living near theſe Fat *Oily Springs*, take great care to gather and ſeparate the *Bituminous Subſtances* from the Water, making very conſiderable Advantages of them, for *Mechanical* and *Medicinal* Uſes. I have ſeen them gather it up with Ladles, and put it into large Filtres, or into great Funnels ſtopt at the bottom; or elſe into Barrels ſet on one end, which have Spiggots near their Bottoms; when they are full and have ſtood a while, they open the Spiggot or Stoppel to let out the Water, and when the *Oil* or *Bituminous* Subſtance begins to come, they preſently ſtop it again.

XLIV. 1. The *Salt Springs* at *Hall* in *Saxony*, are 4 called *Gutiaar*, the *Dutch Spring*, the *Wettritz*, and the *Hackel-dorn*. The 3 *firſt* hold about 7 parts of *Salt*, 3 of *Marcaſite*, and 14 of *Water*. The *laſt* holds leſs, but yields the Pureſt *Salt*.

Salt Springs *at* Hall *in* Saxony, *and at* Lunenburg; *by*---- n. 8. p. 136.

They are, (beſides their Oeconomical uſe) employed, Medicinally to *Bath* in; and to draw a *Spirit* out of it, exhibited with good ſucceſs againſt *Venom*, and the *Putrefaction* of the *Lungs*, *Liver*, *Reins* and *Spleen*.

The *ſalt Water* at *Lunenburg*, being more Greeniſh than White, and not very Tranſparent, is about the ſame Nature, and holds with that of *Hall*. It hath a mixture of *Lead* with it, whence alſo it will not be Sod in *Lead Pans*; and if it held no *Lead* at all, it would not be ſo good, that Metal being judged to Purifie the Water; whence all the *Salt* of *Lunenburg* is preferred before all others, that are made of *Salt Springs*.

2. I made Trial of that *Salt Spring* at *Eaſt-Chenock* in *Somerſetſhire* (above 20 Miles from the (Sea;) which tho' not ſo *ſalt* (by reaſon of the late Rains) as in Summer, yet from a Wine *Quart*, by Evaporation, we obtained near 80 *Grains*.

In Somerſetſhire; *by Dr.* Highmore. n. 56. p. 1130.

3. At *Salt Water-Haugh* near *Butterby*, about a Mile and a half from *Durham*, in the middle of the River *Weare*, riſes a *ſalt Spring*. It is good to be ſeen and taſted, only in the Summer time, when the Water is diſcharged all on one ſide of the Channel: For in Winter, when the River is high it loſes its *Salt* in the freſh Streams, ſo that they are not perceivable. The Water ſeems to *Bubble* up equally in all parts in the Channel, for the ſpace of 40 Yards in length, and about 10 in breadth. The *ſalteſt* of all the *Springs* iſſues out of the middle of a Rock, the Surface of which was manifeſtly *ſaltiſh*; and which, in a hot Day (as I was told) would be all covered over with a perfect *Salt*. *I* had all the Water laved out of the place where it ſeemed to ſtagnate, and immediately

In the Biſhoprick *of* Durham; *by Mr.* Hugh Tod. n. 163. p. 726.

out

out of the Body of the Rock there Bubbled up Water, as *ſalt* as the former. It was as high as any *Brine* can be, and tho but little in quantity in compariſon of the Freſh River, yet of that force to give a *brackiſhneſs* to the Streams a hundred Yards below. Thoſe that have boil'd this *Brine* ſay that it affords a great quantity of *Bay Salt* not ſo Palatable, yet as Uſeful as Ordinary *Salt* is. It *Tinges* all the Stones with a *Red Colour*. The *Sea* is 8 Miles off, where neareſt.

Salt-Springs *and* Salt-Making *at* Nantwich *in* Cheſhire; *by Dr.* Will. Jackſon. n. 53. p. 1060. n. 54. p. 1077. n. 55. p. 1122.

XLV. The *Depth* of the *Salt-Springs* is in ſome places not above 3 or 4 Yards: In *Nantwich*, the Pitt is full 7 Yards from the footing about the Pitt; which is gueſſed to be the Natural height of the Ground, though the Bank be 6 foot higher, accidentally raiſed by Rubbiſh of long *Making Salt*, or *Walling*, as they call it. In two places within our Townſhip the *Springs* break up ſo in the Meadows, as to Fret away, not only the Graſs, but part of the Earth, which lyes like a breach, at leaſt half a foot or more lower than the Turf of the Meadow, and hath a *Salt Liquor*, Ouſing as it were out of the Mud, but very gently.

Our *Country* is generally a Low Ground, witneſs the name given to it (the *Vale Royal* of *England*;) yet it is very full of Collicular Eminencies, and various Riſings to diſtinguiſh it from being all Meadow. The neareſt Hills (of thoſe worth calling Hills) is about 7 Miles diſtant from the *Springs*; it is ſteeper but not much higher than *Highgate Hill*.

We have alſo a peculiar ſort of ground in this County and ſome Adjacent Parts, which we call *Moſſes*: And they are a kind of Mooriſh Boggy ground, very Stringy and Fat; which ſerveth us very well for *Turfs*, cut out like great Bricks and Dried in the Sun. And this kind of ground is ſo much here, that there are few Townſhips but they have their particular *Moſſes*. In theſe is found much of that Wood we call *Firr wood*, which ſerves the Country-People for *Candles*, *Fewel*, and ſometimes for ſmall *Timber Uſes*; and this the Vulgar concludes to have layn there ſince the *Flood*. But generally theſe *Moſſes* ſeem to be places undermined by ſome *Subterraneous Streams*; or by the Diſſolution of ſome matter, that made them equal with the reſt of the ground formerly: In which conjecture I am confirmed by this, That near a place of my Lord *Cholmondeley's* called *Bilkely*, about 9 or 10 Years ſince, not far from one of theſe *Moſſes*, without any Earthquake, a piece of ground, about 30 Yards over, fell in with an huge noiſe, and great *Oakes* growing on it *Fell in* with it together; which hung firſt with part of their Heads out, afterwards ſuddenly Sunk down into the grounds, ſo as to become Inviſible: Out of which Pitt they drew *Brine* with a Pitcher tyed to a Cart-rope, but could then find no *bottom* with the Ropes they had there: Since, the Pitt is filled up with Water, and now doth not Taſte *Salt*, but a very little *Brackiſh*, a very ſmall Rivolet paſſing through it. The neareſt *Salt Springs* to this place are at *Durtwich* about 3 Miles from it.

Our *Springs* are about 30 Miles from the *Sea*; and generally ly all along the River *Weever*: Yet there is an appearance of the ſame *Veine* at *Middlewich* nearer the River *Dane* than *Weever*; which notwithſtanding ſeems not to be

out

out of the Line of the *Weeveriſh Stream*; and theſe lye all near Brooks, and in Meadowiſh grounds.

I could obſerve no Singularity at all in the *Plants*; for, where the *Salt* reaches the Surface, it *Frets* away all (as I ſaid before,) and upon the Turf, near the old decayed Pitts, grows the very ſame, that doth in the Remoteſt place of the Meadow; only I obſerve, that where the Turf was *Fretted* away, *Ruſhes* maintained their ſtation longeſt.

The *Water* is ſo very *Cold* at the Bottom of the Pitt, that when the *Briners* ſometimes go about to Cleanſe the Pitt, they cannot abide in, above half an hour, and in that time they Drink much *Strong Water*. There is not any *Hot-Springs* (that I can hear of) nearer us, than *Buckſton-well*, which is about 30 Miles diſtant.

Several new *Brine Springs* have been of late both ſought and found; yet none knows of any *Shells*, but rather a Blackiſh Slutch mixt with the Sand, which infects the whole Spring (like the *Scuttle Fiſh*) Black, when 'tis ſtirred; elſe the Water runs very Clear.

The *Springs* are Rich or Poor in a double Senſe; for a *Spring* may be Rich in *Salt*, but Poor in the quantity of *Brine* it affords. Thus they have a Rich *Brine* in their chief Pit at *Middle wich*, which yields a full 4*th* part of *Salt*, yet is it ſo Thrifty of it's *Brine* that the Inhabitants are Limited to their proportions out of it, and their Quantity is ſupplyed out of Pits that afford a Weaker *Brine*. Our Pitt at *Nantwich* yields about 1 pound of *Salt* for 6 pound of *Brine*; but then 'tis always (without any ſenſible difference) ſo Plentiful a *Spring*, that whereas they ſeldom *Wall*, that is *Make Salt*, in above 6 Houſes at a time, and there are or ſhould be about 50 *Wich Houſes* in the Town, this Pitt is judged ſufficient to ſupply them all, without falling much lower than a Yard or two at moſt. And this Advantage would accrew over and above, that ſuch quick uſe of the Pit extreamly Strengthens the *Brine*, perhaps to a degree little leſs than that of *Middle-wich-Pitt:* For, I have tryed it my ſelf, that a quart of *Brine*, when the Pit had been drawn off 3 or 4 days firſt to ſupply 5 or 6 *Wich-houſes*, hath yielded an Ounce and an half more of *Salt*, than at another time, when it hath had a Reſt of a week or thereabout.

Mar. 8. 1668. I Weighed *two pounds* of *Diſtilled Water* in a Narrow-mouthed Glaſs-bottle, that I might take an exact Mark for a Quart. This Bottle being filled with our *Brine* to the very ſame Mark, Weighed (beſides the Tare of the Bottle) *two pound* 3 *Ounces* and 5 *Drachms*. This was taken up when the *Wich Houſes began* to Work, ſo that the Pitt was but little drawn. I filled up the Bottle with the ſame *Brine*, and it weighed juſt 3 *Drachms* more. This *Brine*, boyled away, without any Addition or Clarification, made 5 *Ounces* and 2 *Drachms* of *Salt*. Five days after, when the Pit had been Drawn all that while for the working of the *Wich-houſes*, vid: *Mar.* 13. the ſame Bottle fill'd to the Quart Mark aforeſaid with *Brine* then taken up, weighed, beſide the Bottle, *two pound* 4 *ounces* and an *half:* The ſame time, the Bottle filled as in the former Experiment, weighed juſt *two Pounds* and an *half*, which is 3 *Drachms* more than the Quart Mark before; which boiled into *Salt* made 6 *ounces* 6 *Drachms* and two *Scruples*: Which exceeds the for-

mer quantity of *Salt*, one *Ounce* 4 *Drachms* and 2 *Scruples*, though the *Brine* exceeded the former in Weight but 4 *Drachms*.

By which Trial I confuted also a Tradition, which the *Briners* have amongst them, *viz*, that the *Brine* is strongest at the time of the *Spring-Tides*, to wit, at the *Full* and *Change* of the *Moon*. For *Mar*. 8. aforesaid was only one day past the *Full*, and then the *Brine* was Weaker than it was the 13*th* day, when 'twas 6 days past the *Full*. So that I conclude there could be no other reason, than that the much Drawing makes way for the *Salt-Springs* to come the quicker, and allows the less time for the admission of *Fresh-Springs* But 'tis observed by the *Briners* that they make more *Salt* with the same quantity of *Brine* in *Dry* than in *Wet* Seasons.

Their manner of *Working* is this: They have formerly boiled their *Brine* in 6 *Leaden Pans* with Wood fire; upon which account they all Claim their interest in the Pitt by the Name of so many 6 *Leads Walling*; by which they each know their Proportion; but in the memory of many alive they Changed their 6 *Leads* into 4 *Iron Pans*, something better than a Yard Square, and about 6 inches Deep, still fitting the Content of these to that of the 6 *Leads*: And of late many have changed the 4 *Iron Pans* into *Two* greater; and some *Wall* but in *one*: But still the Rulers Gage it to their Old proportions.

They use for their *Fewel* Pit coals, brought out of *Staffordshire*. These *Pans* are set upon Iron Bars, and made in on all sides, very close (that the Flame nor Smoak break through) with Clay and Bricks. They first Fill their *Pans* with *Brine* out of the *Pitt*; which comes to them in several *Wooden Gutters*: Then they put into their *Pans* amongst their *Brine* a certain mixture, made of about 20 Gallons of *Brine* and 2 quarts of Calves, Cows or chiefly Sheep's *Blood*, mixt into a Clarret Colour: Of this mixture they put about 2 *quarts* into a *Pan* that holds about 360 *quarts* of *Brine*; this *Bloody Brine*, at the first Boiling of the *Pan* brings up a *Scumm*, which they are careful to take off with a Skimmer, made with a wooden handle thrust through a long Square
Fig. 63. of Wainscot board, twice as bigg as a good square Trencher: This they call a *Loot*. Here they continue their Fire as quick as they can, till *half* the *Brine* be Wasted, and this they call *Boiling upon the Fresh*. But when 'tis half boiled away, they fill their *Pans* again with new *Brine* out of the *Ship*, (so they call a great Cistern by their Pans sides, into which their *Brine* runs through the Wooden Gutturs from the Pump, that stands in the *Pitt*;) then they put into the *Pan* 2 *quarts* of the mixture following: They take a *quart* of *whites* of *Eggs*, beat them throughly with as much *Brine*, till they are well broken; then mix them with 20 *Gallons* of *Brine*, as before was done with the *Blood*; and thus that which they call the *Whites* is made. As soon as this is in, they Boil sharply, till the *second Scumm* arise; then they Scumm it off as before, and Boil very gently till it *Corn*; to procure which, when part of the *Brine* is wasted, they put into each *Pan*, of the Content aforesaid, about a *quarter* of a *Pint* of the best and strongest *Ale* they can get; this makes a momentary *Ebullition*, which is soon over, and then they abate their *Fires*, yet not so but that they keep it Boyling all over, though Gently; for the Workmen say, that if they boil Fast here, (which they call *Boyling on the Leach*, because they

usually

uſually all this time lade in their *Leach-Brine*, (which is ſuch *Brine* as runs from their *Salt* when it is taken up before it hardens) if, I ſay, they boil faſt here, it waſtes their *Salt*. After all their *Leach-Brine* is in, they boil gently, till a kind of *Scum* come on it like a thin Ice; which is the firſt appearance of the *Salt*: Then that ſinks, and the *Brine* every where gathers into *Corns* at the bottom to it, which they gently rake together with their *Loots*: I ſay gently, for much ſtirring breaks the *Corn*. So they continue till there is but very little *Brine* left in the *Pan*; then with their *Loots* they take it up, the *Brine* dropping from it, and throw it into their *Barrows*, which are Caſes made with flat cleft Wickers, in the ſhape almoſt of a Sugar-loaf, the bottom uppermoſt. When the *Barrow* is full, they let it ſtand ſo for an Hour and an half in the *Trough*, where it drains out all the *Leach brine* above ſaid; then they remove it into their *Hot Houſe* behind their Works; made there by two *Tunnels* under their *Pans*, carried back for that purpoſe. The *Leach-brine*, that runs from the *Barrows*, they put into the next Boyling; for 'tis to their Advantage, being *Salt* Melted, and wanting only Hardning. Fig. 64. Fig. 65.

This work is performed in 2 *Hours* in the ſmaller *Panns*, which are ſhallower, and generally boil their *Brine* more away; wherefore their *Salt* will laſt better, though it does not *granulate* ſo well, becauſe, when the *Brine* is waſted, the Fire and the ſtirring breaks the *Corns*. But this *Salt* weighs heavier, and melts not ſo ſoon; and therefore is bought by them that carry it far. But in the greater *Panns*, which are uſually Deeper, they are about half an Hour longer in boiling; but, becauſe they take their *Salt* out of their *Brine*, and only harden it in their *Hot-Houſe*, its apter to melt away in a moiſt Air. Yet of this ſort of *Salt* the bigger the *Grain* is, the longer it endures; and generally this is the better *granulated* and the Clearer, though the other be the *Whiter*. Upon which I rather think, 'tis the taking off the *Salt* out of the *Brine* before it be waſted, that cauſes the *granulating* of it, than the *Ale* to which the Workmen impute it. This kind meaſures profitably well; therefore it is much bought by them who buy to ſell again.

They never cover their *Panns* at all, during the whole time of Boyling. They have their Houſes like Barns open up to the Thatch with a *Louver-hole* or two to vent the Steam of the *Panns*. Poſſibly Tiles may do better, but no Body is yet ſo curious as to try; but the Steam is ſuch, that I am confident no Plaiſter will ſtick, and the Board will Warp, and their Nails will ruſt ſo, as quickly to fret in pieces.

With our *Salt*, both *Beef* and *Bacon* is very well preſerved, ſweet and good a whole Year together; and I do apprehend this *Salt* to be rather more ſearching than *French Salt*, becauſe *I* have often obſerved that Meat kept with this *Salt*, ſhall be more fiery *Salt* to the midſt of it, than *I* have obſerved when *I* have eaten powder'd Meat on Ship-board, which was probably done with *French Salt*, *I* then being on the *South* ſide of *England*, and in a *Dutch* Veſſel. 'Tis certain *Cheſhire* ſends yearly much *Bacon* to *London*, which yet had never any mark of Infamy ſet upon it; and Hung'd Beef (which others call *Martinmaſs-beef*) is as good and as frequent in *Cheſhire* as in any place; ſo that I conclude, that *this laſt* is fully effectual for any Uſe, and as good as any other.

The *Sweepings* of ſuch *Salt* is conſtantly ſhed and ſcattered about on the Floor, not without taking much of the Dirt, (which occaſions its *Grayneſs*) is called *Gray Salt*. This ſells not at half the Rate of *White Salt*, and is only bought up by the poorer ſort of People, and ſerves them in ſalting *Bacon*, courſe *Cheeſe*, *&c.* *Catts* of *Salt* are only made of the worſt of *Salt*, when yet wettiſh from the *Panns*; molded and intermixt with interſperſed *Cummin Seed* and *Aſhes*, and ſo baked into a hard Lump in the Mouths of their *Ovens*. The uſe of thoſe is only for *Pigeon-Houſes*. But *Loaves* of *Salt* are the fineſt of all for Trencher Uſe. There is no difference in the boiling of theſe from the common way of the *fine Salt*; but in the making up, ſome care is uſed: For firſt they cut their *Barrows*, they intend for *ſalt Loaves*, with a long ſlit from top to bottom equally on both ſides; then they tye both ſides together with Cords; then they fill this *Barrow* with *Salt* boiled as uſually, but in the filling are careful to *Ramm* down the *Salt*, with the end of ſome Wooden Bar, continuing this till the *Barrow* be fill'd to their Minds; then placing it ſpeedily in their *Hot Houſe*, there let it ſtand all the time of their *Walling*: Wherefore they prepare for theſe *Loaves* at the begining of their Work, that they may have all the benefit of their *Hot Houſes*, and when theſe begin to ſlack, they take out the *Loaves*, and untye the Cords that faſtened the *Barrow*, that both ſides of the ſame may eaſily open without breaking the *Loaf*. Then they take the *Loaf*, and bake it in an Oven where Houſhold Bread hath been baked, but now drawn forth. This they do twice or thrice, 'till they ſee it baked firm enough; and this being placed in a *Stove* or in a *Chimney* Corner, and cloſe covered with an Hoſe of Cloth or Leather, like the Sugar Loaf-Papers, will keep very *White*; and when they have occaſion to uſe any, they ſhave it off with a Knife (as you do *Loaf-Sugar*) to fill the *Salt-ſeller*.

Explication of the Figures.

Fig. 63. The Loot.

Fig. 64 *aa*, Two *Barrows* filled with *Salt*. *bb*. The *ſalt* heaped above the top of the *Barrows*, and patted down hard. *C*. The *Leach-Trough*.

Fig. 65. *aaaaaa*, The *Hot-Houſe* between the Wall and the *Chimney*. *bb*, two *Tunnels*. *CC*, The *Chimney-back*, into which the *Tunnels* convey the Smoak. *dddd*, The 4 *Panns*. *E*, The Partition Wall between the *Panns* and the *Hot Houſe*. *ff*. The *Fire-places*. *gg*. *Aſh-holes*. *hh*. The *Hearth* below. *ii*. The *Deſcent* to the *Hearth*.

At Droitwich *in* Worceſterſhire; *by Dr.* Tho. Raſtel. n. 142. p. 1059.

The Country is neither *Plain*, neither hath it any great *Hills*, but many ſmall Riſings, the greateſt Hills near us being the *Lichie* within 6 Miles, which ſome call *Look-high*, ſuppoſing it to be the higheſt Ground in theſe Parts, becauſe the *Springs* which riſe there, run into the North and South Seas; near to which are *Clent Hills*, about the ſame diſtance. On the other ſide the River *Severn*, are *Aberly* Hills at about 7 Miles diſtance from us. There are many *Salt-ſprings* about the Town, which is ſeated by a Brook ſide, called *Salwarp-brook*, which ariſe both in the Brook, and in the ground near it, though there are but 3 *Pitts* that are made uſe of.

Where the *Springs* are *ſalteſt* there grows nothing at all, but by the *Brackiſh* Ditches there grows *After Atticus* with a pale Flower, which *I* find no where elſe with us.

Some

Some of the *Salt Springs* riſe on the top of the ground, which are not ſo *ſalt* as others. The *Great Pit* which is call'd *Upwich Pit* is three foot deep, in which are three diſtinct *Springs* riſing in the bottom, one comes into the *Pit* North weſt, another North Eaſt, the 3d South-Eaſt, which is the Richeſt both in Quantity and in Quality. They all differ in *ſaltneſs*, which I can give no exact Account of, it being impoſſible to ſeperate them, but there will be ſome mixture; the *Pit* is about 10 foot ſquare, the ſides are made with ſquare Elms jointed in at the full length, which, I ſuppoſe, is occaſion'd by the *Saltneſs* of the ground which appears to me to have been a *Bogg*, the ſurface of it is made of *Aſhes*. That it was originally a *Bog*, *I* am induced to believe, for not many Years ſince, digging to try the Foundation of a *Seal* (for ſo we call our Houſes we make *Salt* in) I thruſt a long Staff over head.

Tho' the *Brine* be *Colder* than the other Water, yet it never *Freezeth*, but the Rain Water that lies upon the *Brine* (in extream hard *Froſts*) will *Freeze*, but not much.

The *Soil* about the Town on the lower ſide of it, is a Black Rich Earth, under which two or three foot is a ſtiff Gravelly Clay, then Marle. Thoſe that make Wells for freſh Water, if they find Springs in the Marle, they are generally *Freſh*; but if they ſink through the Marle, they come to a whitiſh Clay mixed with Gravel, in which the Springs are more or leſs *Brackiſh*.

In the great Pit at *Upwich*, we have at one and the ſame time three ſorts of *Brine*, which we call by the names of *Firſt-man*, *Middle man*, and *Laſt-man*; theſe ſorts are of different *ſtrengths*: The *Brine* is drawn by Pump, ſo that which is in the bottom is firſt pumped out, which is that we call *Firſt man*, &c. That I might make an exact tryal of the *ſtrength*, *I* made me a Quart that contained 24 *Ounces Troy*, of *Diſtilled Water*, which Quart being filled with the *firſt Brine*, beſides the Tare of the Quart weighed 29 *Ounces*, which made 7 *Ounces* and 3 *Drachms* of *Salt* without any addition; the next day *I* weighed the ſame *Salt* again, and it weighed 7 *Ounces* and 6 *Drachmes*: So that 4 Tuns of *Brine* make above one Tun of *Salt*. The ſame Quart filled with *Middle-man*, which is the *ſecond* ſort of *Brine*, weighed 28 *Ounces*, *I* alſo weighed a Quart of *Brine* as it came immediately out of the *Springs* which weighed 28 *Ounces*, and the 3d ſort 27 *Ounces*, ſo that what the *firſt* gets, the *laſt* looſeth, which doth precipitate as much in 24 Hours, as if it ſtood a much longer time.

The *Quantity* of *Brine* that this Pit yields every 24 Hours, is as much as will make 450 Buſhels of *Salt*, which is Drawn out twice or three times a Day, for ſo oft we ordinarily Draw, and that as long as the Pump will go.

In the *Beſt* Pit at *Netherwich*, a quart of *Brine* weighs 28 *Ounces* and an *half*; this Pit is 18 Foot deep, and 4 Foot broad, and yields as much *Brine* every 24 Hours as makes about 40 Buſhels of *Salt*, there is but one Spring in the Pitt, that comes in 2 Foot and 8 Inches above the bottom.

The *Worſt* Pitt at *Netherwich* is of the ſame breadth and depth as the former; a Quart of *Brine*, out of which weigheth 27 *Ounces*, and yields as much *Brine* daily, as makes about 30 Buſhels of *Salt*. In this Pitt are three Springs, two

in

in the bottom, and one about two Foot higher. Theſe Pits are within 6 yards of one another.

Theſe Pitts are near the *Brook*, the *Great* Pitt on the North ſide, and about a quarter of a Mile lower; the two *leſſer* Pitts on the South ſide.

In the *great* Pitt *I* found no variation, either in Quality or the Strength of the *Brine*, but the Springs in the other Pitts are augmented by much *Rain*, and yield leſs *Salt*.

That every Man may know his own Proportion, the *Brine* is divided into *Phats Wallings*, a *Phat Walling* is divided into 12 *weaker Brines*, and every *weaker Brine* is divided into 8 *Burdens*, every *Burden* being a Veſſel that contains about 32 *Gallons*, whereof every one hath 6 *Burdens* of *Firſt-man*, 6 of *Middle-man*, and 6 of *Laſt-man*, ſo that every Man hath not only his juſt proportion in Quantity, but in Quality alſo. This *Brine* is carried in Coolers to every Man's *Seal*, by 8 ſworn Men, which we call *Maſters of the Beachin*, and 4 *Middle men*, and there put into great Tuns for uſe.

The *Fewel* heretofore uſed was all Wood; but ſince the Wood hath been deſtroyed by the Iron Works, we uſe almoſt all Pitt-Coals, which are brought to us by Land 13 or 14 Miles.

The *Phats* we boil our *Brine* in, are made of *Lead*, caſt into a flat Plate 5 Foot and an half long, and 3 Foot over, and then the ſides and ends beaten up, and a little raiſed in the middle, which are ſet upon Brick-work, which we call *Ovens*, in which is a Grate to make the Fire on, and an Aſh-hole which we call a *Trunk*; in ſome *Seals* are 6 of theſe *Panns*; in ſome 5, and ſome 4, ſome 3, ſome 2. In each of theſe *Panns* is boiled at a time, as much *Brine* as makes 3 Pecks of *white Salt*, which we call a *Lade*, and is laded out of the *Pan* with a *Loote*, and put into *Barrows*, which are ſet into *Baſtalls* over Veſſels we call *Leach-coms*, that the *Brine* may run from the *Salt*; which *Brine* we call *Leach*, with which we dreſs our *Phats*, when the cold Brine they are firſt filled with is ſomething boiled away. In theſe *Baſtalls* the *Salt* ſtands till its dry, which is about 4 hours; then we carry it into *Cribs* (which are Houſes boarded in the bottom and ſides) where it is kept till ſold, which is ſometimes half a Year or 3 quarters; in which time if the *Crib* is good, it will not waſte a twelfth part, the *Salt* it ſelf being of ſo ſtrong a Body: Whereas in *Cheſhire* they are forced to keep their *Salt* in *Barrows* in *Stoves* to Dry it, and make it no faſter than they ſell.

For *Clarifying* the *Brine* we uſe nothing but the *Whites* of *Eggs*, of which we take a quarter of a *White*, and put it into a Gallon or two of *Brine*, which being beaten with one's Hand, Lathers as if it were Soap, a ſmall quantity of which Froth put into each *Phat*, raiſeth all the *Scum* (ſo that the *White* of an *Egg* will *Clarifie* 20 *Buſhels* of *Salt*) by which means our *Salt* is as White as any thing can be, neither hath it any ill Savour, as that *Salt* hath that is *Clarified* with *Blood*.

For *Granulating* it, we uſe nothing at all, for the *Brine* is ſo ſtrong of it ſelf, that unleſs it be often ſtirred, it will make *Salt* as big grain'd as *Bay Salt*. *I* have boiled *Brine* to a Candy height, and it hath produced *Clods* of *Salt* as clear as the cleareſt *Allum*, like *Iſle* of *May Salt*, ſo that we are neceſſitated to

put

put a ſmall quantity of *Roſin* into the *Brine* to make the *Grain* of the *Salt* ſmall.

Beſides the *White Salt*, we have another ſort which we call *Clod Salt*, which grows to the bottom of the *Phats*, that after the *White Salt* is laded out, is digged up with a *Picker* (which is made like a Maſon's Trowel pointed with Steel, and put upon a ſhort Staff) this is the ſtrongeſt *Salt I* have ſeen, and is moſt uſed for ſalting *Bacon* and *Neats Tongues*, it makes the *Bacon* Redder than other *Salt*, and makes the Fat eat firm; if the Swine are fed with Maſt, it hardens the Fat almoſt as much as if Fed with Peaſe, and *ſalted* with *White Salt*. It is very much uſed by Country Women to put into their Runnet-Pots, and (as they ſay) is better for their Cheeſe: Theſe *Clods*, are uſed to broil Meat with, being laid on Coals. We account this *Salt* to be too ſtrong to ſalt *Beef* with, it taking away too much of its ſweetneſs.

A 3d. ſort of *Salt* we have which we call *Knockings*, which doth Candy on the Stails of the *Barrow*, as the *Brine* runs from the *Salt*, after it is laded out of the *Phats*. This *Salt* is much uſed for the ſame uſes as the *Clod Salt*, though it is not altogether ſo ſtrong.

A 4*th* ſort we have which we call *Scrapings*, that is a Courſe ſort of *Salt* that is mixed with Droſs and Duſt that cleaves to the Tops of the ſides of the *Phats*; This *Salt* is Scraped off the *Phats* when we *Reach* them (that is when we take our *Phats* off the Fires to beat up the Bottom) and is bought by the poor ſort of People to *Salt* Meat with.

A 5*th* ſort is *Pigeon Salt*, which is nothing but the *Brine* running out through the Crack of a *Phat*, and Hardens to a *Clod* on the out ſide over the Fire.

Laſtly, the *Salt-Loaves* are the Fineſt of *White Salt*, the *Grain* of which is made ſomething Finer than ordinary, that it may the better adhere together, which is done by adding a little more *Roſin*, and is Beaten into the *Barrows* when it is *Laded* out of the *Phat*.

Our Salt is not ſo apt to Diſſolve as *Cheſhire Salt*, nor as that *Salt* that is made by Diſſolving *Bay-Salt* and *Clarifying* it, which is called *Salt* upon *Salt* which appears by our Long keeping it without any Fire.

I believe there cannot be better *White Salt* than *ours* for ſeveral Reaſons.

1 There is none can be *Whiter*, and conſequently more free from Droſs.

2. It is the *Weightieſt* as I have ſeen my ſelf, and been informed by others; for the *Baggs* of *Salt* I have uſually ſeen brought out of *Cheſhire* on Horſe back, contain 6 Buſhels and a half or 7 Buſhels, whereas the beſt Horſes that carry *Salt* from Hence (if they carry it above 5 Miles) carry not above 3 Strike and 3 Pecks, or 4 Strike. A *Wincheſter* Buſhel of our *Salt* Weighs half a hundred Weight, ſo that it muſt neceſſarily follow, the Weightieſt and Dryeſt muſt needs be beſt.

3. In the time of the Firſt *Dutch Warr*, our *Salt* was carried down into the *Weſt*, where they had none before but *Foreign Salt*, where at firſt uſing *ours* they complained that it made their Meat too *Salt*, which was becauſe they put as much of *ours* on their Meat as of others: If ſo, it muſt be better than *French Salt*.

4. I have been assured by many that have made use both of *ours* and *Cheshire Salt*, that both for Flesh and White meat they must lay on more of *Cheshire Salt* than *ours*.

5. It doth preserve all sorts of Flesh for *long Voyages, viz.* to *Jamaica*, as well as any; which hath been lately Tried.

6. I have seen *Herrings* that have been *Salted* with our *Salt* in *Ireland*, and brought over to this Town, which have been Whiter and better Tasted than those *Salted* with *Bay Salt*.

7. It is an ordinary way of Powdering *Beef* with us, to give it but one *Salting* to keep it the Whole Year.

We use not *Iron Pans* as they do in *Cheshire* and other places, for we have found upon Trials, that the Strength of the *Brine* doth so Corrode, that it quickly Wears out those of *Forged Iron*, and Breaks those of *Cast-Iron*.

The Formation of Salt *and* Sand *from* Brine; *by Dr.* Rob. Plot. n. 145. p. 96.

XLVI. At my request two Curious Observers (Neighbours to the *Brine Pits* in *Staffordshire*) to 8 folds of Fine *Holland* added as many more of Finer *Cambrick*, through both which they strained a competent quantity of the *Brine*, but found nothing left in this very close Colander, but a little black Dust, which they imputed only to the Foulness of the Water, it being nothing like *Sand*; for having examined the Cloth both with their Fingers and a *Microscope*, they could feel or see no more of *Sand*, than if they had percolated the cleerest Spring Water; and yet this *Brine* is found to hold in *boiling* at least $\frac{1}{4}$ of as much *Sand* as *Salt*.

But notwithstanding this Experiment, it did not seem to their apprehensions necessary that the *Sand* should be generated in the *Boyling*, but might rather be originally there; for before they strained it, they observed in the Water (by the help of a *Microscope*) a great Multitude of very *minute Animals* (much smaller than those in *Pepper Water*) swimming about in it, together with many small *Transparent Plates*, some of them a little bigger than the *Animalcules*, and some less, but all of a Rectangular Oblong Figure, though some indeed seemed very near a Square, which they found also in the *Water* after straining as thick as before, the Pores or rather Interstices between the Threads of the *Holland* and *Cambrick* appearing in the *Microscope* 20 times greater then either the *Animalcules* or *Plates*. And these they judged to be the Original Particles both of the *Salt* and *Sand*, which as the *Water* Evaporates in *Boyling*, they thought might gather together till they made up such a visible course Body as we see the greater *Corns* of each are. Wherein they were confirmed in a little time; for observing with an excellent *Microscope*, some of the strong *Brine*, which drops from the Baskets or *Barrows* when the *Salt* is first put into them, though at first it looks like clear Water, yet upon a more accurate Observation, it appeared exceeding full of these *Oblong Particles*, which as they lookt on them, they could sensibly perceive to gather together, and Club to make greater Parts; and as the Water dryed off from the Glass, to grow far larger and larger, till they appeared as big, and not much unlike a large siz'd Table Diamond: Which made them guess that the *Sand* might be also gene-

rated

rated (if I may ſo ſay) after the ſame manner, it appearing to them to be nothing (pardon the Expreſſion) but an *Inſipid Salt* compoſed of parts not ſo ſharp Pointed as the other, but Rounder and Blunter Angled, and conſequently not ſo Pungent on the Tongue.

Upon this Suggeſtion, having ſome of the *Sand* by me, I endeavoured to *Diſſolve* it in fair Water, to ſee whether I could reduce it again into its former State, but without Succeſs; its parts being ſo inſeparably Fixt, that they would by no means *Diſſolve*. I alſo tryed the *Salt*, which though it *Diſſolved*, yet would not render it ſelf again into the *Plates*. Whereof ſending an Account to my Friends in *Staffordſhire*, they were pleaſed alſo to make a further Tryal of *Diſſolving* the *Sand* ſeparated from the *Salt* in *Boiling*; which though they confeſt, they could not do to any conſiderable Quantity, yet they found that after the ſtraining, it was not ſo heavy by a great deal as before, the Water that came from it being very clear, which made them believe that it did *Diſſolve* in ſome meaſure, unleſs (as is very probable) there were in the *Sand* ſome Particles of *Salt*, which upon *Diſſolution* were ſeparated from it, and ſo rended it Lighter: Nevertheleſs they did not doubt, but a great part of the *Sand* might alſo be *Diſſolved*, though perhaps no great Quantity in *Pump-water*, in which it ſeems they tryed it.

One of the aforeſaid Gentlemen caſually looking upon ſome of the *Salt* made at thoſe *Pits* before it was Dryed and beaten ſmall, obſerved that many of the *larger Corns* were of the ſame Shape to the *Naked Eye*, as the *minute* ones appeared of in the *Microſcope*, and that they were viſibly made up of a great Number of ſmall *Plates*, ſhooting up from a Quadrangular Oblong Baſe into a very Obtuſe Pyramid, hollowed within.

XLVII. At *Northwich* in *Cheſhire*, upon the *Weever*, in 4 *Pitts* is great plenty of *Brine*, it ſtinks of *Sulphur* apparently in all the *Pitts*; it becomes *Atramentous* with *Galls*. *Obſervations on the Midland* Salt-ſprings, *by Dr.* Lifter. n. 156. p. 489.

Here are uſed *Sand-pans*, which are let down in the Corners of the great *Iron Boilers*, before the *Salt* ſhoots into *Grains*, and theſe catch the *Sand*. Beſides there are thick *Stone-Flakes* raiſed from the bottom of the ſaid *Iron Boilers*, once a Week.

N. B. Within half a Mile of theſe *Brine pits* at *Marberry*, a *Salt Rock* was found by the Augur in Boring for Coals. *Vid. Inf.* Cap. III.

Here, and at *Middlewich*, alſo at *Nantwich*, and all along the River *Weever*, which are places many Miles diſtant, ſink on either ſide of the River, and you will ſcarce miſs of *Brine*, as I was credibly inform'd by the moſt knowing Men in that particular: But yet it proves a Venture whether the *Brine* will be ſtrong enough to *Boil*, and turn to Account; and for this Reaſon their *Pitts* ſometimes fail them, to their great loſs (as they ſhewed me one which had been wrought to very great profit) by a ſmall *ſweet Spring* breaking into it, and ſometimes the River *Weever* it ſelf does them this miſchief.

At *Nantwich* upon the ſame River, is one very large *Brine Pitt*. This Water alſo plainly *ſmells* as it were corrupted, or like *Sulphur*, but notoriouſly upon a few Days forbearance of the *Pitt*. It becomes *Atramentous* with *Galls*. It yields a *White Sand* or *Stone* adhering, in the manner of thin *Scales*, to the bottom of the *Iron Pans*, in which the *Brine* is Boiled.

Weſton Brine-Pit near *Stafford*. This Water in the Pit Stinks like Rotten Eggs: With *Galls* it becomes ſuddenly *Atramentous*. It Purges and Vomits violently, and that drunk in a ſmall Quantity. Here are uſed *Sand Pans* to catch the white *Sand*, and there are *Flakes* of *Stone* alſo, raiſed from the bottom of the great *Iron Boilers*.

Droitwich in *Worceſterſhire*. The *Upper Wich* or *Brine Pit* is very neatly kept, and exceedingly drawn, becauſe there are ſo many Proprietors, and but a ſmall *Pit*, comparatively to thoſe which have been named above.

Mr. J. Collins S. & Fiſh. Here the *Salt* is boiled in ſmall *Leaden Pans*, and there is not the leaſt Grain of *Sand* at any time, which either falls before the *Graining* of the *Salt*, or that adheres to the *Pans* bottoms; notwithſtanding what hath been ſaid to the contrary: And therefore this *Brine* being naturally without *Sand*, it muſt yield the more *wholſome Salt*.

The *Lower Pit* at the *Netherwich* in the ſame Town, hath but one Proprietor, as I remember, and therefore is leſs drawn, but yet is conſtantly and well wrought. Here alſo is no News or Knowledge of any *Sand* at all. The Water of theſe *Pitts* ſtinks like Rotten Eggs, eſpecially after *Sunday*'s reſt: And (*N. B.*) will, if Fleſh be Pickled in them, make it *ſtink* in 12 Hours. And yet the *Salt* that is boiled out of theſe Pitts, is accounted the very beſt *Inland Salt* of *England*, and I believe as good as any in the World.

I obſerved in a Ditch over againſt the *Nether Wich-houſes*, the Water ſtanding with a White Scum as at the *Sulphur Spaws* in *Yorkſhire*.

I ſhall add by way of Corollary,

1. That all our *Yorkſhire Wells* called *Sulphur Spaws* (which are many) are no other then ſo many *Brine Pits*, and if they were well Drawn and Wrought would be as little offenſive in *Smell*.

2. That this *Stone-Powder* is alſo to be found adhering to the *Iron Panns*, where the *Sea-water* is boiled into *Salt*, as it is at *Shields* in the *Biſhopriek* of *Durham*; but I do not remember it to be in the *Lead Pans* at *Medop* and *Milthrop* in *Lancaſhire*, where the *Sea Sands* are *Lixiviated*, and that *Lixivium* boiled into *Salt*; nor is it remembred in the Account given of the Making of *Sea-Salt* by *Inſolation*: Nor could I obſerve it in the leaſt, in Diſtilling of *Sea-Water* in a Glaſs Still, or in the *Yorkſhire-ſtinking Wells*; of which a good Quantity is Yearly made for Medical uſe, or rather Curioſity, to vend to Strangers.

Vid. Inf. §. XLVIII.

N. B. This *Sand* falls to the bottom before the *Salt Grains*.

This is ſo alſo in all other *Mineral Salts*, whoſe *Brines* being boiled, ever let go firſt this *ſtony* part: The *Okar* falls in Powder upon the firſt boiling, but the *Lapis Calcarius* riſes in *Flakes* like Wafers, which yet falls in Powder by Froſt, as we have elſewhere obſerved.

3. The

3. This *Stone-powder* irrigated with fair Water, and kept moiſt, does yield an immature *Salt* of an uncommon Figure; which I have deſcribed at large and figured. *De Font. Medic. Angl.*

4 Notwithſtanding the great Affinity betwixt the *Salt* of the *Midland Brine-Pits*, which is *Common Salt*, and the *Sea ſalt*: *I* muſt not omit (amongſt others) a ſpecifick Difference, which is by me (that I know of) now firſt publiſhed, and which, in my Opinion, makes the *Sea Water*, a Water of its own kind: And alſo ſhews that none of the Productions of Incinerated Plants are truly a *Marine Salt*.

The *Angles* of the *Cryſtals* of *Common Salt*, boiled out of the *Midland Brine Pits*; as alſo of *Salt Gem* or *Rock Salt*, which I take to be one and the ſame, are Intire, and ſo are all thoſe *Lixiviated Marine Salts*, ſo called and deſcribed by Dr. *Grew*. But the *Angles* of the *Cryſtals* of true *Sea Salt*, are ever ſome of them cut off into Triangular Planes, at leaſt on one of the ſides. And this *I* learnt by ſuffering a Bottle of *Sea Water*, taken up upon the Coaſt at *Scarborough*, where no River near enters it, to Evaporate leiſurely placed in the Shade, after it had been half boiled away; and here all the *Cryſtals* (which were many, and of different Magnitudes) did yet agree in a like Figure, as is deſcribed; and I do not doubt but it will ſucceed with any *Sea Water*.

XLVIII. *A A A*, is the *Sea*.

11. The Entry, by which the *Sea-water* paſſes into *B. B.*

B B. The *firſt* Receptacle; in which the Water is kept 20 *Inches* deep.

CCC. The 2*d*. Receptacle, where the Water maketh 3 Turnings, as you ſee, and is 10 Inches deep.

2 2. The *Opening*, by which the *firſt* and 2*d* Receptacle have Communication one with another.

EEF. The 3*d*. Receptacle, which is properly called the *Mariſh*.

d d d d d d. Is a *Channel* very narrow, through which the Water muſt paſs before it enters out of the 2*d*. Receptacle into the 3*d*.

33, Is the *Opening*, by which the Water runs out of the 2*d*. into the 3*d*. Receptacle.

The *Pricks* you ſee in the Water throughout the whole Scheme, do Mark the Courſe and Turnings which the Water is forced to make before it comes to *h h h h h*, which are the places where the *Salt* is made.

h h h h h, Are the *Beds* of the *Mariſh*, where the *Salt* is made; and in them the Water muſt not be above an Inch and an half deep. Each of theſe *Beds* is 15 Foot long, and 14 Foot large.

9 9 9 9 9, Are the little *Channels* between the *Beds*.

8 8 8 8 8, Are the *Apertures*, by which the *Beds* receive the *Sea-Water* after many Windings and Turnings.

When it *Rains*, the *Openings* 22, 33, are ſtopped to hinder the Water from running into the *Mariſh*. Unleſs it *Rain* much, the Rain Water doth little hurt to the *Mariſh*; the Heat of the *Sun* ſufficiently Exhaling it, if it be not above an Inch high; only if it have rained very plentifully that Day, no Salt is drawn for the 3 or 4 next Days. But if it Rain 5 or 6 Days, the People are

The Way of Making Salt in France by Dr. ---- n. 51 p. 1027.
Fig. 65.

then neceſſitated to empty all the Water of the *Beds* by a peculiar Channel, which cannot be Opened, but when it is *Low Water*. But 'tis very ſeldom that it Rains ſo long as to conſtrain Men to Empty thoſe *Beds*.

The Hotteſt Years make the moſt *Salt*; and in the Hotteſt part of the Summer there is *Salt* made even during Night. Leſs *Salt* is made in *Calm*, than in *Windy* Weather.

The *Weſt* and *Northweſt* Winds are the beſt for this purpoſe.

Our Country People *Draw* the *Salt* every other day, and every time more than an *hundred* pound Weight of *Salt*.

The *Inſtruments* uſed to *Draw* the *Salt*, have many ſmall Holes to let the Water paſs, and to retain nothing but the *Salt*.

The *Reddiſh Earth* in *Mariſhes* maketh the *Salt* more *Gray*; the *Blewiſh*, more *White*: Beſides, if you let run in a little more Water than you ought, the *Salt* becomes thence more *White*; but then it yields not ſo much. Generally all the *Mariſhes* require a *fat Earth*, neither Spungy nor Sandy.

The *Salt-man* who *draws* the *Salt*, muſt be very Dextrous. In this *Iſle* of *Rhe* there are, that Draw very *Dark* Salt, and others that Draw it as *White* as Snow; and ſo it is in *Xaintonge*. Chiefly care is to be taken, that the *Earth* at the bottom of the *Beds* mingle not with the *Salt*.

The *Salt* we uſe at our Tables is perfectly *White*; being the Cream (or that *Salt* which is formed on the Top of the Water) drawn 4 or 5 Hours before the *Salt* is to be drawn. The *Grains* of it are ſmaller than of the other. Generally the *Salt* of *Xaintonge* is ſomewhat *Whiter* than ours. The Bigneſs of our *Salt* is of the Size of a Pepper-grain, and of a *Cubical* ſhape.

The *Mariſhes* are preferred from one Year to another, by overflowing them a Foot high.

The Timber of the *Mariſhes*, if it be of good *Oak*, keeps near 30 Years; but there is uſed but little Wood, all the *Ditches* and *Apertures* being done with *Stones*.

In Lancaſhire; *by Dr.* J. Beale. *n.* 103. *p.* 51.

XLIX. At *Wire water* in *Lancaſhire*, *Salt* is gathered out of Heaps of *Sand* along the *Sea ſide* in many places: Upon which *Sand* (ſaith *Speed*) the People pour Water, until it gets a *Saltiſh* Humour, which they afterwards Boil with Turfs, till it become *White Salt*.

The Water of the *Brine Pits* in Summer time, when the *Brine* is ſtrongeſt, being caſt in any place where it may be ſoon Dried by the *Sun*, and where we would have *Pigeons* Reſort, does pleaſe them well. So will any Refuſe *Brine*, being boil'd up to a Conſiſtence. But *I* know not, whether ſuch *Brine*, taken from powdred Fleſh, will be kind for *Sheep*.

In Germany; *by* .... *n.* 7. *p.* 128.

L. An Obſerving Gentleman writes out of *Germany*, that no *Salt-Water* which contains any *Metal* with it, can well be ſodden to *Salt* in a Veſſel of the ſame *Metal* which it ſelf contains, except *Vitriol* in *Copper Veſſels*.

He adds, that to ſeparate *Salt* from *Salt-Water* without Fire, if you take a Veſſel of *Wax*, hollow within and every where tight, and plunge it into the *Sea*, or into other *Salt-water*, there will be made ſuch a Separation, that the Veſſel ſhall be full of *Sweet Water*, the *Salt* ſtaying behind; but though this Water have no *Saltiſh Taſte*, yet, he ſaith, there will be found a *Salt* in the

the Eſſay, which is the *Spirit* of *Salt*, ſubtile enough with the Water to Penetrate the Wax.

LI. We have ſeen here (at *Leyden*) a Maid, of about 13 Years of age, which from the time that ſhe was but 6 Years Old, and began to be about her Mother in the Kitchen, would, as often as ſhe was bid to bring her *Salt* or could elſe come at it, fill her Pockets therewith, and *Eat* it, as other Children do Sugar: whence ſhe was ſo Dried up, and Grown ſo *Stiff*, that ſhe could not Stir her Limbs, and was thereby *Starved* to Death. *The Joynts of a Girl made Stiff by Eating Salt; by* ..... n. 8. p. 138.

LII. *Papers, Of Leſs General Uſe,* Omitted.

1. SOme Objections of the *Fr. Journaliſt* to the *Engines* for *Drawing up Water from the Bottom of the Sea*, and for *Sounding the greateſt Depths without a Line*, Anſwer'd by Mr. *Oldenburg*. n. 13. p. 228.
2. Inquiries concerning the *Sea*; by Mr *Rob. Boyle*. n. 18. p. 315.
3. Inquiries and Directions concerning *Tides*; propoſed by Dr. *J. Wallis*. n. 17. p. 297.
4. Patterns of *Tables* propoſed to be made for Obſerving of *Tides*, by Sir *Rob. Moray*. n. 18. p. 311.
5. Quæries about *Tides* in *China* and the *E. Indies*; by Mr. *Edm.* Halley. n. 162. p. 687.
6. Several Engagements for *Obſerving* of *Tides*. n. 21. p. 378.
7. A Correct *Tide-Table*, ſhewing the True Times of *High Water* at *London-Bridge* to every day in the *Year* 1682; by Mr. *Flamſteed*. *Phil. Coll.* n. 4. p. 102.
8. The ſame, for the *Year* 1683. n. 143. p. 10.
9. The ſame, for the *Year* 1684. n. 155. p. 458.
10. The ſame, for the *Year* 1685. n. 166. p. 821.
11. The ſame, for the *Year* 1686. n. 177. p. 1226.
12. The ſame, for the *Year* 1687. n. 185. p. 232.
13. The ſame, for the *Year* 1688. n. 191. p. 428.
14. Objections from *Voſſius*, De *Motu Marium & Ventorum*, and from *Gaſſendus*, *De Æſtu Maris*, to Dr. *Wallis's Theory* of *Tides*, Anſwer'd; by Dr. *Wallis*. n. 16. p. 286.
15. Quæries and Conjectures concerning *Mineral Waters*; by Dr. *Dan. Foot*. n. 52. p. 1054.
16. An Inquiry concerning the *Cauſes* of *Mineral Springs* propoſed; by Dr. *J. Beal*. n. 56. p. 1131.
17. Some Quæries whereby to Examine *Mineral Waters*; by Sir *Will. Petty*. n. 166. p. 802.
18. Inquiries about the *Salt-Springs* in *Worceſterſhire* and *Cheſhire*; by Dr. *J. Beal*. n. 20. p. 359.
19. Inquiries and Suggeſtions concerning *Salt* for *Domeſtick Uſes*; by Dr. *J. Beal*. n. 103. p. 48.

LIII. *Accounts, Refutations, and Emendations, of Books,* Omitted.

1. IS. *Voſſius* de *Motu Marium & Ventorum*. n. 16. p. 286.
2. *Gaſſendus* de *Æſtu Maris*. *ib.* p. 287.

3. De

n. 167. p. 862. 3. De Origine *Fontium* Tentamen Philoſophicum, in Prælectione habita coram *Societate Philoſophica* nuper *Oxoniæ* inſtituta ad *Scientiam Naturalem* promovendam. Per *Rob. Plot.* L. L. D. *Oxon.* 1685. *in* 8°.

n. 233. p. 734. 4. De *Fontium Mutinentium* admiranda Scaturigine, Tractatus Phyſico Hydroſtaticus *Bernardini Rammazzini*, in *Mutinenſi* Lycæo Med. Prof. *Mutinæ.* 1691 *in* 4°. Tranſlated into *Engliſh*, and illuſtrated with many curious Remarks and Experiments by the Auth. and Tranſlator, Dr. *Rob.* St. *Clair. Lond.* 1697. *in* 8°.

n. 51. p. 1038. 5. Dr. *Tobias Whitaker* of Drinking *Mineral Waters.* 1634.

n. 42. p. 850. 6. *Hydrologia Chymica*, or the Chymical Anatomy of the *Scarbrough* and other *Spaws* in *Yorkſhire*, *&c.* by *W. Sympſon. Lond.* 1668. *in* 8°.

n. 49. p. 999. 7. An Anſwer to *Hydrologia Chymica* of *Will Sympſon*; by *Rob. Wittie.*
n. 51. p. 1038. M. D. *Lond.* 1669 *in* 8°. *Beſides the* Account *of this* Book, *there is a Correction of a* Miſtake *of the Printer in the* 3d Page

n. 52. p. 1050. *Some Reflections made on this Accompt of Dr.* Wittie's *Anſwer to* Hydrologia Chymica; *by Dr* Dan. Foot.

n. 57. p. 1154. *Dr.* Foot's *Reflections conſider'd*; *by Dr.* J. Beal.

n. 56. p. 1128. *Some Conſiderations relating to Dr.* Witties Defence *of* Scarborough Spaw; *by Dr.* Highmore,

n. 60. p. 1074. *A Diſcourſe of Dr.* Rob. Wittie, *relating to the Notes and Quæries of Dr.* Foot, *and to thoſe of Dr.* Highmore, *concerning* Mineral Waters, *and* Extracts *made out of them.*

n. 62. p. 2032. 8. A Vindication of *Hydrologia Chymica*, by *Will. Sympſon.* M. D. *Lond.* 1670,

n. 85. p. 5019. 9. *Scarborough Spaw* ſpagyrically Anatomiz'd. *An.* 1670; and a *New Years Guift* for Dr. *Wittie. Lond.* 1671. both *in* 12° *by Geo. Tonſtal.* M. D.

n. 144. p. 59: 10. 1. *M. Liſter* M. D. De *Fontibus Medicatis Angliæ*; Exercitatio nova & Prior. *Eboraci* 1682. *in* 8°.

n. 158. p. 579. 2. M. *Liſter.* M. D. De *Fontibus Medicatis Angliæ*; Exercitatio Altera *Lond.* 1684. *in* 8°.

n. 172. p. 1063. 11. Short *Memoires* for the *Natural Experimental Hiſtory* of *Mineral Waters*; by the Honourable *Rob. Boyle*, *Lond.* 1685. *in* 8°.

n. 206. p. 1003. 12. Tentamen Philoſophicum de *Aquis Mineralibus*, *&c.* Auth *Carolo Leigh.* M. D *Lond.* 1694. *in* 8°. *Dr.* Cay *here Objects many things to that* Author's *Obſervations.*

n. 245. p. 368.
n. 251. p. 146. 13. The *Natural Hiſtory* of the *Chalybeat* and *Purging Waters* of *England*, with their particular Eſſays and Uſes, *&c.* with Obſervations on the *Bath Waters* in *Somerſetſhire*; by *Benj. Allen* M. D. *Lond.* 1699.

n. 125. p. 612. 14. Obſervations ſur les *Eaux Minerales* des pluſieurs Provinces de *France*, faites en *l'Academie Royale* des *Sciences*, *en l'Anne* 1670, *&* 1671. par le Sieur *du Clos.* A *Paris.* 1675. *in* 12°.

n. 123. p. 573. 15. *Bathonienſium* & *Aquiſgranenſium Thermarum* Comparatio, variis adjunctis illuſtrata, a *R. P. Lond* 1676. *in* 8°.

CHAP.

CHAP. III.

Mineralogy.

I. 1. THE *Mine* or *Adit* is to be made 7 or 8 foot high; which though it ſeem to make more work downwards, yet will be found neceſſary for making the better Diſpatch by rendring the *Invention* more effectual.

To Break hard Rocks; *by M.* Du Sons. n. 5. p. 82.

There is a *Tool* of Iron well Steeled at the end, which cuts the Rock, (of the Shape ſhewed by the *Figure* annexed,) 20 or 22 *inches* long or more, and ſome $2\frac{1}{2}$ *inches* Diameter at the Steeled end, the reſt being ſomewhat more ſlender. The Steeled end is ſo ſhaped, as makes it moſt apt to Pierce the *Rock* the Angles at that end being ſtill to be made the more Obtuſe, the Harder the Rock is. This *Tool* is to be firſt held by the hand in the middle between the Sides of the Rock that is to be cut, but as near the bottom as may be. The *Tool* being placed, is to be ſtruck upon with a *Hammer*, the Heavier the better; either ſuſpended by a Shaft turning upon a Pin, or otherwiſe, ſo ſoon as one Man may manage the *Hammer* while another holds the *Tool* or *Piercer*. If it be hung in a Frame, or other convenient way, he that manageth it hath no more to do, but to pull it up at firſt as high as he can, and let it fall again by its own Weight, the motion being ſo directed as to be ſure to hit the *Piercer* right. After the ſtroke of the Hammer, he that holds the *Piercer*, is to Turn it a little on its Point, ſo that the Edges or Angles at the Point may all ſtrike upon a new Place; and ſo it muſt ſtill be ſhifted after every Stroke; by which means ſmall Chipps will at every ſtroke be broken off, which muſt from time to time be taken out, as need requires. And thus the Work muſt be continued, till the *Hole* be 18 or 20 *inches* Deep; the Deeper the better. This *Hole* being made as Deep as is required, and kept as Straight and Smooth in the ſides as is poſſible, there is then a kind of *Double Wedge* to be made, and fitted exactly for it; the Shape whereof is to be ſeen in the annexed *Figure*.

Fig. 67.

Fig. 68.

This *Double Wedge* being 12 or 13 *inches* long, each piece of it, and ſo made as being placed, in their due Poſition, they may make up a *Cylinder*, cut *Diagonal wiſe*. The 2 Flat-ſides that are Contiguous, are to be Greaſed or Oiled, that the one may ſlip the more eaſily upon the other; and one of them, which is to be uppermoſt, having at the Great end a Hollow Creaſe cut into it round about, for faſtning a Cartridge Full of *Gunpowder* to it with a thred, the Round End of the *Wedge* being pared as much as the thickneſs of the Paper or Paſt board that holds the *Powder* needs, to make the outſide thereof even with the reſt of the *Wedge*. This *Wedge* muſt have a *Hole* Drilled through the longeſt ſide of it, to be filled with *Priming Powder*, for firing of the *Powder* in the *Cartridge*: Which needs have no more than *half* a *pound* of *Powder*; though upon occaſion a greater quantity may be uſed, as ſhall be found Requiſite.

Then this *Wedge*, being firſt thruſt into the *Hole* with the *Cartridge*, the Round ſide, where the *Priming Hole* is, being uppermoſt, the other *Wedge* is to be Thruſt in, home to the due Poſition, care being taken that they fit the

Hole

Hole in the *Rock* as exactly as may be. Then the End of the lower *Wedge* being about an inch longer than that of the upper, outwardly and Flatten'd, *Priming Powder* is to be laid upon it, and a piece of burning *Match*, or Thred dipt in *Brimstone*, or other such prepared Combustible matter, fastned to it, that may burn so long before it *Fire* the *Powder* as he that orders it may have time enou_h to retire quite out of the *P t* or *Adit*, having first placed a piece of *Wood* or *Iron* so, as one end thereof being set against the End of the *Lower Wedge*, and the other against the *Side wall*, so as it cannot Slip. Which being done and the Man retired, when the *Powder* comes to take Fire, it will first drive out the *Uppermost wedge* as far as it will go; but the flaunting Figure of it being so made, as the Farther it goes backward the Thicker it grows, till at last it can go no farther, then the Fire Tears the Rock to get forth, and so Cracks and Breaks it all about, that at one time a vast deal of it will either be quite Blown out, or so Crack't and Broken as will make it easie to be Removed.

By Mr. Beaumont. n. 167. p. 854.

2. A considerable *Adventurer* in the *Lead Mines* on *Mendip Hills* acquaints me that the *Miners* there, within these 12 Months, had got a new way of *Cleaving Rocks* with *Gunpowder*.

Fig. 69.

The *Borier* is made of *Iron*, and is 2 *Foot* 2 *inches* in length: It is an *inch* square at the Steeled end from *a* to *b*, and somewhat less in the other part. The use of this Instrument is to make a *Hole* in the *Rock* deep enough to receive the *Powder*. The *Gun* is 6 *inches* in length, $1\frac{1}{4}$ Diameter, and has a *Hole* drilled through it to receive the *Priming Powder*. When a *hole* is made with the *Borier* somewhat deeper than the length of the *Gun*, they Dry it with a Rag, and put into it about 2 or 3 *Ounces* of *Powder*, over which they put a Thin Paper, and on it place the *Gun*, which they bind firmly into the *Hole*, by driving in against the Flat side of the Upper part of it a little Iron *Wedge* 4 *inches* in length, by the *Miners* called a *Quinnet*.

Fig. 70

Fig. 71.

When this is done, they pass down a wire through the *Hole* drilled in the *Gun*, and pierce the *Paper* which covers the *Powder*, and then they *Prime* the *Gun*, and lay a *Train*, and go up out of the work before the *Powder* comes to take Fire. The *Paper* is put at first over the *Powder*, lest when the *Gun* and *Quinnet* are driven down, the Tools may Strike Fire and Kindle the *Powder*.

These *Instruments* are of great advantage to *Miners*; for as soon as a Man has Fired his *Powder* and Broken the Rock, he may Presently go to Work again, whereas after a *Fire* is laid in a *Shaft*, a Man can scarce go to work in 24 *hours*, the *Rocks* being too *Hot* to suffer him.

Ookey-Hole, *and some other* subteraneous Caverns *in* Mendip-Hills; *by Mr.* J. Beaumont. *Ph. Col.* n. 2. p. 1.

II. 1. On the South side of *Mendipp Hills* within a Mile of *Wells* is a Famous *Grotto*, known by the Name of *Ookey-hole*, much resorted to by Travellours: The entrance of it is in the fall of those Hills, which is there all beset with Rocks, having near it a Precipitous Descent about 10 or 12 Fathom deep; at the Bottom of which there always issues from the Rocks a considerable Current of Waters. The naked Rocks above the entrance, shew themselves for about 30 Fathom in Height; though the whole Ascent of the Hill above it, is about a *Mile*, and is very Steep.

As

As you paſs into this *Vault* you go upon a Level, but advancing further into it, you find the Way Rockey and uneven, ſometimes Aſcending, and ſometimes Deſcending, as generally in all Caverns. The *Roof* of it, in the higheſt part, is about 8 Fathom from the *Floor*, and in ſome places it is ſo low that a Man muſt ſtoop to paſs. The *Widneſs* of it is alſo various; in ſome parts it is about 5 or 6 Fathom, in others not above a Fathom or two. It extends it ſelf in *Length* about 200 Yards. People talk much of ſeveral Stones there reſembling *Men* and other Things, but they are only Lumps of Common *Spar* without any *Regular Figures*.

At the fartheſt part of this *Cavern* there riſes a good *ſtream* of *Water*, large enough to drive a Mill, which paſſes all along one ſide of the *Cavern*, and at length glides down about 6 or 8 Fathom betwixt the Rocks, and then preſſing through the Clefts of them, diſcharges it ſelf into a Valley.

This *River* within the *Cavern*, is well ſtor'd with *Eels*, and hath ſome *Trouts* in it, which muſt of neceſſity have been *Engendred* there, and not come from without, there being ſo great a Fall as I have mention'd near the Entrance. It happen'd ſome few Years ſince, that many Cattle which fed in Paſtures through which this *River* paſſes, died ſuddenly after a Flood, the Cauſe of it being ſuppoſed to be, that theſe *Waters* had a Communication under Ground in *Mendip Hills*, with certain *Waters* which came from the *waſhing* of *Lead Ore* in the *Minery Ponds*, which are two Miles and an half diſtant from this *Cavern*, and were conveyed into the Ground by a *Swallow*, near the place where the *Ore* was *waſht*; which *Swallow* has ſince been cauſed to be dam'd up.

In a dry Summer, *I* have ſeen a good number of *Froggs* all along this *Cavern*, even to the fartheſt part of it, and other little *Animals* in ſome ſmall *Ciſterns* of *Water* there.

Before you come to the middle of this *Vault*, you will find a Bed of very *fine Sand*, which is much ſent for by Artiſts to *Caſt Metals* in.

On the *Roof* of it, at certain places, hang Multitudes of *Batts*. And indeed we generally find them in all *Caverns*, whoſe Entrance is upon a Level, or ſomewhat Aſcending or Deſcending, ſo it be not perpendicularly; and even in theſe, if the Paſſage into them be not narrow, and of a Conſiderable Height or Depth.

2. About 5 Miles from this, on the South-weſt part of *Mendip Hills*, near a place call'd *Chedder*, lies another *Cavern*, into which you muſt aſcend about 15 Fathoms on the Rocks. This *Cavern* is not of ſo large Extent as the former; there is no *Current* of *Water*, nor does *Water* drop ſo freely from the *Roof* as generally in other *Caverns*, wherefore the *Spars* appear not of ſo lively Colours as commonly elſewhere.

3. Theſe two *Caverns* have no *Communication* with *Mines*: But we generally obſerve, that whereſoever *Mines* of *Lead Ore* are, there are *Caverns* belonging to them, which are of a various Nature and Situation. The moſt Conſiderable of theſe *Vaults* I have known on *Mendip Hills*, is on the moſt Northerly part of them, in a Hill call'd *Lamb*, lying above the Pariſh of *Harptry*. Much *Ore* has been formerly Raiſed on this *Hill*; and being told

ſome Years ſince that a very great *Vault* was there diſcover'd, I took ſix *Miners* with me, and went to ſee it. Firſt we Deſcended a perpendicular *Shaft* about 10 Fathom, then we came into a *Leading Vault*, which extends it ſelf in Length about 40 Fathom; it runs not upon a Level but Deſcending, ſo that when you come to the End of it, you are 23 Fathom Deep, by a Perpendicular Line. The *Floor* of it is full of looſe Rocks; its *Roof* is firmly *Vaulted* with Lime ſtone Rocks, having *Flowers* of all Colours hanging from them, which preſent a moſt Beautiful Object to the Eye, being always kept moiſt by the diſtilling Waters. In ſome parts the *Roof* is about 5 Fathom in Height, in others ſo low, that a Man has much ado to paſs by Creeping. The *wideneſs* of it, for the moſt part, is about 3 Fathoms. This *Cavern* croſſes many *Veins* of *Ore* in its running, and much *Ore* has been thence raiſed. About the Middle of this *Cavern*, on the Eaſt ſide, lies a narrow Paſſage into another *Cavern*, which runs betwixt 40 and 50 Fathom in length. At the End of the *Firſt Cavern* a *Vaſt Cavern* opens it ſelf. *I* faſtened a Cord about me, and ordered the *Miners* to let me down: And upon the Deſcent of 12 or 14 Fathom *I* came to the Bottom. This *Cavern* is about 60 Fathom in the *Circumference*, above 20 Fathom in *Height*, and about 15 in *Length*; it runs along after the *Rakes*, and not *Croſſing* them as the leading *Vaults* does. *I* afterwards cauſed *Miners* to *drive* forward in the *Breaſt* of this *Cavern*, which terminates it to the Weſt, and after they had *driven* about 10 Fathom, they happened into another *Cavern*, whoſe *Roof* is about 8 Fathom, and in ſome parts 10 or 12 in Height, and runs in Length about 100 Fathom.

Vid. Inf. 3.

The frequency of theſe *Caverns* on thoſe Hills may be eaſily gueſt at, by the frequency of *ſwallow Pits* which occur there in all Parts, and are made by the falling in of the *Roofs* of *Caverns*; ſome of theſe *Pits* being of a large Extent and very Deep; and ſometimes our *Miners ſinking* in the Bottom of thoſe *Swallows*, have found *Oaks* 15 Fathom deep in the Earth.

Elden-Hole *in* Darbyſhire; *by Dr.* Plot, ib. p. 7. Ph. Col. n. 2. p. 7.

III. Dr. *Plot* has learnt by an Inquiſitive Gentleman, who purpoſely made Tryal of it, that one of thoſe *Caverns* in the *Peak* in *Darbyſhire*, hath been *ſounded* in depth by a Perpendicular Plum-Line, no leſs than *Eight and Twenty Hundred* Feet, without meeting with the Bottom, or Water; and yet the *Mouth* of this *Cavern* at the *Top* is not above 40 Yards over.

Pen-Park-Hole *in* Gloceſterſhire; *by Capt.* Sturmy. n. 143. p. 2.

IV. 1 Upon the 2*d* of *July* 1699. *I* deſcended by Ropes affixt at the top of an *Old Lead-Ore-Pit*, 4 Fathoms almoſt perpendicular, and from thence 3 Fathoms more Obliquely, between two great Rocks, where I found the Mouth of this ſpacious Place, from which a Mine-man and my ſelf lowred our ſelves by Ropes 25 Fathoms perpendicular, into a very large Place, which reſembled to us the form of a Horſe-ſhoe; for we ſtuck lighted Candles all the way we went, to diſcover what we could find remarkable. At length we came to a *River* or great Water, which *I* found to be 20 Fathoms Broad, and 8 Fathoms deep. The *Mine-man* would have perſwaded me, that this River *ebbed* and *flowed*, for that ſome 10 Fathoms above the place we now were in, we found the Water had ſometimes been: But *I* proved the contrary, by ſtay-

ing

ing there from 3 Hours *Flood* to 2 Hours *Ebb*, in which time we found no Alteration of this River. Beſides, its Waters were Freſh, Sweet and Cool, and the Surface of this Water as it is now at 8 Fathom Deep, lies *lower* than the Bottom of any part of the *Severn-Sea* near us, ſo that it can have no Community with it. As we were walking by this River 32 Fathoms under the Ground, we diſcovered a great *Hollowneſs* in a *Rock* ſome 3[illegible] Foot above us; ſo that *I* got a Ladder down to us, and the *Mine man* went up the Ladder to that Place, and walked into it about 70 Paces, till he juſt loſt ſight of me, and from thence chearfully called unto me, and told me he had found what he looked for, a *Rich Mine*. But his Joy was preſently turned into Amazement, and he returned Affrighted by the ſight of an *Evil Spirit*, which we cannot perſwade him but he ſaw, and for that Reaſon will go thither no more.

Here are abundance of ſtrange Places; the Flooring being a kind of white Stone Enamel'd with *Lead Ore*, and the Pendent Rocks were glazed with *Salt Peter*, which Diſtilled upon them from above, and time had *Petrify'd*.

Four Days together after his return, Capt. *Sturmy* was troubled with an Unuſual and violent Head Ach, which he imputed to his being in that Vault; and falling from his Head-Ach into a Fever, he ſoon after dyed. *By Sir* Robert Southwell. *ib.*

2. Tis down the *Tunnel*, C C, from the *Superficies* of the *Earth A A*, to the opening of the *Cavity* below, 39 Yards; Then the *Hole E E*, ſpreading into an irregular Oblong Figure, is in the greateſt length 75 Yards, and in the greateſt breadth 41 Yards. From the higheſt part of the *Roof* to the *Water*, was then 19 Yards. The *Water H H*, was now in a Pool at the North End, being the deepeſt part; it was in length 27 Yards, in breadth 12, and only five Yards and an half deep. Two *Rocks G G*, and *L L*, appeared above the *Water* all covered with *Mud*: But the Water was ſweet and good. There was a large Circle of Mud, *K K K*, round the *Pool*, and far up towards the South End, which ſhew'd that the Water has at other times been 6 Yards Higher than at this preſent. *By Captain* Collins. *ib.* p. 4. *Fig.* 1. 72, 73.

Sep. 18, and 19, 1682. The *Tunnel* or Paſſage down, was ſomewhat Oblique, very Ragged and Rocky; in ſome places it was two Yards wide, and in ſome three or four; but nothing obſervable therein, ſave here and there ſome of that *Sparr* which uſually attends the *Mines* of *Lead Ore*. In the Way 30 Yards down, there runs in Southward a *Paſſage D D*, of 29 Yards in length, parallel to the *Superficies* above; it was two or three Yards High, and commonly as Broad, and alike Rocky as the *Tunnel*, with ſome appearances of *Sparr*, but nothing elſe in it except a few *Bats*.

The *Cavity* below was in like manner Rocky and very Irregular; the Candles and Torches burnt clear, ſo as to diſcover the whole extent thereof; nor was the Air any thing Offenſive.

The *Bottom* of this Hole *I*, where the *Land Waters* do gather, is 59 Yards down from the *ſuperficies* of the *Earth*; and by good *Calculation* the ſame bottom is twenty Yards above the *Higheſt Riſing* of the *Severn*, and lies into the Land about three Miles diſtant from it, and about as far from *Briſtol*.

Air *in* Mines; *by Mr. J. Gill.* n. 26. p. 481.

V. One *John Gill* Affirms, from 20 Years Experience of his own, that if in digging deep under Ground, the Workmen meet with *Water*, they never want *Air* or *Wind*; but if they miſs *Water* (as ſometimes it happens, even at 12 or 16 Fathoms deep) they are deſtitute of convenient *Air*, either to Breath in, or to make their Candles Burn; and that when they *Drive* up an *Adit*, for drawing away a great Quantity of a Winter's ſtanding Water from a deep Mine, as ſoon as it is brought up ſo near, that any of the *ſtanding Water* begins to run away, the Men muſt ſecure themſelves as well as they can, from Danger of being daſhed in pieces againſt the ſides of the *Adit*: For the *included Air* or *Wind*, in the *ſtanding Water*, breaks forth with ſuch a terrible Noiſe, as that of a piece of *Ordnance*, and with that violence, as to carry all before it, looſening the very Rocks, though at ſome Diſtance in the *Work* or *Adit*.

To Work in Mines *without* Air-ſhafts; *by* Sir Rob. Moray. n. 5. p. 79.

VI. At the *Mouth* or Entry of the *Adit* (to the *Coal Mines* of *Liege*) there is a ſtructure raiſed of Brick like a Chimney, ſome 28 or 30 Foot High in all; at the bottom, two oppoſite ſides are (or may be) ſome $5\frac{1}{2}$ foot Broad, and the other two 5 Foot; the Wall $1\frac{1}{2}$ Brick thick. At the lower part of it is a *Hole*, ſome 9 or 10 Inches ſquare, for taking out of the *Aſhes*, which when it is done, this *Aſh Hole* is immediately ſtopt ſo cloſe, as *Air* cannot poſſibly get in at any part of it. Then ſome 3 Foot above Ground, or more, there is on that ſide, that is next to the *Adit*, or *Pit* a ſquare Hole of 8 or 9 Inches every way, by which the *Air* enters to make the *Fire* burn: Into this *Hole* there is fixt a ſquare *Tube* or *Pipe* of *Wood*, whereof the Joints and Chinks are ſo ſtopped with Parchment paſted or glewed upon them, that the *Air* can no where get into the *Pipe* but at the End; and this Pipe is ſtill lengthened as the *Adit* or *Pit* advanceth, by fitting New *Pipes* ſo, as one end is always thruſt into the other, and the Joints or Chinks ſtill carefully cemented, and ſtopt as before. So the *Pipe* or *Tube* being ſtill carried on, as near as is neceſſary to the *Wall* or place where *freſh Air* is requiſite, while the *Air* is drawn by the *Fire* from thence through the *Tube*, *freſh Air* muſt needs come in from without, to ſupply the place of the other; which by its Motion doth carry away with it all the ill *Vapours* that Breath out of the Ground: By which means the whole *Adit* will be always fill d with freſh *Air*, ſo that Men will there Breath, as ſurely as abroad, and not only Candles burn, but *Fire*, when upon Occaſion there is Uſe for it for *breaking* of the Rock.

There muſt be Two of the *Iron Grates*, that when any Accident befalls the One, the other may be ready to be in its place; the *Coals* being firſt well kindled in it: But when the *Fire* is near ſpent, the *Grate* being haled up to the Door, is to be ſupplyed with freſh Fewel.

The Higher the *Shaft* of the *Chimney* is, the *Fire* draws the *Air* the better. And this Invention may be made uſe of in the *Pits* or *Shafts* that are Perpendicular, or any ways inclining towards it, when there is Want of *freſh Air* at the bottom thereof; or any Moleſtation by *Unwholſome Fumes* or *Vapours*.

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The whole Contrivance of the *Fabrick*, may be eaſily underſtood by the annexed *Figure*. *Fig.* 74.

A, The *Hole* for taking out the *Aſhes*. *B*, The *ſquare Hole* into which the *Tube* or *Pipe*, for Conveying the *Air*, is to be fitted C, The *Border* or *Ledge* of *Brick* or *Iron*, upon which the *Iron Grate* or *Cradle*, that holds the *burning Coals*, is to reſt; the one being exactly fitted for the other. *D*, The *Hole* where the *Cradle* is ſet. *E*, The *wooden Tube* through which the *Air* is convey'd towards the *Cradle*. *F*, The *Door* by which the *Grate* or *Cradle* is let in, which is to be ſet 8 or 10 Foot Higher than the *Hole D*; and the *Shutter* made of *Iron*, or *Wood* that will not ſhrink, that it may ſhut very cloſe. *G*, The *Grate* or *Cradle* which is narrower below than above, that the *Aſhes* may the more eaſily fall, and the *Air* excite the *Fire*; the Bottom and ſides being Barred. *H*, The *Border* or *Ledge* of the *Cradle*, that reſts upon *Ledge C*, *I*, Four *Chains* of *Iron* faſtened to the four Corners of the *Cradle*, for taking it up and letting it down. *K*, The *Chain* of *Iron* to which the other *Chains* are faſten'd. *L*, The *Pulley* of *Iron* or *Braſs* through which the *Chain* paſſeth. *M*. A *Hook* on which the *Chain* is faſtened by a *Ring*; the *Hook* being fixed at the ſide of the *Dore*. *N*, A *Barr* of *Iron* in the Walls to which the *Pulley* is faſtned.

VII. 1. In a *Coal Pit* belonging to the Lord *Sinclair* in *Scotland*, where the *Coal* is ſome 18 or 20 Foot thick, and anciently waſted to a great depth: The *Colliers*, ſome Weeks ago, having wrought as deep as they could, and being to remove into new *Rooms* (as they call them) did, by taking off, as they retired, part of the *Coal* that was left as *Pillars* to ſupport the *Roof* and Earth over it, ſo much weaken them, that within a ſhort ſpace after they were gone out of the *Pit*, the *Pillars* falling, the Earth above them filled up the whole ſpace, where the *Colliers* had lately wrought, with its Ruines. The *Colliers* being hereby out of Work, ſome of them adventur'd to Work upon Old Remains of *Walls* ſo near the old *Waſtes*, that ſtriking through the ſlender Partition of the *Coal Wall*, that ſeparated between them and the Place where they uſed to work, they quickly perceived their Error, and fearing to be ſtifled by the *Bad Air* that they knew poſſeſſed theſe Old *Waſtes*, in regard not only of the *Damps* which ſuch *Waſtes* do uſually afford, but becauſe there had been for many Years a *Fire* in thoſe *Waſtes* that filled them with ſtifling Fumes and Vapours, retired immediately, and ſaved themſelves from the *Eruptions* of the *Damp*. But next Day ſome 7 or 8 of them came no ſooner ſo far down the Stairs that led them to the place where they had been the Day before, as they intended, but upon their ſtepping into the place, where the *Air* was *infected*, they fell down *Dead* as if they had been ſhot: And there being amongſt them one, whoſe Wife being informed he was *ſtifled* in that place, ſhe went down ſo far without inconvenience, that ſeeing her Husband near her, ſhe ventured to go to him, but being Choaked by the *Damp*, as ſoon as ſhe came near him, ſhe fell down *Dead* by him. Damps *in* Mines, *by Sir* Rob. Moray. n. 3. p. 44.

2. *Damps* happen in moſt of the *Hungarian Mines*, not only in the *Cuniculi* or Direct Paſſages, where they walk on Horizontally (by theſe *Mine-* By Dr. Edward Brown. n. 48. p. 965.

Men

Men called *Stollen)* but alſo in the *Putei* or Perpendicular Cuts or Deſcents (termed *Schachts* by the ſame.) They are met with not only in Places where the Earth is full of *Clay* or the like Subſtances, but alſo where it is *Rocky*; and one Place they ſhewed me in the *Copper-Mine* at *Hern Groundt*, where there had been a very pernicious *Damp*, and yet the *Rock* ſo hard, that it could not be *Broken* by their Inſtruments, but the Deſcent was all made by the means of *Gun-Powder*, Ram'd into long round Holes in the Rock, and ſo Blown up. Another place they ſhewed me, where there is ſometimes a *Damp*, and ſometimes Clear Weather. When there is much *Water* in the *Mine*, ſo as to ſtop up the lower part of this Paſſage, then this *Damp* becomes diſcoverable, and commonly ſtrong. I procured one to enter it, till his *Lamp* went out four or five times, in the ſame manner as at *Grotto del Cane* in *Italy*.

Some of theſe *Damps Suffocate* in a ſhort ſpace of time, others only render the Work men *Faint*, with no further Hurt, except they continue long in the place. The *Miners*, who think themſelves no Workmen, if they be not able to Cure a *Damp*, or to Cure the *Bad Weather*, or Make the *Weather* as they Term it, perform it by *Perflation*, by letting the Air in and out, and cauſing as 'twere a Circulation of it. In the *Mine* at *Hern groundt* they did cure a bad *Damp* by a great pair of *Bellows*, which were Blown continually for many days. The Ordinary *Remedy* is by long *Tubes*, through which the Air continually paſſing, they are able to digg ſtraight on for a long way without Impediment in Breathing: For ſome *Cuniculi* are 500 *Fathoms* long which will not ſeem ſtrange to any one that ſhall ſee the Map of the *Copper Mine* at *Hern-groundt*, or the *Gold Mine* at *Chremnitz*; And in the *Silver-Trinity Mine* by *Schemnitz*, I paſſed quite under a Hill, and came out on the other ſide. At *Windſchachmine* by *Schemnitz* they ſhewed me the place where 5 men and a Gentleman of Quality were *Loſt*: For which reaſon they have now placed a *Tube* there. The like they place over all *Doors*, and over all *Wayes*, where they digg right on for a great ſpace and have no paſſage through. At *Chremnitz* they told me, that 28 men had been *Killed* at one time in 4 *Cuniculi*, 7 in each; and in the *Sinking* of *Leopold's Pitt*, which is 150 Fathoms deep, they were much troubled with *Damps*, which they Remedied in ths manner;

Thy fixt a *Tube* to the ſide of the *Schacht* or *Pit*, from the Top to the Bottom: And that not proving ſufficient, they forced down a broad flat board, which covered or ſtopped the *Pitt*, or couched very near the ſides of it on all ſides but where the *Tube* was, and ſo *Forced* out all the *Air* in the *Pit* through the *Tube*; which work they were forced often to Repeat. And now they have divers other paſſages into it, the *Air* is Good and ſufficient, and I was Drawn up through it without the leaſt Trouble in *Breathing*.

But beſides this Miſchief from *Poiſonous Exhalations*, *Stagnation* of the *Air* or *Water* Impregnated with *Mineral Spirits*, they ſometimes *Periſh* by other ways. For there being in theſe *Mines* an Incredible Maſs of Wood to Support the *Pits* and the Horizontal Paſſages, (the *Putei* and *Cuniculi*) in all places but where it is Rocky, Men are ſometimes deſtroyed by the Wood ſet on *Fire*.

And

And in the *Gold-Mine* at *Chremnitz* the Wood was ſet once on *Fire* by the careleſneſs of a boy, and 50 Miners *Smothered* thereby; who were all taken out but one, that was afterwards found to be *Diſſolved* by the *Vitriol water*; nothing Eſcaping either of *Fleſh* or *Bones*, but only ſome of his *Cloaths*.

3. There are 4 ſorts of *Damps*. The *Firſt* is the *Ordinary* ſort. The *External Signs* of its Approach are the *Candles* Burning *Orbicular*, and the *Flames* Leſſening by degrees until it quite Extinguiſh: The *Internal*, Shortneſs of Breath. I never heard of any great Inconvenience, which any one ſuffered by it, who eſcaped *Swooning*. Thoſe that *Swoon* away, and Eſcape an abſolute *Suffocation*, are at their firſt Recovery tormented with Violent *Convulſions*, the Pain whereof, when they begin to recover their Senſes, cauſeth them to Roar exceedingly. The Ordinary *Remedy*, is to digg a *Hole* in the *Earth*, and lay them on their Bellies, with their Mouths in it: If that Fail, they Tun them full of *Good Ale:* But if that Fail they conclude them deſperate. I have known ſome, who have been Recovered after this manner, (when ſome of their Companions have at the ſame time died) that told me, they found themſelves very well within a little time after they had Recovered their Senſes, and never after found themſelves the Worſe for it. *By Mr.* Jeſſop. n. 117. p. 391.

They call the *Second* ſort the *Peaſe-Bloom Damp*, becauſe, as they ſay, it ſmells like *Peaſe-Bloom*. They tell me, it always comes in the Summer time; and thoſe *Grooves* are not free, which are never troubled with any other ſort of *Damps*. I never heard that it was *Mortal*; the Scent perhaps freeing them from the danger of a ſurprize: But by reaſon of it, many good *Grooves* lie idle at the beſt and moſt profitable time of the Year, when the *Subterraneous Waters* are at the loweſt. They fancy it proceeds from the Multitude of *Red Trifoil-Flowers*, by them called *Honey Suckles*, with which the Lime-ſtone Meadows in the *Peake* do much abound.

The *Third* is the ſtrangeſt and moſt *Peſtilential* of any; if all be true which is ſaid concerning it. Thoſe who Pretend to have ſeen it (for it is viſible) deſcribe it thus: In the Higheſt part of the *Roof* of thoſe Paſſages which branch out from the main *Groove*; they often ſee a Round thing hanging, about the bigneſs of a Foot-Ball, covered with a Skin of the Thickneſs and Colour of a Cob-web. This, they ſay, if by any Accident, as the Splinter of a Stone, or the like, it be broken, immediately Diſperſeth it ſelf, and *ſuffocates* all the Company. Therefore to prevent Caſualties, as ſoon as they have eſpied it, they ſay, they have a Way, by the help of a Stick and a long Rope, of Breaking it at a diſtance; which done, they Purifie the place well with *Fire*, before they Dare enter it again. I dare not Avouch the Truth of this Story in all its Circumſtances, becauſe the Proof of it ſeems impoſſible, ſince they ſay it *Kills* all that are likely to bear Witneſs to all the Particulars: Neither dare I deny, but ſuch a thing may have been ſeen hanging on the *Roof*, ſince *I* have heard many affirm it. Our *Under ground Philoſophers* ſay, The *Steam* which ariſes from their *Bodies* and the *Candles*, Aſcends into the higheſt part of the *Vault*, and there Condenſeth, and in Time has a *Film* grown round about it, and at length Corrupting, becomes *Peſtilential*.

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The *Fourth* which they alſo call a *Damp* (although how properly *I* will not argue) is that Vapour, which being touch'd by their Candle, preſently takes *Fire*, and giving a Crack like a *Gun*, produceth the like Effects, or rather thoſe of *Lightning*. A Fellow they commonly call *Dobby Leech*, is at this Day a ſad Example of the Force of one of thoſe *Blaſts* in *Haſleberg-Hills*, having his Arms and Legs Broken, and his Body ſtrangely diſtorted.

Captain *Wain* told me, he ſaw one of them in a *Bloomery* near *Peniſton*.

N. 119. p. 450. This *Fulminating Damp* has lately done ſome Hurt in a *Coal-Pit* at *Wingerſworth*, two Miles from *Cheſterfield*.

The *Shaft* of the *Coal-Pit* is about 15 Yards Deep; the Soyl a Stiff Mire, *Shaly* about the Middle of the *Shaft*, Dry at the Bottom (as they ſay, though I obſerved ſome moiſture about the Middle) and without any Quarry of *Stone*; the *Stones* in the Field about it are Grit ſtone. It lies almoſt at the bottom of a Riſing ground, being encompaſſed with Hills on all ſides, except towards the Eaſt, or rather South Eaſt.

There are 3 *Pits* which lie almoſt in a Direct Line, the middlemoſt of which is that we ſpeak of. There is alſo a 4*th* which ſtands a little Higher than the reſt.

From the Bottom run 4 *Binks*, as they call them; 4 Yards Wide, and 40 Yards long, except that in which they meet the *fiery Damp*, which wants 4 or 5 Yards of its due length.

The *Bink* in which the *Damp* is, is the fartheſt from the *Air*, which is communicated from the other *Pits*.

The Soyl of this *Bink* (as they tell me) is a ſtiff Clay; neither can they find in it the Sign of any *Mineral*, except *Coal* and *Shale*. The *Coal* they ſay is abſolutely free from the *Pyrites*, with which moſt of our *Coals* are Infected.

The *Bink* in which the *Damp* is, was wrought forward 20 Yards on *Whitſon-Monday* 1675, when *George Mitchel* (one of my Informers) going in to fetch ſome of his Tools, with a *Candle* in his Hand, and coming within four or five Yards of the further end, found himſelf on a ſudden, he knew not how, invironed with *Flames*. His Face, his Hands, his Hair, and a great part of his Cloaths were very much *Burnt*. He heard very little *Noiſe*, although one *Edward Mitchel*, who was working at the ſame time in another *Bink*, told me that both he, and thoſe that ſtood above ground, heard a very great one, like a Clap of *Thunder*, and that the Earth ſhaked; ſo that he was afraid the *Roof* would have fallen in and Buried him.

This being the firſt Accident of this nature, thoſe without ran in a great Amazement, with their *Candles* in their Hands, to ſee what the matter was; which were twice Extinguiſhed, but held in upon the 3*d* Lighting: They ſaw nothing, but met with an intolerable ſtench of *Brimſtone*, and an Heat as ſcalding as an Oven half heated for that was their Expreſſion;) and forced them very ſpeedily to quit the place.

Notwithſtanding this, they wrought forwards for about 3 Weeks, and carried it on till betwixt 30 and 40 Yards, until one *Henry Turnelly* met with the ſame Accident, which had formerly befallen *Mitchel*, and *Mitchel* had alſo the Misfortune to have his ſhare in this: For being by chance under ground, at

at the *Mouth* of the *Bink*, he was ſhot forth for about two or three Yards, and had his Head broken, and his Body bruiſed againſt the further ſide.

About a Week after, *Edward Michel*, another of my Informers, adventuring in again, met with the ſame Misfortune, and was worſe *ſcorched* than any of the reſt.

The things I chiefly took notice of were theſe.

1. That thoſe who were in the *Bink* whilſt it was *fired*, never Heard any more *Noiſe* than that which is uſually made by a *flaſh* of *Gun-Powder* in the open Air, although thoſe in the other *Binks*, and out, heard a very great one.

2. It ſhot off the *Turn* at the *Mouth* of the *Pit*, and ſmall Coals with other Rubbiſh from the *Bottom*, into the Air to a conſiderable Height.

3. They could perceive no *Smell* before the Fire, but afterwards a very ſtrong *ſmell* of *Brimſtone*.

4 They uſed to go with their *Candles* Low, as near as could be to the bottom, becauſe they perceived the Vapour to lie towards the *Roof:* Which, if they held their *Candles* higher than ordinary; they could ſee deſcend like a Black Miſt, and catch hold of the Flame, Lengthen it to two or three handfuls, which would nevertheleſs *burn* after the uſual manner, without any further Miſchief, if they ſuddenly held down their Hands cloſe to the Ground.

5 The *Flame* would continue in the *Vault* for 2 or 3 *Minutes* after the *Crack*; The laſt time, which was the moſt violent, they thought it continued about *half a quarter* of an *Hour*.

6. The *Colour* of the *Flame* was *Blue*, and very bright, ſomething inclining towards *Green*.

7. Although they told me, they were ſenſible of no *Smell*, before the *kindling* of the *Vapour*, yet the Colliers Cloaths that worked in the adjoining *Pits*, *ſmelt* very ſtrong of *Brimſtone*; which makes me ſuſpect all the *Pits* to be infected, although the *Air* ſecures them from Miſchief. Their Inſenſibility I aſcribe to the Cuſtom.

To the *Queries* ſuggeſted by Mr. *Boyle*, I Anſwer as followeth.

1. That *Damps* are generally obſerved to come about the latter end of *May*, and to continue during the *Heat* of *Summer*; and in thoſe places which have *Damps* all the Year long, yet they obſerve them to be moſt violent at that *Seaſon*. And *I* could meet with no other certain Rule for any *Periodical Returns*, except this *Annual*; although it be certain, they do often *Return* in the ſame *Summer*.

2. *I* never heard of any *Damps* that *Kindled* of themſelves, although I have been told, that in ſome places they have been *Kindled* by the motion of the *Sled* in which they draw their *Coals*.

3. *Damps* generally are held to he heavier than the *Air*; but this was manifeſtly Lighter, for it lay towards the top of the *Bink*.

4 Upon the *Breaking* of the *fulminating Damp*, there proceeded a Dark Smoak, of the *Smell* and *Colour* of that which proceeds from *Gun-Powder* Fired.

5. Many *Damps* are ſeen, but many alſo are not ſeen; which whether they be viſible or no, is hard to tell, but *I* ſuppoſe all would be Viſible; had we a convenient light to view them by, becauſe be they either Thicker or Thinner than the Air, that Denſity of Thinneſs will occaſion a Refraction, and that muſt needs render them Viſible.

6. Some *Damps* will quite extinguiſh all thoſe *Fires* that are let down into them, be they never ſo many ſucceſſively, or never ſo Great; and *Fire* is obſerved to be ſo far from *Curing*, that it often Creates *Damps* in places not otherwiſe ſubject to them. Indeed they are a preſent Remedy, if you can ſo order them as by their help to make a *Circulation* of the *Air* through the Infected place, otherwiſe they do Hurt; and thoſe *Grooves* wherein they are forced to *Break* their *Rocks* by the help of great *Fires*, are ſeldom free from *Damps*.

7. Men uſually Work in places Infeſted either by the *Fulminating* or other *Damps*, after they ſuppoſe the Vapour ſpent.

8. *Damps* are common both in Wet and Dry Ground; but I cannot tell in which moſt.

9. *Damps* are obſerved to be moſt *Peſtilential*, and to *Kill* the ſuddaineſt, that are in *Grooves* not ſtirred for many Years; eſpecially if ſuch *Grooves* have formerly had great *Fires* in them.

10 The general Opinion of our Workmen is, That there are ſome *Damps* which *Kill*, by reaſon of the *Noyſome Steam*, and others meerly by *Want* of *Air*. Which latter Opinion *I* have heard diſallowed by the more Experienced ſort: For they ſay that there is no *Groove* that wants *Air*, be it never ſo deep; but the *Air* ſtagnating in very deep *Grooves* or *Pits*, the groſſer parts muſt needs at length ſeparate themſelves by their own Weight, and ſubſiding to the bottom, there *Corrupt*, and conſequently get *Malignant* Qualities, eſpecially in the *Summer time*, when the Sun promotes the *Fermentation*. Beſides this, the ſtanding *Air* being in a ſhort time filled with the *Vapours*, ariſing from Men's Bodies and the *Steams* of *Candles*, and paſſing ſo often through the *Lungs* of the Work-men, is quickly rendred unfit for that Uſe (whatſoever it is) to which *Reſpiration* is Accommodated; and this they take to be the moſt frequent Cauſe of Ordinary *Damps*.

Damps will often follow the *Water*, and particularly this ſort of *Fiery Damp*, if I am rightly inform'd.

By Mr. Roger Moſtyn. n.136. p. 895.

4. The *Cole-Work* at *Moſtyn* in *Flintſhire* lies in a large parcel of Woodland, which hath a great Fall directly North to the Sea-ſide: But the *Dipping* or Fall of the *Coal* partly croſſing the Fall of the Ground, is within a Point of due Eaſt, and lies 40, 50, and ſometimes 60 yards under the level of the Sea. This *Work* is upon a *Coal* of 5 Yards in Thickneſs, and hath been begun upon, about ſix or eight and Thirty years ago. When it was firſt found, it was extream full of *Water*, ſo that it could not be wrought down to the bottom of the *Coal*, but a *Witchet* or Cave was *driven* out in the middle of it upon a Level for gaining room to Work, and drawing down the *Spring* of Water that lies in the *Coal*, to the *Eye* of the *Pit*; In *Driving* of which *Witchet*, after they had gone a conſiderable way under ground, and were

ſcanted

ſcanted of *Wind*, the *Fire-Damps* did begin by little and little to Breed, and to appear in Creviſes and Slits of the *Coal*, where *Water* had lain before the opening of the *Coal*, with a ſmall *blewiſh Flame*, working and moving continually, but not out of its firſt *Seat*, unleſs the Work-men came and held their Candles to it, and then being weak, the Blaze of the *Candle* would drive it, with a ſudden Fizz, away to another Creviſe, where it would ſoon after appear Blazing and Moving as formerly. This was the firſt Knowledge of it in this Work, which the Work-men made but a ſport of, and ſo partly neglected it till it had gotten ſome ſtrength; and then upon a Morning, the firſt *Collier* that went down, going forwards in the *Wichet* with his Candle in his Hand, the *Damp* preſently darted out violently at his Candle, that it ſtruck the Man clear down, ſinged all his Hair and Cloaths, and diſabled him for Working a while after. Some other ſmall Warnings it gave them, inſomuch that they reſolved to employ a Man on purpoſe, that was more reſolute than the reſt, to go down a while before them every Morning to chaſe it from place to place, and ſo to weaken it. His uſual manner was to put on the worſt Raggs he had, and to wet them all in Water, and as ſoon as he came within the Danger of it, then he fell down groveling on his Belly, and went ſo forward, holding in one Hand a long Wand or Pole, at the end whereof he tied Candles Burning, and reached them by degrees towards it, then the *Damp* would flie at them, and if it miſſed of putting them out, it would quench it ſelf with a Blaſt, and leave an ill ſcented Smoak behind it. Thus they dealt with it till they had wrought the *Coal* down to the bottom, and the Water following, and not remaining as before in the Body of it, among *Sulphureous* and *Braſſy Metal* that is in ſome *Veins* of the *Coal*, the *Fire Damp* was not ſeen nor heard of till the latter end of the Year 1675, which happen'd as followeth.

After long Working of this *Coal*, it was found upon the Riſing Grounds, that there lay another *Roach* of *Coal* at the depth of 14 Yards under it, which prov'd to be $3\frac{1}{2}$ Yards thick, and ſomething more *Sulphureous*. This encouraged us to ſink in one of the *Pits* we had formerly uſed on the *5 Yards Coal*; and we ſunk down 20 Yards before we came to the ſaid *Roach*, in regard it was at the Sea ſide, and upon the loweſt of the *Dipp*, where the Rocks ſucceſſively Thicken as they fall. As we ſunk the lower part of it, we had many Appearances of the *Fire Damp* in watry Creviſes of the Rocks, we ſunk through *Flaſhing* and Darting from ſide to ſide of the *Pit*, and ſhewing *Rain-bow-Colour like* on the Surface of the *Water* in the bottom; but upon drawing up of the *Water* with Buckets, which ſtirr'd the *Air* in the *Pit*, it would leave *Burning*, till the *Colliers* at work, with their Breath and Sweat, and the Smoak of their Candles thickned the *Air* in the *Pit*, and then it would appear again; they lighted their *Candles* in it ſometimes when they went out; and ſo in this *Pit* it did no further Harm.

But being deſirous to get the *Work* in ſome forwardneſs before *Summer*, (when the *Heat* of the Weather at ſometimes, and the Cloſeneſs of the *Air* in Foggy Weather at other, occaſions the *ſmothering Damp*) it was reſolved for expedition ſake, and ſaving of ſome Charges, to *ſink* a Pit within the *Hollows*

or *Deads* of the Upper *Work*, at 16 or 17 Yards diſtance from the *Firſt Pit*. This we proceeded in, till we came 6 or 7 Yards deep; then the *Fire Damp* began to appear as formerly, accompanying the Workmen ſtill as they *ſunk*, and they uſing the ſame means as afore, ſometimes Blowing it out with a Blaſt of their Mouth, at other times with their Candles, or letting it *Blaze* without interruption. As we ſunk down, and the *Damp* got ſtill more and more ſtrength, we found that our want of *Air* perpendicularly from the *Day*, was the great Cauſe and Nouriſher of this *Damp*: For the *Air* that followed down into this *Pit*, came down at the firſt ſunk *Pit*, at the forementionʼd Diſtance, after it had been diſperſed over all the old Hollows and *Deads* of the former *Work*, that were filled up with *Noyſome Vapours*, Thick ſmothering Fogs, and in ſome places with the *ſmothering Damp* it ſelf. Nevertheleſs we held on *Sinking*, till we came down to 15 *Yards*, plying the Work Night and Day (except Sundays and Holy Days) upon which Intermiſſion the *Pit* being left alone for 48 Hours and more, and the *Damp* gaining great ſtrength in the interim, by that time the Workmen went down, they could ſee it *Flaſhing* and *Shooting* from ſide to ſide like Sword Blades Croſs one another, that none durſt adventure to go down into the *Pit*. Upon this they took a Pole and bound *Candles* ſeveral times to the end of it, which they no ſooner ſet over the *Eye* of the *Pit*, but the *Damp* would Fly up with a long ſharp *Flame*, and put out the *Candles*, leaving a foul Smoak each time behind it. Finding that theſe things would not allay it, they adventured to bind ſome *Candles* at a Hook hanging at the Rope's end that was uſed up and down in the *Pit*: When they had *lower'd* down theſe a little way into the *Shaft* of the *Pit*, up comes the *Damp* in a full body, Blows out the *Candles*, Diſperſeth it ſelf about the *Eye* of the *Pit*, and *Burneth* a great part of the Men's Hair, Beards, and Cloaths, and Strikes down one of them, in the mean time making a *Noiſe* like the lowing or Roaring of a Bull, but lowder, and in the end leaving a *Smoak* and *Smell* behind it worſe then that of a Carrion. Upon this diſcouragement theſe Men came up, and made no further Trial; after this the *water* that came from it, being up at the other *Pit*, was found to be Blood Warm, if not Warmer.

In this juncture there was a ceſſation of the *work* for three days, and then the *Steward*, thinking to fetch a Compaſs about from the *Eye* of the *Pit* that came from the *Day*, and to bring *wind* by a ſecure way along with him, that if it Burſt again it might be done without danger of Men's Lives, went down and took two Men along with him, which ſerved his turn for this purpoſe. He was no ſooner down, but the reſt of the Workmen that had wrought there diſdaining to be left behind in ſuch a time of Danger, haſted down after them and one of them more undiſcreet than the reſt went headlong with his *Candle* over the *Eye* of the *Damp-Pitt*, at which the *Damp* immediately Catched and Flew to and Fro over all the *Hollows* of the *Work*, with a great *Wind* and a continual *Fire*, and as it went keeping a mighty great Roaring *Noiſe* on all ſides.

The Men at firſt appearance of it had moſt of them fall'n upon their faces, and hid themſelves as well as they could in the looſe *Sleck* or Small Coal, and

under

under the Shelter of Posts, yet never the less the *Damp* returning out of the Hollows, and drawing towards the *Eye* of the *Pit*, it came up with incredible force; the *Wind* and *Fire* Tore most of their Cloaths off their Backs, and Singed what was left, burning their Hair, Faces and Hands, the Blast falling so sharp on their Skin as if they had been whipt with Cords; some that had least Shelter, were carried 15 or 16 Yards from their first Station, and beaten against the *Roof* of the Coal and sides of the Posts, and lay afterwards a good while Senseless, so that it was long before they could Hear or Find one another. As it drew up to the *day pit*, it caught one of the Men along with it that was next the *Eye*, and up it comes with such a Terrible Crack, not unlike but more shrill than a Cannon, that it was heard 15 *Miles* off with the Wind, and such a Pillar of smoak as Darkned all the Sky over head for a good while. The brow of the Hill above the *Pit* was 18 Yards High, and on it grew Trees 14 or 15 yards long, yet the Man's Body and other things from the *Pit*, were seen above the Tops of the Highest Trees at least 100 yards. On this *Pit* stood a Horse Engine of Substantial Timber and strong Iron Work, on which lay a *Trunk*, or Barrel, for Winding the Rope up and down, of above a 1000 pound Weight, it was then in motion one *Bucket* going down, and the other coming up full of *Water*: This *Trunk* was fastened to that Frame with Locks and Bolts of Iron, yet it was Thrown up and carried a good way from the *Pit*, and pieces of it, though bound with Iron Hoops and strong Nails, blown into the Woods about; so likewise were the two *Buckets*; and the Ends of the Rope, after the Buckets were blown from them, stood a while *Upright* in the *Air* like Pikes, and then came leisurely drilling down. The whole Frame of the Engine was stirr'd and mov'd out of its place, and those Men's Cloaths, Caps, and Hats, that escaped, were afterwards found shattered to pieces, and thrown amongst the Woods a great way from the *Pit*. This happened the 3*d* of *Feb.* 1675, being a Season when Other *Damps* are scarce Felt or Heard of.

5. About 2 Miles on the South East of *Stony Easton*, at a Place nearly bordering to *Mendip Hills*, begins a *Running* of *Coal* consisting of several *Veins* which extends it self towards the East about 4 Miles. There is much Working in this *Running*, and *Fire Damps* continually there happen: So that many Men of late Years have been there *Kill'd*, many others *Maimed*, and a Multitude *Burnt*. Some have been blown up at the Work's Mouth; the *Turn Beam* (which hangs over the *Shaft*) has been thrown off it's Frame by the Force of it; and those other Effects whereof you had an Account from other Places are generally found. The Middle and other Easterly parts of this *Running* are so very subject to those *Fiery Damps*, that scarce a *Pit* fails of them: Notwithstanding which, our *Colliers* still pursue their Work; but to prevent Mischief, they keep their *Air* very Quick, and use no *Candles* in their Works but of a Single Wick, and those of 60 or 70 to the Pound, which nevertheless give as great a *Light* there, as others of 10 or 12 to the Pound in other places, and they always place them behind them, and never present them to the *Breast* of the *Work*.

By Mr. J. Beaumont. *Ph. Col.* n. 1. p. 6.

When

When any are *Burnt*, the uſual Method they obſerve in their *Cure* is thus: They preſently betake themſelves to a Good *Fire*, and ſending for ſome *Cow's Hot Milk*, they firſt *Bathe* the Burnt places with that; when they had done this a while, they make uſe of an *Ointment* proper for *Burnings*, which the Maſters of the *Works* have always in a readineſs for ſuch Chances, being furniſhed therewith at the Cheap rate of 12 Pence the Pound by a Good old Woman living near the *Works*.

The *Colliers* aſſure me, That theſe *Works* are apt to take *Fire* all the Year, which it will freely do at any time if a *Candle* be carry'd within *Air*: But moſt and with moſt Violence in the Winter, and chiefly in a *Black Froſt*, when the *Air* runs beſt; That the Danger of *Firing* is alike both in Wet and Dry Grounds; and that there are no *Fumes* coming out of the *Mouth* of any *Shaft* which will be Lighted by a *Candle* or *Torch*.

I have heard of one *Damp* here, which took *Fire* of it ſelf, and kindled the *Vein* of *Coal* which burnt a Conſiderable time before it went out.

Our *Damps* lye as well towards the Bottom or *Soal* of the *Work*, as towards the *Roof*, it being nothing but an inviſible *Sulphureous Breath* expanded through the whole *Work*.

I cannot perceive at the *Mouth* of any *Shaft*, or underſtand by any Workman, of any Unuſual *Wind* or *Current* of *Vapours* coming from beneath. In Wet Works there are many times *Bubbles* on the Surface of Water there ſtanding, which will preſently take *Fire* if a *Candle* be held to them: But I cannot find that thoſe *Bubbles* are cauſed by any *Subterraneous Breath*, but Riſe from the Falling of *Coal* into the *Water*, or from Dropping of *Water* from the *Roof*, as we ſee they do in Ponds from Drops of Rain in the Summer.

I may here further acquaint you, as a Novelty, that this laſt Summer 1679 two *Fire Damps* happen'd in our *Lead Mines* on *Mendip Hills*: But they were of ſo ſmall a Force, that the Workmen received no prejudice by them.

A Well and Earth in Lancaſhire *taking* Fire *at a Candle; by Mr.* Tho. Shirley. n. 26. p. 482.

VIII. About the latter end of *Feb.* 1659. returning from a Journey to my Houſe in *Wigan*, I was entertained with the relation of an odd *Spring* ſituated in one Mr. *Hawkley*'s ground (if I miſtake not) about a Mile from the Town, in that Road which leads to *Warrington* and *Cheſter*; The People of this Town did confidently affirm, that the *water* of this Spring did *Burn* like *Oyle*.

When we came to the ſaid *Spring* (being 5 or 6 in company together) and applyed a *Lighted Candle* to the Surface of the *Water*, 'tis true, there was ſuddenly a large *Flame* produced, which *Burnt* vigorouſly: But obſerving that this *Spring* had its Eruption at the foot of a Tree, growing on the top of a Neighbouring Bank, the *Water* of which Spring filled a Ditch that was there, and covered the *Burning place*, I applyed the lighted Candle to divers parts of the Water, contained in the ſaid Ditch, and found as I expected, that upon the touch of the Candle and the Water, the *Flame* was Extinct.

Again, having taken up a Diſh full of *Water* at the *Flaming-place*, and held the

the *Lighted Candle* to it, it went out. Yet I obſerved that the *Water* at the *Burning-place* did *Boyle*, and heave like Water in a Pot upon the Fire, though my Hand put into it perceived it not ſo much as *Warm*.

This *Boyling* I conceived to proceed from the Eruption of ſome *Bituminous* or *Sulphureous Fumes*; conſidering this place was not above 30 or 40 yards diſtant from the Mouth of a *Coal-Pit* there; And indeed *Wigan*, *Aſhton*, and the whole Country, for many miles compaſs, is underlaid with *Coal*. Then applying my hand to the Surface of the *Burning-place* of the *Water*, I found a ſtrong *Breath*, as it were a Wind, to bear againſt my Hand.

When the Water was Drained away, I applyed the *Candle* to the Surface of the *Dry Earth*, at the ſame point where the *water* Burned before; the *Fumes* took *Fire* and Burned very Bright and Vigorous. The *Cone* of the *Flame* Aſcended a foot and an half from the Superficies of the Earth: And the *Baſis* of it was of the Compaſs of a Man's Hat about the Brims. I then cauſed a Bucket full of *water* to be poured on the *Fire*, by which it was preſently *Quenched*. I did not perceive the *Flame* to be *Diſcoloured* like that of *Sulphureous Bodies*, nor to have any manifeſt *Scent* with it. The *Fumes*, when they broke out of the Earth and preſt againſt my Hand, were not, to my beſt remembrance, at all *Hot*.

IX This *Subterraneal Fire* keeps no Analogy with other *Vulcano's*; It increaſeth or Decreaſeth according to the Subject it feedeth on: Which is, for the moſt part, a *Day-Coal* (as they call it) for the *Upper Seam* of the *Coal* next expoſed to the Air, ſo that you may Light a *Candle* at it in ſome places, in other places it is ſome Fathoms deep, according as the *Day-Coal* Heightens or Deepens.

A Subterraneal Fire *in a* Coal-Mine *near* Newcaſtle; *by Dr.* Lucas Hodgeſon. n. 130. p. 762.

No *Sal-Armoniack*, nor any thing like it to be found except where an Actual *Fire* hath come. There being a mixture of the *Steams* of *Sal-Armoniack* and *Sulphur* riſing together in moſt places, it is hard to Diſtinguiſh them; for though the *Flowers* of *Brimſtone* ſeem to Riſe *firſt*, yet there is commonly a Cruſt of *Sal Armoniack* under them.

There is a *Milky Subſtance* which is found no where, but where the *Sal Armoniack* and *Sulphur* are totally gone, and the *Acid* part or *Aluminous Spirit* of that White Maſs will alſo take Wing by the Increaſe of the *Fire*, leaving a *Caput Mort*. Dry, Stiptick, and as hard as a Stone; yet I account that a *pound* of this Maſs, before the *Fire* preſs too much upon it, will go near to afford by *Solution*, *&c.* *Half* a *pound* of tolerable *Cryſtallin Allum*.

The *Neighbouring Soil* differs little from other grounds with us, having neither *Common Salt*, nor *Niter* in it; for though there be a *Salt-Well* with us, yet it is both on the other ſide of *Tyne*, and a conſiderable diſtance from the *Fire*.

I have induſtriouſly obſerved the *Springs* that are near the *Fire*, and find none of them that give the leaſt ſuſpicion of *Sal-Armoniack*. The *Water* that runs from the adjacent *Colyeries* is *Vitrioline*, giving as deep a Tincture with *Galls* as *Scarborough-Spaw*. In a word, it Differs nothing from the *Waters* that ordinarily

ordinarily drown our *Colyeries*, and coſt our Coal owners ſo much to be quit of them. The other *Springs*, moſt of which are Dry this Year, (1676) are of Ordinary uſe, containing no *Mineral Salts* in them. But I hope you will ceaſe to wonder, that *Coal* ſhould produce a *Volatile Salt* by the Action of the *Fire*, ſeeing I have gathered *Sal Armoniack* from a Burning *Brick-Kiln*, where nothing but *Clay* and *Coal* are burnt together, and I hope none will expect the *Volatile Salt* in the *Sal Armoniack* from Ordinary *Clay*. The reaſon which firſt prompted me to ſeek this *Salt* there, was that the *Smell* of the *Kiln* did ſomewhat reſemble that of the *Subterraneal Fire*. There is alſo a ſort of *Mineral* we call a *Slate*, which is partly *Coal*, partly *Alumſtone*, partly *Marcaſite*, which being laid up in Heaps and Burnt, are uſed for hardning the *Coal-ways*; upon theſe Heaps, whilſt Burning, I have often gathered both *Brimſtone* and *Sal Armoniack*.

When I pour'd *Cold Water* upon the Powdred *Marcaſite*, it produced a *Vitrioline Water*, but no *Heat*.

As to the reſemblance betwixt this *Sal Armoniack* and that which comes from Mount *Ætna*, where no *Coals* are ſuppoſed to be, whence it ſeems to follow, that our *Volatile Salt* may proceed from ſomewhat elſe than *Coal*; to which difficulty I Anſwer, that when I deduced *ours* from *Coal*, I did not exclude other *Bituminous* Subſtances that are Analogous to it of which I ſuppoſe the Country, where Mount *Ætna* is, affordeth no Inconſiderable Quantity; neither will it follow, that no *Coals* have been *wrought*, therefore there are *none*; and if Trial hath been made, and no *Coals* found; yet it will be a Doubt ſtill, whether thoſe Trials have been ſufficient. However it be, yet I think it were not impertinent (by the way) to enquire, whether the Sagacious *Venetians*, may not be beholden to Mount *Ætna*, or ſome other *Subterraneal Fires*, for the great quantity of *Sal Armoniack* they ſell to our Merchants: For this *Fire* affordeth no Inconſiderable Quantity thereof, eſpecially in Dry Weather.

Though it may ſeem incredible to ſome, that *Black Coal* ſhould yield a *White Snowy Volatile Salt*, yet they that know that all *Volatile Salts* whatever may be freed from their *Fætor* and Intenſe Colour, by tranſmuting them into a *Sal Armoniack* by the Mediation of an *Acid*, as *Spirit* of *Salt*, *Spirit* of *Vitriol Alum*, *&c.* And then Subliming them till they be *White*, will ceaſe to doubt of this matter. The reaſon of which Change, I preſume is, becauſe, though theſe *Volatile Salts* carry over always ſome of the *Fætid Oyl* with them while in a ſtate of *Volatility*, yet being thus in a manner *Fixed*, the *Fætid Oyl* muſt neceſſarily by force of *Fire* Riſe firſt, leaving the ſubſequent *Compound Salt*, or *Sal Armoniack*, without *Smell*; though it is ſtill a doubt, whether the *Volatile Salt* is Better or Worſe for this Labour.

We have no *Petreſcent Springs* near us; but there is a *Cave* ſome miles off, at the fartheſt end of which few have been, from the Roof of which hang large Lumps of *Petrified Water*, like *Icicles*, ſome of them reaching down to the ground like Pillars; theſe *Icicles* are good *Limeſtone*, as I have Tried.

An Eruption of Fire near Fierenzola; by Dr. Rob. St. Clair. n. 245. p. 378.

X. I have lately received an Account from my Brother, that on a ſide of one of the *Appennine Mountains* half way betwixt *Bologna* and *Florence*, near a Place call'd *Petra Mala*, about 5 Miles from *Fierenzola*, there is a ſpot of Ground about 3 or 4 Miles Diameter, which inceſſantly ſends up a *Flame* Riſing very high, without *Noiſe*, *Smoke*, or *Smell*; yet it gives a very great *Heat*, and it has been obſerved to be thus in all Times, except of great Rains, which put it out for a time; but when that is over it Burns with Greater Vigour and Heat than before. The *Sand* about it, when turned up, ſends up a *Flame*; but within 3 or 4 Yards of it there grows *Corn* all round about; for it continues always in the ſame Spot.

This *Flame* ſeems to proceed from a Vein of *Bitumen*, or *Naptha*, that *Cropes* (as the *Miners* call it) only here; which when by Plowing, or ſome other Accident, the upper Cruſt has been turned up, was Kindled into a *Flame* by the Heat and Agitation of the *Air*, as other *Saline Sulphureous* Bodies are; of which Eſq, *Boyl's Phoſphorus* is a particular Inſtance. The like *Spontaneous Aſcenſion* is ſeen in many *Mineral* Subſtances, but none that I know of, ſo Quick in its Production, or ſo Laſting, as this is, the whole Wood and Fields having been Deſtroyed by them. The Neighbours there have been ſo little Curious to Obſerve it, that they believed there was a great *Hole* in the *Flame-place*; but he found it to be Firm Ground. Neither does any there Remember when, and upon what Occaſion it firſt began. The *Flaming Well* near *Wigan* ſeems to proceed from a Cauſe much like this, in which you may *Boyl* an *Egg*, and upon the approaching of a *Lighted Candle* it takes *Fire*; both ſeem to proceed from a *Naphtha* or *Subtile Bitumen*, only that in a Hotter Country, and being in a Dryer Soil, is more Subtile and Inflammable; juſt as the *Petroleum* which is found in *Italy* is a White like *Spirit* of *Turpentine*, and is more Penetrating than the *Petroleum* which is to be found in the *Northern Countries*; an inſtance of which we have in a *Well* two Miles diſtant from *Edinburgh*, call'd the *Baulme Well*, of a Black Red Colour and very Thick, but being Diſtilled, does in Colour, Taſte, and Smell, reſemble that of *Italy*.

The *Spontaneous Aſcenſion* of the *Naphtha* ſeems to be made out by the *Smell* that our *Bitumen* near *Edinburg* yields, being moſt like *Coal-Smoak*. There are three ſuch *Fires* on the ſame Hills that are Extinguiſh'd in the Summer, but Burn in the Winter; The reaſon of which I judge to be, that the Bowels of the Earth being Cooler in Summer than in Winter, do not ſend forth that Quantity of thoſe *Subtile Exhalations* as may be ſufficient to maintain a *Flame* in Summer; but in Winter, the Bowels of the Earth being Hotter (which is made evident by the Smoaking of Springs in Winter, and not in Summer, and the Experience of Miners) greater Plenty of Steams are ſent forth, which in the Air are agitated into a *Flame*, the Brisk Motion of the Parts one againſt another, being Promoted by the Subtilty and Brisk Motion of the *Aerial* Particles, *quæ mutuas dant Operas*.

An Historical Account of the Eruptions *of Mount* Ætna; *by Mr.* Oldenburg. n. 48. p. 967.

XI. To pass by what is related by *Berosus*, *Orpheus*, and other less credible Authors, about the *Eruptions* of this Mountain, both at the time of the Ingress of the *Ionian Colonies* into *Sicily*, and that of the *Argonauts* (which latter was in the 12*th Age* before the *Christian* Account;) we shall first take notice of that, which happen'd at the time of the *Expedition* of *Æneas*, who being Terrifyed with the *Fire* of this then *Burning Mountain*, left that Island; whereof *Virgil* gives a notable Description.

Lib. 3. Æneid.

After this we find in *Thucydides*, that in the 76 *Olympiad*, which is about 476 *before Christ*, there was another *Fire*, and about 50 Years after that Another.

Then, in the time of the *Roman Consuls* there happen'd 4 *Eruptions* of Ætna, recorded by *Diodorus Siculus* and *Polybius*.

The Next was in the time of *Julius Cæsar*, related by the said *Diodorus* to have been so Fierce, that the Sea about *Lipara* (an Island near *Sicily*) by its fervent Heat, Burnt the Ships and Killed all the Fishes thereabout.

Another we read of in the Reign of *Caligula*, about 40 Years *after Christ*, which was so Dreadful, that it made that Emperor, then being in *Sicily*, to Fly for it.

About the Martyrdome of the Romish S. *Agatha* it *Burned* again very Fiercely; though some say, that by Vertue of her Intercession it was stay'd from reaching *Catania*.

Again it *Burnt A. C.* 812, in the Reign of *Charles M.*

Then from the Year 1160 to 1169, whole *Sicily* was Shaken with many Terrible *Earth quakes*, and the *Eruptions* of the same Mountain destroyed a vast Tract of Inhabited Land round about it, and Reached as far as *Catania*; the Cathedral of which it Destroyed; and the Religious Men living in it.

Again in the Year 1284, there happened another Terrible *Fire* about the time of the Death of *Charles* King of *Sicily* and *Arragon*.

A. 1329. until 1333, there was another.

A. 1408. another.

A. 1444. another, which lasted till 1447.

A. 1536. another which lasted a Year.

A. 1633. another continuing several years.

A. 1650. it *Burnt* on the North East side, and Vomited so much *Fire*, that by the *Fiery* Torrents, caused thereby, great Devastation was made; as *Kircher* relates in his *Mundus Subterraneus*; whose assistance we have also made use of in the foregoing *Chronology* together with that of *Philotheus*.

The same Author, having been in *Sicily* himself, observeth that the People of *Catania*, digging for *Pumice Stones*, do find at the Depth of 100 *Palmes* (which is about 68 *Feet*) Streets Paved with Marble, and many Footsteps of Antiquity; an Argument that Towns have Stood there in former Ages, which have been Overwhelmed by the Matter cast out of this Mountain. They have also found several Bridges of *Pumice Stones*

Stones, doubtleſs made by the Flux of *Fiery Torrents*, the Earth being very much Raiſed ſince.

An Eruption of M. Ætna in 1669. by ſome Engliſh Merchants. n. 51. p. 1028.

XII. There was for the ſpace of 18 Days before this *Fire* broke out, a very Thick Dark Sky in thoſe parts, with *Thunder* and *Lightning* and frequent *Concuſſions* of the *Earth*, which the People make terrible reports of; though I never ſaw nor heard of any. Buildings caſt down thereby, ſave a ſmall Town or Village called *Nicoloſi*, about *half* a *Mile* diſtant from the New Mouth, and ſome ſuch other ſlight Buildings among thoſe Towns, that were after over-run by the *Fire*. Beſides, it was obſerved that the Old Top or Mouth of *Ætna* did, for 2 or 3 Months before, Rage more than uſual; the like of which did *Volcan* and *Strombolo*, two Burning Illands to the Weſtward. And the top of *Ætna*, much about the ſame time, have ſunk down into its Old *Vorago*, or Hole, in that 'tis agreed by all, that had ſeen this Mountain before, that it was very much *lower'd*.

It firſt *Broke out* on the 11*th* of *March* 1669, about two Hours before Night, and that on the South Eaſt Side or Skirt of the Mountains, about 20 Miles beneath the *Old Mouth*; and 10 Miles from *Catania*. At firſt it was reported to advance 3 Miles in 24 Hours; but at our being there (*viz. April* 5) when we were come within a ſhort Mile of *Catania*, it ſcarce moved after the rate of a Furlong a Day; and after this Degree of Progreſs it continued for 15 or 20 Days after, paſſing under the *Walls* of *Catania* a good way into the Sea; but about the latter end of this Month, and the beginning of *May* (whether it was that the Sea could not receive this matter faſt enough, or rather that the Mouth above did caſt out a larger quantity) it bent all its force againſt the City; and having wrought it ſelf up even with the *Walls* thereof, over it paſſed in diverſe places; but its chief Fury fell upon a very pretty Convent, which was that of the *Benedictins*, having large Gardens and other Grounds betwixt them and the *Wall*: Which when it had filled up, it fell with all its Force on this Convent, where it met with ſtrong reſiſtance, which made it Swell, (as uſually it did, where it met with any obſtruction) almoſt as high, as the higher Shops in the old *London Exchange*, this Convent being built much after that faſhion, though conſiderably bigger. Some parts of this Wall were driven in, whole and entire, almoſt a foot, as appeared by the riſing of the Tiles in the midſt of the Floor, and Bending of the Iron Bars that went croſs above. And 'tis certain, had this Torrent fallen in ſome other part of the Town, it would have made great Havock amongſt their Ordinary Buildings; but here its fury ceaſed upon the 4th of *May*, running henceforward in little Channels or Streams, and that chiefly into the Sea. It had overwhelmed in the Upland Country, ſome 14 Towns and Villages, whereof ſome were of good Note, containing 3 or 4 thouſand Inhabitants, and ſtood in a very fruitful and pleaſant Country, where the *Fire* had never made any Devaſtation before: But now there is not ſo much as any ſign where ſuch Towns have ſtood; only the Church and Steeple of one of them, which ſtood alone upon an High Ground, does ſtill appear.

As to the Matter, which thus ran, it was nothing elſe but diverſe kinds of *Metals* and *Minerals*, rendred liquid by the Fierceneſs of the *Fire* in the *Bowels* of the Earth, boiling up and guſhing forth, as the Water doth at the head of ſome great River; and having run in a full Body for a Stones caſt or more, the Extremity thereof began to Cruſt and Curdle, becoming when cold, thoſe Hard, Porous Stones which the People call *Sciarri*, having the neareſt reſemblance to huge Cakes of Sea-Coal, full of a fierce Fire. Theſe came roling and tumbling over one another, and where they met with a Bank, would fill up and ſwell over, by their weight bearing down any Common Building, and Burning up what was Combuſtible. The chief Motion of this Matter was forward, but it was alſo dilating it ſelf as a Flood of Water would do on even ground, thruſting out ſeveral Arms or Tongues, as they call them.

About two or 3 a Clock in the Night, we mounted an high Tower in *Catania*, whence we had a full view of the *Mouth*, which was a terrible ſight, *viz.* To ſee ſo great a Maſs or Body of meer Fire. Next Morning we would have gone up to the *Mouth* it ſelf, but durſt not come nearer than a Furlong off, for fear of being overwhelmed by a ſudden turn of the Wind, which carried up into the Air, ſome of that vaſt Pillar of Aſhes, which to our apprehenſion, exceeded twice the bigneſs of *Paul's Steeple* in *London*, and went up in a ſtreight Body to a far greater height than that; the whole Air being thereabout all covered with the lighteſt of thoſe *Aſhes* blown off from the top of this Pillar: And from the firſt breaking forth of the *Fire* until its Fury ceaſed (being 54 Days) neither Sun nor Star were ſeen in all that Part.

From the Outſide of this Pillar fell off great quantity of Stones, but none very big, neither could we diſcern any *Fire* in them, nor come to ſee where the Fiery ſtuff broke out, there being a great Bank or Hill of *Aſhes* betwixt it and us. At the *Mouth*, whence iſſued the *Fire*, or *Aſhes*, or both, was a continual noiſe, like the beating of great Waves of the Sea againſt Rocks, or like Thunder afar off, which ſometimes I have heard here in *Meſſina*, though ſituated at the foot of High Hills, and 60 Miles off. It hath alſo been Heard 100 Miles Northward of this place in *Calabria* (as I have been credibly informed) whither the *Aſhes* have been alſo carried: And ſome of our Sea men have alſo reported, that their Decks were covered therewith at *Zant*, though it is likely not very Thick.

Vid. Cap. I. §. XXXIX.

About the Middle of *May* we made another journey thither, where we found the face of things much Alter'd; the City of *Catania* being 3 Quarters of it compaſſed round with theſe *Sciarri*, as high as the top of the Walls; and in many places it had broke over. The firſt Night of our arrival, a New *Stream* or gutter of *Fire* broke forth among ſome *Sciarri*, which we were Walking upon an hour or two before, and they were as High as to be even with the Top of the Wall. It poured it ſelf down into the City in a ſmall Gutter of about 3 foot broad, and 9 foot long of meer *Fire*, the Extremities ſtill falling off into thoſe *Sciarri*; but this Stream was Extinct by the next morning, though it had filled up a great void place with its *Sciarri*. The next Night was a much Bigger Channel diſcovered, pouring it ſelf over another part of the Wall into the *Caſtle-Ditch*, which continued (as we were informed) ſome

Days

Days after our Departure. Divers of thoſe ſmall *Rivolets* did run at the ſame time into the Sea.

It was obſerved, that thoſe *Streams* of *Fire* never grew Broader, nor viſibly Longer, nor Moved out of the place they were ſeen in; which puts us a little more to Examine their Working, and we did conclude, that not only then, but in the Fury alſo of its Running it made it ſelf certain Cruſted Gutters to run in, to keep it ſelf, as it were from the *Air*, which by Degrees did cool and fix it; as more plainly appeared above at the *Mouth*, where, the firſt time of our going thither, we found the *Sciarri* generally thus cold and Fixt. And hence alſo it might proceed, that theſe live *Sciarri*, Meeting with any Bank or High ground, would puff and ſwell up, till they had overcome it; ſo that in many places, eſpecially under the *Walls* of *Catania*, were Valleys of thoſe *Sciarri*, and the *Fire* never broke forth, or diſcovered it ſelf in thoſe *ſtreams*, until it had gained its Height; for thoſe *Rivolets* ever went Declining.

It having ſpent two Days about *Catania*, we again went up to the *Mouth*, where now, without any danger of *Fire* or *Aſhes*, we could take a free view both of the Old and New Channel of the *Fire*, and of that great Mountain of *Aſhes* caſt up. That which we gueſſed to be the Old Bed or Channel, was a three corner'd Spot of about 2 Acres, with a Cruſt or *Sciarri* at the bottom, and upon that a ſmall Cruſt or Surface of *Brimſtone*. It was hedged in on each ſide with a great Bank or Hill of *Aſhes*, and behind and at the upper end roſe up that huge Mountain of the ſame matter. Between thoſe 2 Banks the *Fire* ſeems to have had its paſſage. At the upper end in the Nook, upon a little Hillock or cruſted *Sciarri*, was an *Hole* about 10 foot wide, whence it is probable the *Fire* Iſſued; and it might have had ſeveral other ſuch *Holes*, ſince either Cruſted over, or Covered with Aſhes. At the Bottom of this *Hole* the *Fire* was ſeen to flow along, and below it was a Channel of *Fire*; beneath that ſurface of *Sciari*, which being cleft a-top for ſome ſpace, we had an eaſie and leiſurable view of the *Metal* flowing along, whoſe Superficies might be a Yard broad, though poſſibly it carried a greater breadth underneath, the Gutter going ſloping. What depth it had we could not gueſs: It was impenetrable by Iron Hooks and other Inſtruments we had. We were very deſirous to have got ſome of this Matter at the Spring Head, but we could penetrate no more into it, than with ones Finger into the Palm of the Hand. 'Tis likely that ſome Running may have been more yielding than we found this. From this *Channel*, but eſpecially from that *Hole* above it, iſſued great ſtore of a ſtrong *ſulphureous Smoak*, wherewith ſome of our Company were at firſt almoſt ſtifled, through Inadvertency. About once in a quarter of an Hour, there would riſe a Pillar of *Smoak* or *Aſhes*, but nothing comparable to the former; which ſeemed to come from the Middle Top of that New made Mountain.

At this our laſt being at *Catania*, we found the People buſie in barricading the Ends of ſome Streets and Paſſages, where they thought the *Fire* might break in; and this they did by pulling down the Old Houſes thereabouts, and laying up the looſe Stones in manner of a Wall, which they ſaid would reſiſt the *Fire*, as not being mixt with *Lime*; though it was the great Weight and

Force

Force of that *Fiery Matter* in Preſſing forward, and not its Burning, that overthrew the Buildings, as plainly appeared in the Convent of the *Benedictins* and in the *Town-Walls*, where the great Deluge of *Fire* did pour it ſelf; it not Breaking into the City, but pouring it ſelf over the *Walls*, as hath been ſaid.

Unto this very Time, 'tis ſaid to have run a Mile into the Sea, and as much in Front, though it was much leſs, when we were there. The Shore goes gently declining; having at the extremity of the *Sciarri* about 5 Fathoms, and about half as much they are above Water. The Superficies of the Water, for 20 Foot or more of thoſe *Rivolets* of *Fire*, was Hotter than to endure one's Hand in it, though Deeper it was more Temperate; and thoſe *live Sciarri* ſtill retained their *Fire* under Water, as we ſaw, when the Surges of the Sea retreated back in their ordinary Reverberations.

The general face of theſe *Sciarri* is in ſome reſpect not much unlike, from the Beginning to the End, to the River of *Thames* in a great Froſt, at the top of the *Ice* above *Bridge*; I mean lying after ſuch a Rugged manner in great Flakes, but its Colour is quite different, being moſt of a Dark Dusky Blew, and ſome Stones or Rocks, of a vaſt bigneſs, cloſe and ſolid.

But notwithſtanding their Ruggedneſs, and ſtore of *Fire*, which we could ſee glowing in the Clefts and Cavities, we made a ſhift to ramble over a good part of them; as 'tis ſaid alſo, that People would do the ſame in its greateſt violence of Burning. For as thoſe *live Sciarri*, and thoſe *Rivers* of *Fire* themſelves, were ſo tough and impenetrable as to bear any Weight, ſo the ſuperficies of the *Sciarri* might be touched and Handled, the *Fire* being inward, and not to be diſcerned but near Hand, eſpecially in the Day time: And 'twas ſomewhat a ſtrange Sight to ſee ſo great a *River* come ſo tamely forward; for, as it approached unto any Houſe, they not only at good leiſure removed their Goods, but the very Tiles and Beams, and what elſe was Moveable.

I ſhall add, that the whole Country, from the very *Walls* of *Catania* to 20 Miles on this ſide, is full of thoſe Old *Sciarri*, which former *Eruptions* have caſt forth, though the People Remember none ſo Big as this laſt, or that Burſt out ſo low. This Country is notwithſtanding well Cultivated and Inhabited; for length of Time hath either Molifyed much of thoſe Old *Sciarri*, or new Mould or Aſhes have overgrown them; though there ſtill remains much Country, which, it may be, will never be made ſerviceable.

What is the Perpendicular Height of this Mountain, I cannot learn. It cannot perhaps be rightly taken, being ſo ſubject to alter its Height and Shape. But it is a very goodly Mountain to look upon, as one paſſes by Sea to the Eaſtward, ſtanding Alone by it ſelf, Riſing from the very Shore; and at ſhorteſt Paſſage is reckoned Twenty Miles up to the Top, though from *Catania* it hath Thirty Miles as before.

a. 52. p. 1041. A good Quantity of *Aſhes* being taken up in diverſe parts of and about *Ætna*; ſome at the Top, or the *Mouth* of the new made Mountain, ſome a Mile off, ſome Four, ſome Ten Miles; ſome but Half a Mile Diſtant, and others on the Skirts of the ſaid Mountain; the four firſt were found very Dry like Duſt; but the two latter being very Moiſt, though

in

in *Sicily* (as we are inform'd) they have lain a good while expoſed to the Heat of the Sun; beſides that, the Two laſt differ from one another, in that one ſort of them conſiſts of Hard and ſmall Lumps, the other of very ſoft Dirty Grains, yet both moiſt and of a *Vitriolate* Taſte.

Some of the *Sciarri* are Courſer, taken up at ſome diſtance from the *Mouth*; and of theſe ſome Black, with a Cruſt of *Brimſtone*, ſome of a Red Hew; others are finer, and ſaid to be got out of the *Gutters* of *Fire* at the very *Mouth*. Both theſe kinds are Light; but then there is a third ſort of Stone, very Solid and Ponderous, which ſeems to be made up of a Conflux of diverſe *Minerals* melted together.

The *Fire* ſpread about Three Miles in Breadth, and Seventeen Miles in Length.

XIII. 1. When the Eaſterly Wind had blown about 6 or 7 Weeks, till as I gueſs about the Fourth of *June*, 1693. The *Mountain* in the Iſland *Sorca* began early in the Morning, about Day-break, to caſt out more *Fire* than ordinary, which continued for five or ſix Days, during which it was Dark and Cloudy Weather, till at laſt it brought forth not only a moſt prodigious *Flame*, but alſo ſuch a Black and *Sulphureous Vapour*, that the Inhabitants of *Hiſlo* (being a Village in the Weſtern part of the Iſland, and neareſt to the *Opening* of the *Mountain*) were wholly covered by it; and afterwards followed a whole ſtream of *Burning Brimſtone*, which conſumed many that could not eſcape. Afterwards the Inhabitants perceived that a Part of the ſaid *Mountain* was ſunk down, and three or four Days after another Part; and ſo from time to time, until the *Burning Lake* was become almoſt as great as half of the Iſland: Wherefore the Inhabitants went on board of their Veſſels and Boats, from whence they perceived that huge great Pieces of the Mountain fell into this *Fiery Lake*, as into a Bottomleſs Pit, with a moſt prodigious *Noiſe*, as if a Whole Cannon were diſcharged. But the moſt Remarkable thing was, that the more vehement the *Fire* was, the leſſer the Iſland was *ſhaken*. The Inhabitants of another Town, called *Woroc*, upon the Eaſt ſide of the Iſland, not thinking themſelves in ſo great Danger, the *Opening* or *Fiery Lake* being yet at ſome Diſtance, remained a Month longer, until they ſaw the ſame continually Approaching them. They obſerved that when great Pieces fell down, and that the *Lake* became Wider, the *Noiſe* was ſo much the greater. So that they ſaw no likelihood but that all the Iſland would be ſwallowed up. Wherefore they unanimouſly tranſported themſelves to *Banda*, leaving all their Moveables for want of Veſſels; and arrived at *Amboina* this 18th of *July*. 1693.

An Account of ſeveral Burning Mountains *in the* Molucca Iſlands; *ſent to* M. Nich. *Witſen. by*—— n 216. p. 49.

Several *Burning Mountains* have now been filled up and Quenched; others have begun to *Open* themſelves, and caſt out *Fire*, as in the Iſle *Chiaus*.

There

There is likewiſe a *Burning Mountain* upon the Iſland *Celebes*. And in an infinite Number of Places, there is *Hot Water* found, if you digg but 10 *Foot* Deep.

In the Mountains of *Ternata* is always heard a Terrible *Noiſe*, as of the Crying of a great many People, cauſed by the *Fire*. It often caſteth out *Stones*, and is probably exceeding Deep: And the rather becauſe it is likely that the ſeveral *Burning Mountains* of the *Molucca* Iſlands, are beneath conſumed by the *Same Fire*, which Joyneth the ſpacious *Openings* together.

The *Burning Mountain* upon *Banda* caſteth forth a prodigious Quantity of *Smoak* and *Aſhes*, oftentimes much *Fire*; and makes a *Noiſe* as if a great many of the greateſt Cannon were heard all at once. This *Mountain* hath caſt out ſo many *Stones* (and ſome near 6 Foot long) that the Adjacent Sea, which has been 40 or 50 Fathoms deep, is not only Fill'd up there, but become many Fathoms Higher than the Water; whereby it may be conjectured how Large the *Inward Cavities* of this Mountain are.

By .... n. 216. p. 42.

2. After ſeveral Vain Attempts to ſearch and Examine the Conſtitution of the Opening of the *Burning Mountain* in the Iſle of *Ternata*, at laſt, having paſſed through great Difficulties and Mounted very Dangerous Precipices, we arriv'd at the Top *Octob.* 12. 1693. When I firſt approach'd this Terrible *Fire-Vomiting Opening*, wherein there is an inexpreſſible *Noiſe*, I could ſee nothing of the Inward Parts, by Reaſon of the *Smoak*: Wherefore I went back a little, tarrying for a better Opportunity. After ſome time, I found the *Smoak* very much diminiſh'd, and making haſt to the *Mouth* of it, I ſaw the *Opening* which is underneath the North ſide, from whence the *Cavity* extended it ſelf towards the South, till the Edges on both ſides came to Terminate at the North ſide of that which was fallen in. Wherefore we went towards the Eaſt ſide, to look into the *Weſtern Cavity*, but we ſaw nothing but a *Fiery* and *Flaming Subſtance*, and the Conveyances of it. We did not Venture to go to the North ſide, to ſee into the *South Cavities*, not only becauſe of the Southerly Wind, but alſo becauſe 'tis like, that the moſt Spacious *Antra* are on the South ſide, which cauſeth the *Smoak* to be driven Northerly and becauſe we had formerly met with pieces of *Burning* Matter that was caſt out, towards the North-ſide. Having ſeen enough and ſatisfied my Curioſity, we withdrew and returned to *Malayen*; bringing with us ſome pieces of Branches of the Fruitful *Clove Trees* that we had paſſed by.

The Northerly ſide of this *Burning Hole*, is at the utmoſt height of the Mountain to the Northward, or from *Hori*. To the Weſt and Eaſtward of it there is on each ſide a Hill Higher than the Brinks of this *Hole*, both of them grown over with Reed or Cane, by the Inhabitants call'd *Cannacanna*: The moſt Weſterly, is ſituated more Northerly from the *Hole*; on the South-ſide of this we got up. The moſt Eaſterly, on the Contray Part, lyeth more backwards from it, and to the Southward of it. The Southerly Hill, on the Weſt ſide of the Mountain turns about to the Eaſtward with a Riff or Ridge, and Terminates at the North ſide of the Mountain. The *Mouth* of this fearful *Hole* on the Weſt and South-Eaſt Sides is ſurrounded, as by a Bank; each Bank having a ſeveral Ditch: and the Brink of the *Mouth* is upon the Higheſt part,

part, Descending on the Outside. The three Hillets neareſt to the *Hole*, are quite Barren, and nothing but Stone; but the moſt remote is covered with thick *Reeds*.

Round about the *Hole* lyes ſcattered much of the Matter that hath been Caſt forth; and it is perceivable, that it muſt be *Soft* when it comes out, becauſe it falls Flat, according to the Figure of the Place where it Falls. The *Colour* of it is Dark Green, not Clear but ſomewhat Gray; and this Matter generally does Burſt or ſeparate it ſelf as the Dung of a Cow. There are of this both Great and Small Pieces now turned into *Stone*, being inwardly Blackiſh and Spongeous, Mixt with White Spots. And to give you ſome further Particulars of this *Burning Mountain*, I have obſerved that the Extreameſt or moſt Southerly round Bank is all covered with *Cannacanna*; and it is the Higheſt alſo. The *Smoak*, which in reſpect of *Malayen*, ſeem'd to come forth out of a Higher Place, now in the Deſcending of the *Mountain*, doth notwithſtanding ſeem to come forth at the ſame Height.

There is a Barren Hill that ſeems to be ſituated on the North ſide of the *Top*, a little Deſcending towards *Malayen* but it is about the ſame Height as the Higheſt Top that is ſeen from *Malayen*. Furthermore the Reaſon why the *Smoak* Seems to come forth from a Higher place is, becauſe the *Opening* is more Southerly, and then in regard of *Malayen*, only it ſeems that the *Smoak* comes forth more towards the Midſt. Wherefore I do certainly believe that the right *Opening* formerly has been where the Round Banks now lye; that is, to the Southward: For whereas after a good ſpace of Violent *Burning*, there groweth a ſmall Bank; any Perſon that ſhould ſee the Situation, would be of my Mind. And beſides it being 9 or 10 Years, ſince the laſt *Burning* was perceived, there are to be ſeen round about the *Opening* (beſides the Barrenneſs on both Sides, which is ſome Diſtance from the *Opening* in Deſcending towards the Weſt and North ſides, as alſo above on the South and Eaſt ſides) Trees all about, of an unequal Thickneſs, as all grown ſince that time, and now newly Burſt and *Burnt* by the *Fire*.

Laſtly, My Opinion is, that although the *Smoak* of it has not been ſeen from below, the *Fire* nevertheleſs hath not Diſcontinued, becauſe the *Inward Noiſe* is ſo Terrible, that any Perſon whoſoever hears it, would judge with me that it is a *Bottomleſs Pit* of the *Vehementeſt Fire*, which cannot be Quenched while the World laſts. The Horror and Danger that one undergoes who will ſee this, is rather to be conceived by Thoughts, than expreſſed by Words.

3. *Nov.* 2. 1694. A very thick *Smoak* was ſeen about the Top of the Mount *Gownong Apy*, which was much augmented on the 21 and 22. and that Night the *Flame* broke out: On the 23, 24. and ſome following Days, the *Fire* was continually Increaſing on the Weſt ſide, and with ſuch *Blows* as if the greateſt Pieces of Cannon had been Diſcharged: So that we were fearing that the whole *Mountain* ſhould have been Caſt upon us. A Day of *Humiliation* and *Prayer* was Proclaimed by the Government againſt the *7th* throughout all *Banda*. Sometimes the Mount brought forth ſuch a *Noiſe*, as the greateſt Storms can do about the Rigging of a Ship, or a Building on Shoar, and afterwards followed *Stones* on the Weſt ſide as far as the Sea, which was a Hor-

By ... n. 228. p. 530.

rible Spectacle. Fiſhermen have related unto me, that ſo many *Stones* have been caſt out already, that the Place where they uſed to Fiſh with Lines at 40 Fathom Water is now Dry, and the *Fire* cometh out of the *Water* ſo vehemently, that it is Dreadful to ſee, and the *Water* is ſo *Hot* that we cannot come near it. And now the Mountain *Burneth* moſt towards the ſide of the *Loutoir*. The *Trees* on the Eaſt and Weſt ſide are altogether Spoil'd, and the Weſt ſide is covered with *Stones* God knoweth how high. The Stink of *Brimeſtone* during the Weſterly *Monſoon* is ſo intolerable, that one could ſcarce endure it in the Streets of *Neira* where it cauſeth a great *Sickneſs*. The Water which runneth down, is by Reaſon of the *Brimſtone* and *Salt Petre* become ſower, and without a Natural Taſte. The *Gardens* which were on the *Gounong Apy*, and formerly brought forth great ſtore of Fruits for Man's Livelihood, are partly covered with *Stones*, and partly *Deſert*. The greateſt Fear is becauſe it is *Conſum'd Inwardly* towards the *Old Hole*, which was *Blown-up* in the Year 1615, and becauſe the *Fire* ſeemeth to take its Courſe towards the Southweſt, and that it being quite *Hollow* there, will Tumble inwardly, or be Subverted.

By .:. *ib. p.* 531. 4. The Mount *Gounong Apy* Caſteth out *Stones* round about the Mountain, and the *Fire* Aſcendeth ſo High, that we can ſee it above the High-land at *Denter*.

By ... *ib. p.* 532. 5. Mount *Gounong Apy* (*Burning* continually) doth Caſt out ſo great a Quantity of *Fire* and *Aſhes*, that the *Trees* of the Country *Neira*, and part of thoſe on the High Country of *Loutoir*, is ſo much covered with *Aſhes*, that not one good *Fruit* is to be expected from them.

By .:... *ib.* 6. At *Neira* there is neither *Leaf* nor *Herb*. The Ground is cover'd with *Stones* and *Aſhes*; One half of the High Country is likewiſe in a Sad Condition, many *Trees* be wholely or partly *Dead*, and the reſt *Lingring*. There is not one Houſe at *Neira* without Damage, ſeveral are quite Demoliſhed to the Ground by the Weight of the *Duſt* and *Aſhes*.

Thoſe of *Denter*, *Weyer*, *Celam*, and the inward Coaſt, as far as *Walking*, have likewiſe a ſad Experience of this Calamity. We are ſometimes Viſited with *Earthquakes*; and eſpecially *May* 11 *h.* 1695. about 2 a Clock in the Afternoon, we had two hard *Motions*.

By M. Nich. Witzen. n. 228. p. 529. 7. The Mountain *Kemas* or Brothers, in the Territory of *Manado*, is blown up with a moſt *Dreadful Noiſe*, as of the Hardeſt Thunder, which cauſed *Darkneſs* and an *Earthquake*, with very Heavy Blows, and other Diſmal Signs at *Ternata*: Which Noiſe hath alſo been heard at *Amboyna*. The *Mountain* of *Brimſtone* upon *Amboyna*, call'd *Wawany*, does alſo *Burn* Dreadfully.

From all which it ſeemeth Evident that in thoſe Parts and Seas, there are *Subterraneous Fires*, having a mutual *Communication* one with another: Which God knoweth but may, at ſome time cauſe the ſudden *Subverſion* of them, and conſequently a Notable Change or Alteration of the World's Globe. Thoſe who have ſeen theſe things with their own Eyes have told me, that when a *Hole* is made in the Ground 10 or 12 *Foot* deep, the Ground is *Warm*.

XIV. 1. On the 19th of *Jan.* 166$\frac{5}{6}$ at divers places near *Oxford*, was observed a small *Earthquake* towards Evening. In *Oxford* it self, I do not hear that it was observed to be an *Earthquake*; yet I remember about that time (whether precisely then or not I cannot say) I took notice of some kind of Odd *Shaking* or Heaveing, I observed in my Study, but did impute it to the going of Carts or Coaches, supposed to be not far off; though yet I did take notice of it, as a little differing from what is usual on such Occasions; (and wondred the more that I did not hear any: But not knowing, what else to refer it to, I thought no more of it. And the like Account I have had from some others in *Oxford*, who yet did not think of an *Earthquake*; it being a rare thing with us.

An Earthquake *near* Oxford, 1665. *by Dr.* Wallis. *n.* 10. p. 166.

I find my Notes, concerning my *Thermoscope* and *Baroscope* for that Day to be these.

166$\frac{5}{6}$. *Day*	*January. Hour*	*Thermo. Inches*	*Barosc. Inches.*	*Weather.*
19.	8. *Morn.*	14$\frac{1}{12}$	29$\frac{1}{2}$	Hard Frost. Close.
	4. *Even*	14$\frac{3}{8}$	29$\frac{1}{4}$	Hard Frost. Cloudy.
	9. *Even*	14$\frac{3}{4}$.	29$\frac{3}{4}$	Rain. Wind.
20.	8. *Morn.*	15$\frac{1}{4}$	28$\frac{3}{4}$	Sunshine. Wind.

I hear, it was observed at *Blechington*, above 5 Miles to the North of *Oxford*, and so along by *Bostol*, *Horton*, *Stanton*, *St. Johns*, and so towards *Whately*, which is about 4 Miles Eastward from *Oxford*. Not at all these Places at the same time, but Moving forwards from *Blechington* towards *Whately*. For it was at *Stanton* about 6 of the Clock, or later (as I understood from Mr. *Boyle*, who was there at that time) but had been at *Blechington* a good while sooner. And I am told that it was taken notice of by Dr. *Holder* (a Member of our *Society*) who was then at *Blechington*, to be observed by those in the further part of the *Garden*, some very discernable time before it was observed by those in the House; creeping forward from the one place to the other.

2. Riding somewhat late betwixt *Oxford* and a Lodging I have at a place 4 Miles distant from it, *I* found the *Cold* very piercing, which put me upon Galloping at no very lazy rate; and yet before I could get to my Lodgings, I found the *Wind* turned, and felt the *Rain* falling. This Accident, considering the shortness of the Time, and that it was preceded by a setled *Frost*, was surprising to me, being one of the Greatest and Suddainest Alterations of the *Air*, *I* had ever observed. Soon after (by my Guess about an Hour) there was a manifest *Trembling* in the House where *I* was (which stands high in Comparison of *Oxford*: But it was not there so great, that *I* should have taken any notice of it as an *Earthquake*; if I had not been Advertised of it as being taken Notice of by the People of the House. Soon after there happen-

By Mr. Robert Boyle; n. 11. p. 179.

ed a Brisk *Storm*: Whereupon I sent to make Inquiry at a place called *Brill*, which standing upon a much higher Ground, I supposed might be more Oba noxious to the Effects of the *Earthquake* The Person I sent to, writ me e Ticket, whose Substance was, That the *Earthquake* there was much mor Considerable, than where I lodged, and that a Gentleman's House in the Neighbourhood *Trembled* very much, so as to make the Stones manifestly to *Move* to and fro in the Parlour, to the great Amazement and Fright of all the Family. The Hill whereon this *Brill* stands, I have observed to be very well stored with *Mineral* Substances of several kinds. I have been informed by others, that this *Earthquake* Reached a good many Miles.

By Dr. J. Beale. n 116. p. 357.

3. I conceive the *Subterraneous Steams* might be the Cause of such a *Midland Earthquake*. And I know no surer or better way to find out the Nature and Properties of those *Steams*, than by Observing the Effects, and all the Alterations of the *Air*, as Mr. *Boyle* and Dr. *Wallis* have done.

An Earthquake *at* Oxford. 1683. *By Mr.* Tho. Pigott. n. 151. p. 311.

XV. *Sept.* 17. 1683. An *Earthquake* happened here at *Oxford*. The Rarity of such Effects makes many People not know what they are; and by heightning their Surprise, imposes upon their Judgments. One fancied it to be the falling of something about his House; Another the tumbling of Wood; a Third the Ratling of a Cart; one one thing, and one another, till either a mature Deliberation, or Intelligence from other Hands, convinced them to the contrary; and satisfy'd them it was an *Earthquake*. Besides, the *short continuance* of the *Trembling*, would hardly permit them to make any Accurate Observation.

I, for my part, perceived the *Sound* and *Motion* very plainly, and though when *I* saw the Clearness of the Morning, *I* judged that to be an *Earthquake*, which otherwise *I* might have thought to have been only a Distant Thunder, yet had *I* not so clear an Impression of it in my Mind as to make any Considerable Observations of my own: So that what *I* can afford you, will be only some Occasional Reflections upon *Earthquakes* in general, and Remarks upon the Intelligence, which I have picked up here and there concerning this in particular.

1. This *Earthquake* happened at a time in which such Effects are commonly Experienced, if we may credit *Aristotle*, who tells us that they are most frequently, tho' not always in *Spring* and *Autumn*; in which there is generally a greater Abundance of *Moisture* sucked up, more *Vapours*, and a larger quantity of *Nitre* (as Experience doth Demonstrate) all which Ingredients may conspire to the producing of an *Earthquake*. For, if we consider how capable they are of a large *Expansion*, how forcible they are when *Rarify'd* in Vessels Closed and placed over the Fire; in *Æolipyle*, from which they break out with forcible Blasts, or in Winds, which frequently proceed from the *Rarefaction* of such Principles, we may suppose that those *Vapours* which produce such great Commotions in the *Air*, may cause a considerable Disturbance in the *Earth*, when pent and locked up by Cold, or any such like Accident.

2. The

2. The latter part of the firſt Week in *September* was ſo *Rainy*, that moſt People were apprehenſive of a Flood, and upon *Sunday* the 9th of *September*, there fell ſome very conſiderable Showers in the Afternoon; but from that time it Cleared up, and to the End of the next Week continued very Warm and Pleaſant Weather. The Evening of *Sunday* the Sixteenth, was inclinable to *Froſt*, and the next Morning it was found to be a very Hard *Froſt* for the Seaſon, and then about Seven of the Clock, the Day being very *Clear* and *Calm*, the *Earthquake* happen'd. The like Obſervations of Cold preceding that of 166½ were made by Dr. *Wallis* and Mr. *Boyle*.

3. The *Quickſilver* in the *Barometer* (as *I* am told by the Operator in *Chymiſtry* here) ſtood as High then, as at any time theſe Three Years; which together with a remarkable *Calmneſs* of the Air, a matter generally looked upon as one of the Circumſtances which accompany *Earthquakes*, and by many reckon'd amongſt the *Signs* which fore-run them, may be ſufficient to ſhew how free the *Air* was from *Vapours* at that time; and ſurely the fewer there were Above, the More may be ſuppoſed Below.

4. *Ignes Fatui* were frequently ſeen a few Days before this *Earthquake* happen'd; which may paſs for a Probable Argument, at leaſt, to ſhew how full the *Earth* was then of *Damps* and *Exhalations*, ſince a *Stench* that hath Tainted Well-Water after an unuſual manner, hath upon the ſame Account been generally Reckon'd amongſt the *Signs* of an *Earthquake*, by which it may be Predicted: For by this it was that *Pherecydes* is ſaid to have Preſaged the *Earthquake* of *Lacedemon*, and *Helmont* mentions another who pretended to the ſame Fore-ſight, by Taſting the Water of a very deep Well in the Caſtle of *Lovain*.

5. The *Motion* of this *Earthquake* was not of that ſort, which are termed *Pulſes* or *Succuſſions*; ſuch as ſtrike the Ground at Right Angles with a Violent Shock, or intermittent Knocking, ſo as oftentime to raiſe the *Earth* to a conſiderable Height, or force their way by a Breach; but it appear'd rather to be ſuch a *Trembling Motion* as Vibrates and Shakes without Altering the Poſition of the Earth, and leaves all things in the ſame Poſture in which it found them. For it *Shook* the Earth with a *Tremulous* and *Vibrating Motion*, whoſe Reciprocations were repeated with a great deal of Quickneſs. The *Pulſes* were, as I could perceive, a little diſcontinued, and yet they came ſo Thick that I could not Count them, tho' the whole *Earthquake* Continued here, ſcarce more than 6 2*ds* of Time; and when that Ended the *Motus Reſtitutionis*, or ſetling of the Building in which *I* was, did ſeem to be with a *Craſh*.

6. Now as *Tremulous* and *Vibrating Motions* are proper to produce *Sounds*, ſo was this *Earthquake* accompanied with a *Hollow Murmuring Sound*, like diſtant Thunder, as *I* have obſerved before, which *Sound* kept Time ſo exactly with the *Motion*, and was ſo Conformable to it in all reſpects, that it plainly appears there was the ſame Reaſon for Both. To thoſe that were within Doors it appear'd to be more Conſiderable, and as it were in the *Air* above, occaſioned chiefly

chiefly by the *Shaking* of the Building; as we may gueſs by a Blow or a Stamp in a Room, which beſides the Principal *Sound* from the part that is Stricken, cauſes another Obſcure one, together with a Small *Shaking* throughout the whole; and in the *Laboratory* it was heard more Loud: For all *Sounds* have a great Advantage there, But thoſe who were Abroad in the Fields and open Air, perceived with a gentle *Shaking*, a *Hollow Murmur* towards the Surface of the Earth, not unfitly compared to the Groaning of ſome planks of Elm, Aſh, or Firr, when the Application of Fire cauſes both a *Trembling* and *Sound*. That there is a conſiderable *Heat* within the Earth is manifeſt, from the Experience of *Miners* working in the Deeper Grooves; from thoſe *Hot-Springs* which break out thence; from *Fermentations* occaſioned by *Mineral Spirits*. Nor is it leſs commonly Obſerved, that ſuch *Heats* and *Fermentations* within the Earth are Augmented by *Froſty* Weather, when the *Steams* being more Pent up, and hindred from breaking out, do Work more forcibly upon one another. And that *Sounds* and *Tremblings* may be produced by ſuch *Heat*, though it did but work upon *Air*, *Watery Vapours*, or *Nitre*, only included in Pores and Cavities, appears by ſeveral Experiments; as that of filling Glaſs bubbles half full with *Water* and *Nitre*, which being ſet to the *Heat* of the *Fire* will *Tremble* with a ſort of *Humming Sound*, and after that Break with a great deal of *Noiſe* and Violence.

7. This *Sound* as well as *Trembling* appears to have been the ſame in moſt of thoſe places where they were perceived; from whence we may infer, that they were not Cauſed by the Falling of the Earth or Rock from the upper part of ſome *Cavern*; nor from any Commotion of *Vapours* within the Hollow, as Powder works in a Mine, by which Similitudes it is uſual to expound ſome *Earthquakes*: For then it would have been perceived more plainly in places above it, or thoſe that were near adjoining, and not Equally conſiderable in Towns of ſuch various diſtances, as *Oxford*, *Burford*, *Watlington*, *Benſon*; *Brill*, and *Ailsbury* in *Bucks*; *Wallingford*, *Radley*, *Appleton*, and ſome other places in *Barkſhire*; with many more round about.

8. Yet *I* cannot but ſay that it was leſs conſiderable in ſome places than in others: The Men of ſome Towns ſpeak dubiouſly, eſpecially towards the North of *Oxford*; and ſome talk of a Neighbouring Town *feeling* it, tho' their own did not. Yea even here in Town the *Earthquake* was not perceived ſo plainly in ſome places as in others; but that may depend upon Circumſtances, as the Poſition and Form of the Houſes, or ſome Accidents, as Noiſe of Carts intervening, which might render it leſs obſervable. Beſides, *I* do not deny but there may be ſome *Cuniculi*, little Paſſages or Hollows here and there under ground, which might advantage the *Trembling*, and elſewhere more ſolid parts which might Damp and Obſtruct it.

9. This might occaſion ſome Difference in the Sound too. One perceived it like a *Voice* under ground, but he could not tell which Way it paſſed, perhaps there might be a *Cavern* there. Another who was travelling over *Shotover* heard the ſame; and it is very likely that there are conſiderable Hollows there. One who was Fiſhing in the *Charwel* informs me, that whilſt his Boat

trembled

trembled under him, and the leſſer Fiſhes ſeemed much affrighted by an unuſual Skipping, he heard the *Murmur* as of a Riſing Wind, Which he fancied juſt then Breaking out, and Rumbling upwards but felt none. The like relation, as to Rumbling in the Air, I have from good hands concerning ſome People that were in *Dourton-park* in *Buckinghamſhire*; which I mention only for the Diſtance ſake: For moſt hereabouts Agree in the ſame Fancy. I my ſelf Heard it like a *Diſtant Thunder*, a Noiſe determined to one Place, not Fleeting or Paſſing from me, tho' the *Craſh* which Ended the *Shaking* of the building, little deceived me in my firſt Imaginations.

Ariſtotle (*de Mundo*) calls the *Earthquakes* of this kind, by the name of Βράσμοι, as if they Boiled, becauſe they Ply up and down. And I take this that happened here, to be no ſuch Forcible, or Irregular Ebullition Raiſing the Earth with intermitting Shocks, as that of *Mechlin* for inſtance *Apr.* 4. 1640. deſcribed by *Van Helmont*: But a Regular *Effervescence* of incloſed Vapours, more evenly diſperſed, working up and down the Earth with a *Trembling* of each Part, and a Reciprocal Agitation of the Whole. For I could never meet with any, who pretended to Determine from what part this *Earthquake* Came, or whither it Went.

10. All who felt this *Earthquake*, ſay it happened about 7 a Clock: But I dare make no Inference from hence, that the *Shaking* really was in all Places at the ſame Time, unleſs the Time had been exactly obſerved, to a Minute at leaſt, in ſeveral Places. For ſince all *Tremours* and *Sounds* are found to Move above 15 *Miles* in a *Minute*, and above 94 in an *hour*, and conſequently the *Trembling* of the *Earth* paſſing along with a Continued *Noiſe*, may be ſuppoſed as Quick in it's *Motion*. It might according to this *Calculation* in a *minutes* time have reached the Extremity, of its Sphere or Compaſs: For the Circuit of this *Earthquake*, was but 70 *Miles*, or thereabouts; it's Largeſt Extent was from South-Eaſt to North-Weſt, the leaſt from *N.* to *S.* For it was perceived a little ſhort of *Kirklington N.* of *Oxford* at *Blechington* and at *Alysbury*, *S. E.* where it was perceived plainly; as alſo at *Thame* which is *E.* and ſo at *Aſton*, *Kinſton* and *Stocken-Church-hill*; at *Watlington S. E.* (ſome ſay at *Reading* which is more *S.* and then it's compaſs may be ſuppoſed Larger) at *Wallingford S. E. b S.* as much as any place; at *Abington South* but not much; not ſo far as *Farington S. W.* but at *Bampton W.* at *Burford* to the North, at *Lo. Harborough N. W.* not much: at *Woodſtock* which is more *N.* little or none; and at *Glympton* Two Miles beyond it, not at all, as I am informed. But this is a very inconſiderable Space, if compared with that which happened in the Southern Parts of *Norway Apr.* 24. 1657. and took up 160 *Miles* in Length and ſo much in *Breadth*, ſaith *Michael Peterſon Eſcholt*, that deſcribes it; And *Kircher* mentions one 200 *Miles* in Length.

11. The *Effects* too of this *Earthquake* were very inconſiderable, as Shaking down ſome Pewter in a very few places; Caſting out a Truckle bed Weſtward, which when looked upon I found ſo very eaſie to Move and apt to Run, as alſo the Room ſo Smooth and Declining towards that Point, that I could as little Infer from thence that the *Motion* came this or that Way, as from

from the Falling of many Books from the Northſide of a Ware-houſe when a Few only fell from the South. And of whatever Nature the Encloſed *Vapours* were, which cauſed this *Earthquake*, it ſeems as if they were not able to Force their Paſſage through the Earth (at leaſt but Slowly): For the *Air* till the End of the Week continued *Fair*, tho' the Week enſuing was very *Windy* and *Boyſterous*.

12. We have *Earthquakes* here very *Seldom*; not one before for almoſt a ſcore of Years, except that which is doubtfully reported to have happened about 4 a Clock in the ſame morning. But ſeeing the Earth abounds with ſuch great Variety of Matter, which may Produce them, as alſo with ſo many *Caverns* and Chinks of ſuch Various Figures, through which they may be Agitated with ſuch Different *Motions*, it ſeems more eaſie to ſhew how they may Begin, how they may be Carried on, how they may Produce ſuch Different Effects, and how they may Continue; than to Determine why they ſhould happen ſo *Rarely*, do no more *Miſchief*, or be Stopped ſo ſoon in their *Motion*.

An Earthquake *in the* Midland-Counties. 1683. *by Mr.* Tho. Pigot. n. 151. p. 321.

XVI. There was another *Earthquake* far more conſiderable, which happened *Oct.* 9. about 11 at Night: And was in *Oxfordſhire* Northwards very much; ſome ſay they felt it here at *Oxford*. It ſpread all over the *Midland Counties*, and Extended into *Darbyſhire*: In which, as in the Coal-Countrys, it was very *Violent*. They Report that it was in all its ſeveral places at the ſame Time, not Determining preciſely: And that it Produced ſome Remarkable Effects.

An Earthquake *in* Sicily. 169$\frac{2}{3}$. *by Mr.* Martin Hartop. n. 202. p. 827.

XVII. 1. 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*.

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 obſerved here at *Naples* to happen to Mount *Veſuvio* once in about 80 years, as I heard the Ingenious Mr. *Peccacio* ſay. Of theſe the laſt 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 continually *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 *Deflagrations*, where you Mix an equal Quantity of Pulverized *Nitre*, has ſeen an exact Type of theſe *Burnings* Hills, For after each Spoonfull you put

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.

The *Motion* of the *Earth* is not from the *Perpendicular*, but *Horizontal*; as appears by the *Cracks* in the *Earth*, which they ſay, are to be found now all over *Sicily*: '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 Moved ſo Great, the Motion muſt be prodigiouſly Violent. We obſerve that *Thunder* which is the Effect of the *Trembling* of the *Air*, cauſed by the ſame Vapours diſperſed through it encountring one the other, has Force enough to *Shake* our Houſes. And why there mayn't 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 Noyſie Vapour above us, is in much larger Quantities to be found Under-ground. I can attribute this *Horizontal Trembling* to nothing elſe but the Furious Paſſage of the *Incenſed* Matter from one Grotto to Another: For 'tis very Probable theſe are continued, in ſome Parts of the Earth, for ſeveral Leagues together; Witneſs your Laſt *Earthquake* about 4 or 5 Years ago, which was felt, (with little difference as to Time) in *England* and *Ireland*. Another Confirmation of this is, the Manner how theſe *Trembling Fits* are performed; 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 *Veſuvio* ceaſes to *Burn*, the *Sulfaterra* ſends out it's *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 that *Naples* ſtands upon a *Burning Arch*, through which, as a Pipe, theſe two furious Neighbours do reciprocally receive the above ſaid *Exhalation*. This ſeems to me a Growing Evil to this wealthy and Populous City. And what may poſſibly make good the Prediction of *Sanazarius*, who was born here.

Et te, quis putet hæc? Altrix mea, durus Arator.
Vertet: et Urbs, dicet, hæc quoque Clara fuit.

2. The Iſland of *Sicilia*, of 700 *Miles* Circuit, and divided into 3 Valleys, began on *Friday* the 19*th* of *January* 1693. about half an hour paſt 4 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*th* of the ſame Month, at 20 hours and 3 quarters, the Hand of God appeared much more Terrible, awakening the moſt Lethargick Sinner. The *Shakes* of this *Earthquake* did no damage in the Valley of *Mazara*, only Frighting the People. *By P.* Aleſſandro Burgos. *ib.* p. 830.

Palermo received ſome Detriment in moſt of the Buildings, eſpecially the Palace and Hoſpital of St. *Bartholomews*, The Steeple of St. *Nicholas*, be-

longing 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* aree 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. Many Private Buildings were Thrown down, and all the reſt Shored up. There were but few perſons Killed.

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 it's *Dome* very much Hurt. *Caſtiglione* had the Caſtle and many Houſes Thrown down; in *Franca villa* 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 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 *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 *Ætna*, 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*, *St. Gregorio*, *Pedara Trecaſtagni*, *Bonnacorei*, *Nicoloſi*, *Motta*, *Meſterbianco*, *Fenicia*, and ſeveral other Fruitful Villages ſituated near *Mongibello*, are Deſtroyed, with all the Habitations of Pleaſant Hills about *Cananea*, which are now in the Duſt.

Paterno, about 12 Miles from *Catania*, a Populous City at the foot of *Mongibello*, loſt moſt of its Buildings, all the Convents of Fryars, and a very Fine Monaſtery. In the Ruines were Buried 40 Perſons. *Aderno*, had the ſame Fate.

Cantabiano Piemonte in the Valley of *Emona*, *Francofonte*, *Palagonia* in the Valley of *Noto*, are little leſs than wholly Level'd, and about 300 Perſons Deſtroyed The Marqueſs of *Francofonte* 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

its Sacred Edifices, amongſt which the *Dome* was the moſt Sumptuous and Large in all *Sicily*, Adorned with excellent Pictures, and Richly Furniſhed, and Bleſſed with the Reliques of the Invincible Martyr St. *Agatha*, Honoured with the Bodies of Several Kings; beſides it had a very 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* College, 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 the Ancient and Modern Churches, Colleges, and other publick Buildings, inhabited with 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 privileges granted by the King. The Univerſity where the Learned Laurel was conferred 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 11*th* at 20 hours and $\frac{3}{4}$, 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 *Mongibello* 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 that 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 towards *Catania*, he with Amazement ſaw nothing 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 Footſtep to be ſeen. All its Edifices are Levelled with the Ground, except the Chappel of St. *Agatha*, the *Rotunda*, the Caſtle of *Urſino*, the Walls that encompaſſed 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 *Jeſuites* 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, *Gregorio 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 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 now there is but the Carcaſs 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 Levelled with the Ground.

Sortino and *Caſſero* are quite Demoliſhed; in the firſt, about 3000 Periſhed.

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 periſhed about 3000. The Enraged Sea grew terrible Boiſterous, and Tempeſtuouſly beat againſt the Walls of the *Dominican Convent* with ſuch fury, that ſome Galleys belonging to the *Knights* of *Malta*, ſcarcely eſcaped Shipwrack in the Port. In fine,

Luctus ubique, Pavor, & plurima Mortis Imago.

The Country of *Milili* 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 Pallaces, now Mourns in Ruines. It was ſenſible of *Fridays*, but 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 Periſhed. Scarce a Village in the whole Dioceſs is left; Confuſion Reigns every where; and the Miſery is encreaſed by want of Food, cauſed by the Granaries and Mills being Deſtroy'd.

Laſerla

Laferla, *Palazz'olo*, and *Buſceni* lie in Ruines, with many Inhabitants Deſtroy'd

Spacaforno, 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 3 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 into the open Air, or under Huts and Cabins.

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, ſuffer'd in this Univerſal Calamity, the total Ruin of its Proud Edifices: As the Principal Church, with its very High Steeple or Spire, the famous College 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 Saint. The Temple of the *Conventuals* thrown down, the famous Bridge that joins 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 College 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 a 1000 People were loſt.

Modica, a Populous place, and a Chief of the Seigniory 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 College of the *Jeſuites*, from whom we have the Account; and that the Cities of *Ragaſa*, *Sicily*, 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 from 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.

People. The Southern Coasts, as *Licati*, *Terra Nova*, and *Circuti*, have suffered Dammage in their Buildings. And all the Castles of the Valley of *Emone* near *Mongibello*, are Cracked and Broken or Thrown down.

By the Noble Vincentius Bonajutus. n. 207. p. 2.

3 The continual *Fiery Eruptions* of *Ætna* (of which the *First* that we have any Account of, happened 500 Years before the Destruction of *Troy*, as *Diodorus Siculus* Relates) have been taken for the most likely Causes of the Horrible Shakes that from Time to Time have laid Waste the Island of *Sicilia*; as is observed by *Fazello*, where he Remembers that of the Year 1542, which on the 10th of *December* at the 23d *Hour*, Shook the whole Island, and especially *Val di Nota*, *Syracusa*, *Lentini*, *Sortini*, *Mililli*, *Catania*, *Agosta*, *Noto*, *Caltagirone*, *Militello*; and in short, the same Cities and Castles which were miserably ruined by the *Two* late violent *Earthquakes* of this present Year 1693.

In Dec. 1. l. 1. Cap. 4. *and* Dec. ult. l. 10.

The *First* of which was at 5 a Clock the next Night after the 9th of *January*. Its Motion was of that sort which *Aristotle* and *Pliny* call the *First Species*, and is by them likened to the Shaking Fit of an Ague, causing such a Motion as *Shakes* the *Earth* from Side to Side. In this first almost all the Edifices in the Country were Thrown down, whereof some were very High and Strong built Towers. A great part of the City of *Catania*, with many, others were Demolish'd, and a great many Buildings in *Val di Noto*. *Syracusa* was also much shattered, but not Ruined. This was not Preceded by any *Darkness* in the *Air*, but a Pleasing, Serene, Warm Time, which was the more Observable, as being Unusual at that Time of the Year, yet it was not to any Excess.

Some Persons, which the Evening before were Travelling in the Country, observed a great *Flame* or *Light*, at about an Italian Miles Distance, and so Bright, that they took it for a Real Fire made by some of the Country People; and though they went directly towards it, yet it seemed to keep at the same Distance from them. Whilst they were observing this Appearance, the *Earthquake*, began which was sensible even to the Horses they rode upon, that were Affrighted thereat, and the Trees were all shaken. Upon this, the Amazed Travellers looking for the *Light* they saw Just before, found it quite Vanisht. We perceiv'd, Turning towards the Sea, that the Waves which before the *Shake* only beat gently upon the Shoar, began now to make a Dreadful Noise. The next Day, which was the 10th, the Night and Day following, the *Air* was Overshadowed with *Darkness*, and Tinged with a deep Yellow, and the Obscured Sun struck our Minds with the Melancholy Presage of the Approaching *Earthquake*; Which was the 2d, and happen'd on the 11th of the same *January*, about the 21 Hour, and lasted about 4 Minutes. It was much like the 2d *sort*, which *Aristotle* and *Pliny* call a *Pulse* or *Stroke*, from its resemblance to the Beating of an Artery. And by *Possidonius* in *Seneca*, is Represented by the Name of *Vibrations*, it being a Perpendicular Lifting up of the *Earth*. Its *Impulse* was so Vehement and Powerful, that not only many Cities and Countries of the Kingdom of *Naples*, but the Island of *Malta* participated also of its Fury. It was in this Country impossible to keep upon our

Legs;

Legs, or in One place on the Dancing Earth; nay those that lay along on the Ground, were toſſed from ſide to ſide, as if on a Rolling Billow.

In Open places the *Sea* Sunk down conſiderably, and in the ſame proportion in the Ports and incloſed Bays, and the Water Bubled up all along the Shore.

The *Earth opened* in ſeveral places in very long Clefts, ſome an Hand's breadth, others half a *Palm*, others like great *Gulfs*. From theſe *Openings* that were in the Valleys, ſuch a quantity of *Water* Sprung forth as overflowed a great ſpace of Ground, which to thoſe that were near it, had a ſenſible *Sulphureous ſmell*, though in a low degree, and without that Unpleaſant Stifling produced by the Smoak of *Brimſtone*.

In the Plain of *Catania*, an Open Place, it is reported, that from one of theſe *Clefts*, Narrow, but very Long, and about 4 *Miles* off the Sea, the Water was thrown forth altogether as *Salt* as that of the *Sea*.

In the City of *Noto* is a Street of half a Mile long, Built of Stone, which at preſent is ſetled into the ground, and quite hanging on one ſide, like a Wall that Inclines; and in another Street before the *Aſſent del Durbo*, is an Opening big enough to ſwallow a Man and Horſe.

Great Rocks were looſened and Thrown down from the Mountains every where: And in the Country of *Sotino*, Inhabited by about 5000 Perſons, a great Number Periſhed in the Houſes which were beaten down by them in their way, as they rolled down from the Hills. A great Ciſtern or Reſervatory of Water Hollowed on the top of a Rock was looſen'd and Thrown off from the reſt of the Rocks, and ſlid down to the Bed of the River that runs in the bottom, where the Ciſtern remains as it was full of the ſame Water it had received before the *Earthquake*.

A very great many *Grotto's* made by Art or Nature, are now fallen in.

In *Syracuſa*, and other places near the Sea, the Water in many *Wells*, which at firſt were *Salt*, are become *Freſh*, and have not as yet loſt their Goodneſs, ſo they are ſtill fit to Drink.

The Fountain *Arethuſa*, for the ſpace of ſome Months, was ſo *Brackiſh*, that the *Syracuſans* could make no Uſe of it; and now that it is grown Sweeter, its Spring is encreaſed to near double.

In the City of *Termini* all the running Waters are Dryed up, and amongſt the reſt a ſmall River near to it, with which they Watered their Gardens and Orchards. It was contrary with the *Hot Baths*, which were Augmented by a 3d part of what they were before the *Earthquake*.

In many plain and level places very high Walls leaped from their Foundations above two paces, leaving that whole ſpace perfectly clear and free from Rubbiſh and Ruins, as if they had been taken up and carried off. And in *Syracuſe*, two Side-Walls of a ſmall Houſe Jumped up from each other, the one Upright, and ſtood upon its bottom at a great Diſtance from its former place; and the other, leaving its Companion, flew away ſo as to make an Angle with the other, to the wonder of the Beholders of ſo Extravagant an Accident. Not far from the Country of *Caſſaro*, from the Tops of 2 Mountains, between which through a long Valley ran a River, two very great Rocks were looſened, which tumbling down over againſt each other, met ſo exactly as to cloſe up the Valley,

ley, and ſtop the Current of the River, which not finding any *Subterraneous* or ſide Paſſage, has fill'd up the Valley to the top of the Rocks that were thrown down, and runs over them, forming a Lake 3 Miles round of a conſiderable Depth.

In the Territory of *Sortini*, in a piece of ground half a Mile long, but much narrower, the Ground at ſeveral little interſtices, is Sunk from the Level in ſome places Two, in other Three *Palms*, and ends in a very deep Circular *Gulf* or Swallow.

A Fountian in the very Minute of the *Earthquake* on the 11*th* Threw forth its Waters Tinged of a *Blood red*, which continued for 3 Hours, and then it Dryed up, leaving many Holes in the Mud at the bottom, through which Real *Aſhes* were thrown out; and the next day the Waters Returned of the former Quality, without the leaſt Alteration.

In the City, encompaſſed with Caves on 3 ſides, although by the conſiderable *Shakes* that were given it there was not much Ruine made, yet a very Dreadful Sound and Noiſe was heard for a great while.

The South Winds have Blown very much, which ſtill have been impetuous in the moſt Senſible *Earthquakes*, and the like has happened at other times.

From the 11*th* of *Jan.* to this 14 of *Sept.* there have been conſiderable and Strong South Winds, preceded by a Noiſe like Cannon at a great diſtance, ſome of a Longer ſome of a Shorter continuance; this has been obſerved in all parts, but louder in Cavernous places, and in the Valleys between the Mountains, where the *Shakes* were more Violent, in proportion to the Diſtance from the Sea.

Darkneſs and *Obſcurity* of the *Air* has always been over us, but ſtill Inferiour to that on the 10*th* and 11*th* of *Jan.* and often theſe *Clouds* have been Thin and Light, and of a great Extent, ſuch as Authors call *Rariæ Nubeculæ*. The Sun often, and the Moon always Obſcured at the Riſing and Setting; and the Horizon all day long Dusky, ſo that our wonted Proſpects are Shortned; but for ſome little time paſt it has grown ſomething Clearer.

The Heat at the beginning of Summer was not Extream, but the Sun entering *Virgo*, it grew very Great, and at Noons Intolerable.

Since the Firſt of *Auguſt*, which was a moſt Tempeſtuous Day, not only for the Exceſſive Rains for about four hours, but for the Hail and very Loud Thunder, the *Shakes* of the *Earthquake* have been leſs ſenſible and ſeldomer, and for two Months not ſo Univerſal, but ſometimes in one place, ſometimes in another.

It has been obſerved that in leſs ſolid Ground ſuch as Chalk, Sand or Looſe Earth, the Miſchief was without compariſon Greater than in the Rocky places. And in *Syracuſa* the Difference was Viſible in 3 places; that is in the Middle of the City, in the little Iſland, and in *Zaracati*, where the Ancient *Syracuſa* ſtood; in all which places the Buildings being on a Rocky Foundation remain for the moſt part Untouch'd, or only *Shaken* or at leaſt not Quite Demoliſhed. Whereas on the contrary, in the reſt of that Territory which is not Rocky, a very great Number of Noble Structures and Towers lye like a Horrid Deſart, and Heap of vaſt Ruines.

The *Effects* it has had on *Humane Bodies* (although I do not believe they have all immediately been cauſed by the *Earthquake)* have (yet) been Various ſuch as *Fooliſhneſs*, but not to any great Degree, *Madneſs*, *Dulneſs*, *Sottiſhneſs*, and *Stolidity* every where: *Hypochondriack*, *Melancholick*, and *Cholerick* Diſtempers. Every day *Fevers* have been Common, with many *Continual* and *Tertian*; *Malignant*, *Mortal* and *Dangerous* ones in a great Number, with *Deliria* and *Lethargies*. Where there has been any *Infection* cauſed by the Natural *Malignity* of the *Air*, infinite Mortality has followed. The *Small Pox* has made great Deſtruction among young Children. And in ſhort, there has been no State, nor Condition, which has not had its ſhare in ſo Univerſal a Calamity.

The Number of Inhabitants before the Earthquakes, *and of thoſe that* Periſhed *therein.*

The Names of the Cities.	*Number.* of Inhabit.	*Numb of thoſe* Kill'd.	*Names of the* Cities.	*Numb* of Inhab.	*Number of thoſe* Killed.
Agoſta.	6173	2300	*Mazzarino.*	7696	
S. Agata.	1402	20	*Nicoloſi.*	844	4
Avola.	6225	800	*Nixerni.*	1483	
Buſcema.	2192	900	*Noto.*	12043	3000
Bonaccurſo.	844	94	*Occhiella.*	2910	100
Bontello.	172	2	*S. Giovanni Lapunta.*	1082	15
Butera.	3492		*Jaci Realé.*	12895	739
Buccheri.	3295	300	*Jaci S. Antonio.*	6363	1335
Caltagirone.	12339	800	*Leontini.*	10063	1212
Catania.	18914	18000	*Licodia.*	4898	741
Comiſo.	5305	269	*Mineo.*		1355
Caſtel di Jaci.	331	32	*Palagonia.*	1862	29
Carleontini.	2751	77	*Pedara.*	1582	475
Caſſaro.	1458	15	*Palazzolo.*	5571	700
Chiaramonte.	4830	303	*Raguſa.*	9946	5000
Floridia.	1037	20	*Sortino*	6316	2500
Ferla.	3610	800	*Syracuſa.*	15399	4000
Fenicia Moncada.	1651	14	*Scichili.*	9382	2000
Francoſonte.	2039	345	*Scordia.*	907	33
Giarlatana.	2981	541	*Spaccafurno.*	7987	2200
Maſcali.	1300	15	*Trezza.*		200
Maſſa Nunziata.	394	55	*Trecaſtagni.*	3264	1000
Militello Val di Noto.	6438	600	*Terranova.*	5289	
S. Michele.	1838	1	*Tremiſteri.*	996	90
Melilli.	5480	900	*Vittoria.*	3950	200
Monteroſſo.	234	232	*Terra Grande ô Via Grande.*	1602	200
Modica.	18203	3400	*Vizzini.*	10678	2000
			Sum.	254936	59963

An Earthquake *at* Lima 1687. *by* P. Alvarez de Toledo. n. 209. p. 81.

XVIII. On *Monday, Oct.* 20. 1687. (*N. S.*) at 4 of the Clock in the Morning, came a Horrible *Earthquake* and *Noiſe*, with which ſome Houſes Fell, and ſome Perſons were Killed under their Ruines.

At 5 of the Clock in the ſame Morning was Another *Shake* with the ſame *Noiſe*.

At 6 of the Clock in the aforeſaid Morning, when we thought we had been all in Safety, came Another *Shake* with great Fury and Ruſhing *Noiſe*; The *Sea* with great Bellowing came beyond its Bounds; the *Bells* Rung of themſelves; and the Deſtruction was ſo great, that no Building Stood. The *Noiſe* was ſuch, that thoſe in the Fields aſſure us, that the Cattle were in great Aſtoniſhment, *Callao*, *Canete*, *Piſco*, *Chancay*, and *Los Chorillos*, are all Ruined. There are more than 5000 Dead Bodies Found, and they Find more dayly, ſo that we know not their Number

An Earthquake *in* Jamaica $168\frac{7}{8}$ *by Dr.* Hans Sloan. n 209. p. 81.

XIX. The Inhabitants of *Jamaica* Expect an *Earthquake* every year, *&c.* Some of them are of Opinion, that they follow their great *Ruins*. One of them happened on *Sunday* the 19*th* of *Feb.* $168\frac{7}{8}$. about 8 in the Morning. I found in a Chamber one Story high, the Cabinets, and ſeveral other Moveables on the Floor, to Reel as if the Foundations of the Houſe had been Raiſed. I looked out at a Window to ſee what was the Matter, and found that the Pigeons, and other Birds in an Aviary hard by, were on their Wings in a great Aſtoniſhment. It came by *Shocks*; there were Three of them, with a little Pauſe between. It laſted about a *Minute* of time in all; and there was a Small *Noiſe* accompanied it. A pair of Stairs Higher it Threw Down moſt things off the Shelves, and had much more Viſible Effects than Below. This was generally Felt all over the Iſland, at the ſame Time or near it; ſome Houſes therein being Cracked and very near Ruin'd, others being Uncovered of their Tiles, very few Eſcaped ſome Injury, and the People in them were generally in a great Conſternation, ſeeing them Dance. The Ships in the Harbour at *Port-Royal* Felt it; and one who was Eaſtward of the Iſland, coming thither then from *Europe*, met with, as he ſaid, at the ſame time, an *Hurricane*. One Riding on Horſe-back was not ſenſible of it. A Gentleman being at that time abroad in his Plantation, told me, he ſaw the Ground *Riſe* like the Sea in a *Wave*, as the *Earthquake* paſſed along, and that it went Northward; for that ſome ſmall time after he had Felt it, he ſaw by the Motion of the Tops of the Trees on Hills ſome Miles diſtant, that it had then reached no Further than that Place. The *Spaniards* who Inhabited this Iſland, and thoſe Neighbouring, Built their Houſes very Low; and they conſiſted only of Ground-Rooms, their Walls being made of Poſts, which were as much buried under ground as ſtood above, on purpoſe to avoid the Danger which attended other manner of Building from *Earthquakes*. And I have ſeen in the Mountains a far off Bare Spots, which the Inhabitants told me, were the Effects of *Earthquakes* throwing down part of the Hills, which continued Bare and Steep.

XX. 1. The

XX. 1. The Terrible *Earthquake* which happen'd *June* 7. 1692. between Eleven and Twelve of the Clock at Noon, *Shook* down and *Drown'd* 9 Tenths of the Town of *Port-Royal* in two *Minutes* time: And all by the *Wharf-side* in leſs than One; very few eſcaped there. I loſt all my People and Goods, my Wife and two Men, Mrs. *B.* and her Daughter. One white Maid eſcaped, who gave me an Account that her Miſtreſs was in her Cloſet two pair of Stairs high, and ſhe was ſent into the Garret, where was Mrs. *B.* and her Daughter, when ſhe felt the *Earthquake*, and bid her take up her Child and run down; but turning about, met the Water at the top of the *Garret* Stairs; for the Houſe *Sunk downright*, and is now near 30 *Foot* under Water. My Son and I went that Morning to *Liguania*, the *Earthquake* took us in the Mid-way between that and *Port-Royal*, where we were near being overwhelmed by a Swift *Rowling Sea*, 6 Foot above the Surface, without any Wind; but it pleaſed God to Save us, being forced back to *Liguania*, where I found all Houſes even with the Ground; not a Place to put ones Head in, but in Negro Houſes. The Earth continues (*June* 20) to ſhake 5 or 6 times in 24 Hours, and often *Trembling*. Great part of the Mountains fell down, and fall daily. I pray God divert thoſe Heavy Judgments which ſtill Threaten us.

An Earthquake *in* Jamaica, 1692. *by*---- n. 209. p. 83.

2. We have had a very great *Mortality* ſince the *Great Earthquake* (for we have little ones daily) almoſt half the People that eſcaped upon *Port-Royal* are ſince Dead of a *Malignant Fever*, from Change of Air, want of Dry Houſes, Warm Lodging, Proper Medicines, and other Conveniencies. *September* 23. 1692.

By ---*ib.*

3. A great Part of *Port-Royal* is *Sunk*; that where the Wharfs was, is now ſome Fathoms of *Water*: All the Street where the Church ſtood, is *Overflowed*, that the Water ſtands ſo High as the Upper Rooms of thoſe Houſes which are Standing. The *Earth* when it Opened, ſwallowed up People, and they roſe in other Streets; ſome in the middle of the Harbour, and yet were ſaved; though at the ſame time I believe there was loſt about 2000 Whites and Blacks. At the North above 1000 Acres of Land *Sunk*, and 13 People with it. All our Houſes were thrown down all over the Iſland, that we were forced to live in Hutts. The 2 Great Mountains at the entring into 16 *Mile-Walk* Fell, and Met, and ſtopt the River, that it was Dry from that Place to the *Ferry* for a whole Day; and vaſt quantities of Fiſh taken up, which was greatly to the Relief of the Diſtreſſed. At *Yellows* a great Mountain *Split*, and Fell into the Level Land, and Covered ſeveral Settlements, and Deſtroy'd 19 White People. One of the Perſons whoſe Name was *Hopkins*, had his Plantation *Removed* half a Mile from the Place where it formerly ſtood; and now good Proviſions grow upon it. Of all *Wells* from *one* Fathom to 6 or 7, the Water flew out at the Top with the great *Motion* of the *Earth*. Since, it has Continued *Shaking* ſometimes *two* or *three* times in a Day; ſo at Night, ſometimes more, ſometimes leſs; but God be praiſed they are but ſmall. Our People ſetled a Town at *Leguanca-ſide*, and there is about 500 Graves already, and People are every Day a Dying Still. *Sept.* 20. 1692.

By---- ib. p. 88.

By----ib. p. 85.

4. Between 11 and 12 a Clock, we felt the Tavern (where I then was) *Shake*, and ſaw the Bricks begin to Riſe in the *Floor*, and at the ſame Inſtant heard one in the Street cry, *An Earthquake*. Immediately we ran out of the Houſe, where we ſaw all People with lifted up Hands, begging God's Aſſiſtance. We continued Running up the Street, whilſt on either ſide us, we ſaw the Houſes, ſome *ſwallowed* up, others *Thrown* on Heaps; the Sand in the Street *Riſe* like the Waves of the Sea, *Lifting up* all Perſons that ſtood upon it, and immediately *Dropping down* into Pits; and at the ſame Inſtant a *Flood* of *Water* breaking in, and Rowling thoſe poor Souls over and over; ſome catching hold of Beams and Rafters of Houſes, others were found in the Sand that appeared, when the Water was Drained away, with their Legs and Arms out; we Beholding this Diſmal Sight; the ſmall piece of Ground whereon 16 or 18 of us ſtood (praiſed be God) did not ſink. As ſoon as the Violent *Shake* was over, every Man was deſirous to know if any part of his Family were left Alive. *I* endeavoured to go towards my Houſe upon the Ruines of the Houſes, that were floating upon the Water, but could not: At length I got a Canoa, and Row'd up the Great Sea-ſide towards my Houſe, where *I* ſaw ſeveral Men and Women floating upon the Wreck out to Sea; and as many of them as I could, *I* took into the Boat, and ſtill rowed on till I came where I thought my Houſe had ſtood, but could not hear of neither my Wife nor Family. Next Morning I went from one Ship to another, till at length it pleaſed God that *I* met with my Wife and two of my Negroes. She told me when ſhe felt the Houſe *Shake*, ſhe ran out and called all the Houſe to do the ſame: She was no ſooner out, but the *Sand lifted* up; and her Negro Woman graſping about her, they both *dropt* into the Earth together; and at the ſame inſtant, the *Water* coming in, Rowled them over and over, till at length they catched hold of a Beam, where they hung till a Boat came from a *Spaniſh* Veſſel and took them up.

The Houſes from the *Jews-ſtreet* End to the *Breaſt-work* were all ſhak'd down, ſave only 8 or 10 that remained from the *Balcony* upwards *above Water*: And as ſoon as the *violent Earthquake* was over, the Water men and Sailers did not ſtick to *Plunder* thoſe Houſes; and in the time of their Plunder, one or two of them fell upon their Heads by a *ſecond Earthquake*, where they were loſt.

As ſoon as the *violent Shake* was over, the Miniſter deſir'd all People to join with him in Prayer; and amongſt them were ſeveral *Jews* that Kneeled, and anſwered as they did. Nay, I heard one ſay, They were heard to call upon *Jeſus Chriſt*: A thing worth Obſervation.

Several Ships and Sloops were *Overſet* and *Loſt* in the *Harbour*: Amongſt the reſt the *Swan Frigat* that lay by the Wharf to Careen, by the Violent *Motion* of the *Sea*, and *Sinking* of the Wharf, was forced over the Tops of many Houſes; and paſſing by that Houſe where my Lord *Puke* lived, part of it fell upon her, and Beat in her Round Houſe: She did not Overſet, but helpt ſome Hundreds in ſaving their Lives.

As to the *Fire-Balls* which you heard was ſeen in the *Air*, it was a great Falſhood; but a Great and Hideous *Rumbling* was heard in the Mountains; inſomuch

inſomuch that it frighted many Negroes that had been run away ſome Months from their Maſters, and made them come Home.

The *Water* that *Iſſued* from the *Salt panns-Hills*, forced its Paſſage, in I believe 20 or 30 ſeveral Places, ſome more forcibly than others: For in 8 or 10 Places, it came with that violence, that had ſo many Sluices been drawn up at once, they could not have run with greater Force, and moſt of them 6 or 7 Yards High from the Foot of the Hill: 3 or 4 of the leaſt of them we obſerved were near 10 or 12 yards High in the Mountain We Taſted the Water in moſt of the Places and found it to be *Brackiſh*. It continued running that Afternoon, all Night and till next Morning about Sun riſe, at which time the *Salt Panns* were quite Overflowed.

The *Mountains* betwixt *Spaniſh-Town* and 16 *Mile-Walk*, as the way lies along the River, if you remember about the Midway they are almoſt Perpendicular, eſpecially on the other ſide the River; thoſe *two Mountains* in the *Violent Shake* of the *Earthquake* Joyned together, which ſtopt the Paſſage of the River, and forced it to ſeek another, which was a great way in and out amongſt the Woods and *Savana*'s; for (as I have heard by ſeveral hands) it was 8 or 9 days before the Town had any Relief from it: In ſo much that before it came, the People were in thoughts of Removing into the Country, concluding it had been *Sunk* as *Port-Royal* was. The *Mountains* along the River are ſo *Thrown on Heaps*, that all People are forced to go by *Guanaboa* to the 16 *Mile-Walk*.

Mr. *Bosby* (who with his Wife had a Miraculous Eſcape) told us, That that Afternoon, coming to his Plantations, he found the Ground *Opened* in ſeveral places; and in one two Cows were *dropt in* and ſmothered.

The *Weather* was much *Hotter* After the *Earthquake* than Before; and ſuch an Innumerable Quantity of *Muſquetoes*, that the like was never ſeen ſince the Inhabiting of the Iſland.

The *Mountains* at *Yallowes* far'd no better than thoſe of 16 *Mile-Walk*, a great part of one of them *Falling* down, Drove all the Trees before it; and at the Foot of the Mountain, there was a Plantation that was wholly Overthrown and Buried in it

The *Mountains* in *Leguanee Fell* in ſeveral places, and in ſome very ſteep.

The *Water* in the Streets of *Port-Royal* did not ſpout up, as you have heard; but in the *Violent Shake* the Sand cracking and *Opening* in ſeveral places where People ſtood, they ſinking into it, the Water Boiled out of the Sand, that covered many and Saved others. *Ib. p.* 88.

5. The *Year* 1692 Began in *Jamaica* with very Dry and Hot Weather, which continued till *May*, when there was *very* Blowing Weather and much Rain till the End of the Month, from which time till the *Earthquake* happened, 'twas exceſſive Hot, Calm, and Dry; and on *Tueſday* the Seventh of *June*, about 40 *Minutes* paſt Eleven in the *Forenoon*, it being then a very Hot, Clear, Sun-ſhine Day, ſcarce a Cloud to be ſeen in the Sky, or a Breath of Air to be felt, happen'd that *Great Shake*, ſo Fatal to this Place, and to the Whole Iſland. *By---Communicated by Dr.* Ch. Love-Morley. *ib.* p. 89.

It

It began with a ſmall *Trembling*, ſo as to make People think there was an *Earthquake*, which Thoughts were immediately confirmed by a 2*d Shake* ſomething Stronger, accompanied all the while with a *Hollow Rumbling Noiſe*, almoſt like that of Thunder, which made them begin to Run out of their Houſes. But alas! this was but ſhort Warning for them to provide for their Safety; for at the Heels of this 2*d*, came the *Third Violent Shake*, which in leſs than a Minutes Time (it continuing near a *Minute*) Shook the very *Foundation* of *Port-Royal* in ſuch a ſort that I believe 3 parts in 4, of the *Houſes*, and the *Ground* whereon they Stood, and moſt part of thoſe who inhabited them, all *Sunk* at once quite *Under Water*; and on the place which was Left, and is now Standing, *Shook* down and *Shatter'd* the Houſes in ſo violent a manner, that at our Landing it looked more like a Heap of Rubbiſh, than any thing elſe, there being (I believe) ſcarce One Houſe in Ten left Standing, and thoſe ſo Cracked and Shatter'd that few of them were fit, or thought ſafe to Live in, and ſtand now (*Jul* 3. 1693.) Empty. All thoſe Streets which were next the Water, towards the Harbour-ſide, where there were Excellent Wharfs, cloſe to which Ships of 700 Tun might Lie and Deliver their Loading, where were the Beſt Store-Houſes and conveniencies for Merchants; where were Brave Stately Buildings, where the Chief Men of the place lived, and which were in all reſpects the Principal parts of *Port-Royal*, now lie in 4, 6, or 8 *Fathom Water*. That part which is now ſtanding, is part of the End of that Neck of Land which runs into the Sea, and makes this Harbour (at the Extremity of which ſtands the *Fort*, not *Shook* down but much *Shatter'd* by the *Earthquake*) and is now a perfect Iſland; the whole Neck of Land from the *Fort* of *Port-Royal* now ſtanding to the *Palliſadoes*, or other end of *Port-Royal* towards the Land, (which is above a Quarter of a Mile) being quite Diſcontinued and Loſt in the *Earthquake*; and is now alſo with all the Houſes, which ſtood very thick thereon, quite *Under-Water*; all which part or Neck of Land which is diſcontinued) as alſo all the other parts of this place which *Sunk*, were, for what I can Learn, nothing but Perfect Sands and by the People Driving down Timber and Wharfing, *&c.* were by little and little Gained in time out of the Sea, which now has at once Recovered all again.

Capt. *Hals* and ſome others ſay, That when they came hither with *Venables*, the place whereon *Port Royal* was ſince Built, was like one of the Keys or little Iſlands that lye off this Harbour, (which by the way are all *ſtanding*) but Continued by a ſmall Ridge of Sand, which then juſt appear'd above Water, with the other part of the Neck of Land, and I believe there is now as much Ground left ſtanding as then.

And one, who had been there ſome years before under one *Jackſon* (who took and plundred St. *Jago &c* and Return'd with *Venables*, told Capt. *Hals* at his Coming hither, that the *Point* or Place now ſtanding, when he was here before under the ſaid *Jackſon*, was wholly *Separated* from the Land by the Sea, (as it is at this time) and Pointing to the Ridge of Sand above mentioned, ſaid, That did not appear when I was here before. This is very Probable, for already ſince the *Earthquake*, the Sandy Ground at the Paliſadoes, or other ſide, hath Gained from the Sea ſeveral Acres. On this Sandy Neck of Land

did

did People Build great Heavy Brick Houſes whoſe Weight, on ſo Sandy a Foundation, may be ſuppoſed to Contribute much to their Downfal; for the Ground gave way as far as the Houſes ſtood only, and no further; part of the *Fort* and the *Palliſadoes*, at the other end of the Houſes, ſtanding.

This Part of *Port-Royal* which is now Standing, is ſaid to ſtand upon a Rock: But alas! The ſtrange *Rents* and *Tearings* of the *Mountains* here, ſufficiently evince, that Rocks and Sand are equally Able to withſtand the Force of a *Violent Earthquake*. If this place be nothing but Sand (as ſome would have it, that are it's no Well-wiſhers) it ſeems ſtrange that the Force of the *Earthquake* did not Diſſipate and Diſſolve the very Foundation of it, and that it did not Fall to Pieces and Scatter under Water, as the Reſt of the Place did; for the *Shake* was ſo Violent, that it *Threw* People down on their Knees, and ſometimes on their Faces, as they run along the Streets to Provide for their Safety; and it was a very Difficult matter to keep ones Leg. The Ground *Heav'd* and *Swell'd* like a Rolling Swelling Sea; ('tis a ſtrange Compariſon but every body here Uſing it, I venture to do ſo likewiſe) by which means ſeveral Houſes now Standing were *Shuffled* and *Moved* ſome yards from their Places. One whole Street (a great many Houſes whereof are now alſo ſtanding) is ſaid to be Twice as Broad now, as before the *Earthquake*, and in many places the Ground would Crack, and Open and Shut, quick and faſt: Of which ſm ll *Openings* I have heard Major *Kelley* and others ſay, They have ſeen 2 or 3 Hundred at one time, in ſome whereof many People were *Swallowed* up; ſome the *Earth* Caught by the Middle, and *Squeezed* to Death; the Heads of others only appeared above Ground; ſome were *Swallowed* quite down, and *Caſt up* again with great quantities of Water; others went down and never were more ſeen. Theſe were the Smalleſt *Openings*: Others that were more Large, *Swallowed* up great Houſes; and out of ſome *Gapings* would Iſſue forth whole Rivers of Water *Spouted* up a great Height into the Air, which ſeemed to Threaten a Deluge to that part of *Port-Royal*, which the Earth ſeemed to favour, accompanied with Ill *Stenches* and Offenſive Smells: by means of which *Openings*, and the *Vapours* at that time belch'd forth from the Earth into the Air, the Sky which before was Clear and Blue, was in a Minutes time become Dull and Reddiſh, (as I have heard it compared often) like a Red Hot Oven. All theſe Dreadful Circumſtances occurring at once, accompanied all the while with Prodigious Loud *Noiſes* from the *Mountains*, occaſioned by their *Falling*, *&c.* and alſo a hollow *Noiſe* Under ground, and People Running from one place to another, with Fear looking like ſo many Ghoſts, and more reſembling the Dead than the Living, made the whole ſo Terrible, that People thought the Diſſolution of the whole Frame of the World was at hand. Indeed 'tis enough to Raiſe Melancholy Thoughts in a Man now, to ſee the *Chimneys* and *Tops* of ſome *Houſes*, and the *Maſts* of *Ships* and *Sloops*, which partaked of the ſame Fate, Appear above Water; and when one firſt comes a ſhore, to ſee ſo many Heaps of Ruines, many whereof by their Largeneſs ſhew, that once there had ſtood a brave Houſe; to ſee ſo many Houſes Shattered, ſome Half *Fallen down*, the reſt deſolate and without Inhabitants; to ſee where Houſes have been *Swallowed* up, ſome appearing Half above ground, and of others the Chimneys only;

but

but above all to Stand on the Sea ſhore, and to look over that part of the Neck of Land, which for above a quarter of a Mile was *Swallowed* up, there where once Brave Streets of ſtately Houſes ſtood, Appearing now nothing but Water, except here and there a Chimney, and ſome Parts and Pieces of Houſes, ſerving only to mind us of their ſad Misfortune.

And tho' *Port-Royal* was ſo great a ſufferer by the *Earthquake*, yet it left more Houſes ſtanding there, than in all the Iſlands beſides. It was ſo violent in other places, that People could not keep their Legs, but were violently *Thrown* down on the ground, where they lay on their faces with their Arms and Legs ſpread out, to prevent being *Tumbled* and thrown about by the Incredible *Motion* of the *Earth*, like that as is the General Compariſon of a Great Sea. It ſcarce left a Planter's Houſe or Sugar Work ſtanding all over the Iſland: I think it left not a Houſe ſtanding at *Paſſage-Fort*, and but one in all *Liganee*, and none in *St. Jago*, except a few Low Houſes built by the Wary *Spaniards*. And 'tis not to be doubted, but that had there been 500, or 5000 Towns in *Jamaica*, the *Earth quake* would have Ruined every one. In ſeveral Places in the Country the *Earth Gaped* prodigiouſly: On the North ſide the Planters Houſes, with the greateſt part of their Plantations, (and the Planters Houſes be not very near to one another) were *Swallowed*, Houſes, People, Trees, all up in one Gape; inſtead of which appeared for ſome time after a great *Pool* or *Lake* of *Water*, covering above 1000 Acres, which is ſince Dryed up, and now is nothing but a Looſe Sand or Gravel, without any the leaſt Mark or Sign left whereby one may Judge, that there ever had ſtood a Tree, Houſe or any thing elſe. In *Clarendon* Precinct, the Earth *Gaped*, and *Spouted* up with a prodigious force great quantities of *Water* into the Air, 12 Miles from the Sea; and all over the Iſland, there were abundance of *Gapings*, or *Openings* of the *Earth*, many thouſands; Marks of many whereof, which upon their *Cloſing* they left behind them, any one cannot chuſe but ſee, that goes into the Country; and I have ſeen ſeveral. But in the *Mountains* are ſaid to be the moſt violent *Shakes* of all; and 'tis a generally received opinion, that the nearer to the *Mountains*, the greater the *Shake*; and that the Cauſe thereof, whatever it is, lies there. Indeed they are ſtrangely *Torn* and *Rent*; inſomuch that they ſeem to be of quite Different Shapes now from what they were, eſpecially the *Blew*, and other *Higheſt Mountains*, who ſeem to be the greateſt ſufferers; which during the time of the *firſt great Shake*, and as long as the *Great Shakes* continued, which was above Two Months after the *firſt Shake*, (during which time the *Shakes* came very Strong and Thick, ſome times 2 or 3 in an hour) bellowed out Prodigious Loud *Noiſes* and *Echoings*.

Not far from *Yallowes*, a *Mountain*, after having made ſeveral *Leaps* or *Moves*, Overwhelmed a whole Family, and a great part of a Plantation, lying a Mile off. And a large High Mountain, near *Portmorant*, near a days Journey over, is ſaid to be quite *Swallowed* up; and in the place where it ſtood there is now a Great *Lake* of 4 or 5 *Leagues* over.

In the *Blew Mountains* and its nigh Neighbours, from whence came thoſe *Dreadful Roarings*, Terrible and Amazing to all that heard them, may be reaſonably

reaſonably ſuppoſed to be many ſtrange Alterations of the like Nature: But thoſe Wild, Deſert Places, being very rarely or never viſited by any body, not by Negro's themſelves, we are yet Ignorant of what happened there. But whereas they uſed to afford a Fine *Green* Proſpect, now one half part of them at leaſt, ſeem to be wholly Deprived of their Natural *Verdure*. There one may ſee, where the *Tops* of Great Mountains have *fallen*, Sweeping down all the Trees, and every thing in its way, and making a *Path* quite from Top to Bottom; and other places, which ſeem to be *Peeled*, and *Bare* a Mile together; which vaſt *Pieces* of *Mountains*, with all the *Trees* thereon, falling together in a Huddled, and Confuſed manner, *Stopped up* moſt of the *Rivers* for about 24 Hours; which afterwards having found out new Paſſages, brought down into the Sea, and this Harbour, ſeveral Hundred Thouſand Tun of Timber) as I have heard computed from the moſt knowing People there, which would ſometimes float in the Sea in ſuch Prodigious Quantities, that they looked like moving Iſlands. I have ſeen ſeveral of thoſe large Trees on this Shore, all Deprived of their Bark and Branches, and generally very much Torn by the Rocky Paſſages, through which, by the force of a falling Stream and their own Weight, they might be ſuppoſed to be Driven. One great Trunk of a Tree particularly, I have ſeen amongſt the reſt, ſo *Squeezed* as a *Sugar-Cane* after it had paſſed the Mill. Some are of Opinion that the *Mountains* are *Sunk* a little, and are not ſo High as they were: Others Think the whole Iſland is *Sunk* ſomething by the *Earth quake*. *Port-Royal* is ſaid to be *Sunk* a Foot; and in many Places in *Liganee*, I have been told, are *Wells* which require not ſo long a Rope to Draw Water out of them now as before the *Earthquake*, by 2 or 3 Foot.

In this Harbour in *Port-Royal* at the time of the *Great Shake* (though the Seas were very Calm) was ſuddainly Raiſed ſuch a ſtrange *Emotion* in the Water, that immediately it *ſwelled* as in a Storm, Great Large *Waves* appearing on a ſudden Rolling with ſuch a force, that they drave moſt Ships (if not all) in the Harbour from their Anchors, breaking their Cables in an Inſtant: but this was ſoon over, and in a little time all was *ſmooth* again. One Capt. *Phips* told me, That he and another Gentleman happened at the time of the *Earthquake*, to be in *Leganee* by the Sea ſide; and that at the time of the *Great Shake*, the *Sea Retired* from the Land in ſuch ſort, that for 2 or 3 Hundred Yards the Bottom of the Sea appeared Dry, whereon they ſaw lye ſeveral Fiſh, ſome whereof the Gentleman who was with him ran and took up, and in a Minute or two's time the Sea Returned again and overflow'd great part of the Shoar. At *Yallhouſe* the Sea is ſaid to Retire above a *Mile*.

'Tis thought there were loſt in all parts of the Iſland 2000 People, and had the *Shake* happened in the Night, very few would have eſcaped alive.

Since my Arrival here I have felt ſeveral *Shakes*; the *firſt* and Greateſt whereof was on *Good-Friday*, 1693. it Lifted me compleatly off my Chair, and ſet me on my Legs, and was ſaid to be a ſmall *Shake*: but I did not then hear the *Noiſe* (minding ſomething elſe) which always immediately foreruns or rather Accompanies it, but I have ſince felt ſeveral leſs *Shakes*, and Heard the *Noiſe* often, which is very Loud, and may be eaſily taken, by thoſe not

Uſed to hear it, for a Ruffling Wind, or for a Hollow Rumbling Thunder; but hath ſome Puffing Blaſts peculiar to it ſelf, and are moſt like thoſe of a Match made of Brimſtone, when Lighted, but in a much greater Degree, and ſuch as a large Magazine of Brimſtone may be ſuppoſed to make, when on Fire. It is obſervable, that Every ſmall *Shake* is felt on *Shipboard* as ſenſibly as on *Shore*, the Water ſhaking as well as the Land.

It is likewiſe Obſerved, that in Windy Weather there never comes a *Shake*, but in very calm Weather it is always expected. This Obſervation hath held true in every *Shake* that hath happened ſince the *Firſt* Great One.

'Tis obſerved, that after Rain, they are generally ſmarter than at other times; which may be from the ſhutting up of the Pores of the Earth, whereby the Force is more Pent in, and hath not ſo free a Paſſage as to Perſpire and ſpend it ſelf, *&c.*

Shakes often happen in the Country, not felt at *Port-Royal*; and ſometimes are felt by thoſe that live in and at the foot of the *Mountains*, and by No body elſe.

'Tis obſerved, That ſince the *Earthquake*, the *Land Breezes* often fail us, and inſtead thereof, the *Sea-Breezes* often Blow all Night; a thing rarely known before, but ſince common.

In *Port-Royal*, and in many places all over the Iſland, much *Sulphureous*, Combuſtible Matter hath been found, ſuppoſed to have been thrown out, upon the opening of the Earth, which upon the firſt touch of Fire, would Flame and Burn like a Candle.

St. *Chriſtophers*, one of the *Caribee Iſlands*, was heretofore much troubled with *Earthquakes*, which upon the *Eruption* of a great Mountain there of Combuſtible Matter, which ſtill continues, wholly Ceaſed, and have never been felt there ſince: Wherefore many expect ſome ſuch Eruption in ſome of the Mountains here, though we hope there is no neceſſity for it; the *Shakes* having been obſerved to loſe their Force, and to become Weaker and Weaker ever ſince the *Firſt* Fatal one; and 'tis now ſo long ſince we have heard any, except now and then one ſo Weak as ſcarce to be felt, that we have great Hopes they will now quite Ceaſe.

After the Great *Shake*, thoſe People that Eſcaped, (as many as could) got on board the Ships in the Harbour, where many continued above 2 Months after; the *Shakes* all that time being ſo Violent, and coming ſo Thick, ſometimes two or three in an Hour's Time, accompanied with frightful *Noiſes*, both from under the Earth, and from the Continual *Falling* and Breaking of the *Mountains*, that they dared not come Aſhore. Others went to the place call'd *Kingſtown* (or by others *Killcown*) where, from the firſt Clearing of the Ground, and from Bad Accommodations, the Huts built with Boughs, and not ſufficient to keep out Rain, which in a great and an unuſual manner followed the *Earthquake*, lying Wet, and wanting Medicines, and all Conveniences, *&c.* they Dyed miſerably in Heaps. Indeed there was a general *Sickneſs*, (ſuppoſed to proceed from the Hurtful Vapours belched from the many *Openings* of the *Earth*) all over the Iſland, ſo general that few eſ-

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caped being ſick; and 'tis thought it ſwept away in many parts of the Iſland, 3000 Souls; the Greateſt part from *Kingſtown* only, yet an Unhealthy Place. Beſides the great quantities of Dead People Floating from one ſide of the Harbour to the other, as the *Sea* and *Land-Breezes* blew them, ſometimes 100 or 200 in a Heap, may be thought to Add ſomething to the *Unhealthfulneſs* of this Place. *July* 3. 1693.

6. Moſt of the *Ships* loſt their Anchors and Cables which were towards the Wharfs or Town, which I ſuppoſe came from the Sands and Houſes falling on them; and they, After the *Earthquake*, rode in fewer Fathoms Water than before; and one may Believe that ſome of the *Phænomena* may be Accounted for from that. *By Dr.* Sloan. *ib.* p. 80.

XXI. The *Earthquake* which happen'd between the 4th and 5th of *Jan.* 1699. hath had ſtrange Effects about the *Tungarouſe* and *Batavian Rivers*. The great *Batavian* River from above *Tangala Warna*, being a Place from whence the ſaid River receiveth the greateſt part of its Water, is *ſtopt* up, or Covered with Earth from the *Faln Hills*, till beyond the River *Tſjouſpokitſjyl*; ſo that the Place where the River had its Courſe formerly, was not to be ſeen. But far beyond that Hill towards *Batavia*, the Water comes forth again from *Under* the Earth, which is ſunk down, but Thick and Muddy, paſſing Over and Thorow the Trees, wherewith the River was Formerly *ſtopt up*. The Trees lying in the River are of a ſpecial Bigneſs, and ſo cloſe Packt together, that it is impoſſible to Conceive how they came ſo. *An* Earthquake in 1699. *at* Batavia; *ſent to M.* Nieh. Witzen. *by*---n. 264. p. 595.

From the *Mountains* Situated near the Beginning of the *Batavian River*, call'd by the *Javanians Songſy-tſialiwong*, ſeven Hills are *Sunk down*, *viz.* 5 on this ſide, and two on the other. But the *Mount* from whence the River hath alſo its ſource, above *Tangal Warna*, within the Mountains *Terbackti*, is not ſunk down, nor hath received any Damage.

The *Tangarang* River, call'd by the Natives *Songhy Sedany*, is alſo ſtopt up, and Covered with Earth, from the Hill and Branch *Salack*, to the River *Antum*, and from thence to *Tangarang*, being *fill'd* up with Trees; but not in ſuch a Quantity, nor ſo cloſe together, as in the *Batavian* River. On this ſide the *Tangarang* River, 9 are *ſunk* down by the *Earthquake*; and Seven Branches, that had formerly their Iſſue in the River *Tangarang*, are alſo Covered with the Earth; but Three other Hills, lying alſo on this ſide of the ſame River, and call'd *Minjan*, *Dauw*, and *Halfichi*, had not ſuſtained any Damage, whereby the Branches *Autan* and *Kaniki*, (the latter into the firſt Branch, and the firſt into the River *Tangarang*) have kept their Courſe. And the Hill *Oudjong-teboc*, being call'd alſo *Sedani*, from whence the *Tangarang* River had its ſource, is not *Sunk* down nor Hurted. It is alſo obſerved in the *Tangarang* River, at the Place where it is ſtopt up with Trees, that the Deſcending Water being Thick and Muddy, went backward with a Motion not unlike the Waves of the Sea, when moved by a Tempeſt.

The High-Land between the *Batavian* and *Tangarang* Rivers, behind the Old Court of the *Jaccatra* Kings, called *Pakkawang*, having been a great

Wood is Changed ſince the *Earthquake*, into a great and Open Field, wholly Deſtitute of Trees, the Surface of the Ground being Covered with a Red Clay ſuch as the Maſons uſe here; which in ſome places was ſo hard that it could endure Treading and going upon it, and in other places Men did Sink above a Foot into it. At the Place of the Old Court called *Pakowang* Situated between the *Batavian* and *Tangarang* Rivers, no other Damage hath been ſeen, than that the Land thereabouts hath been *Rent* and Divided aſunder with great Clefts more than a Foot wide. The River *Tſicome*, proceeding from a Pit or Well in the aforeſaid Court of *Packowang*, and running a great way under Ground, and then coming Forth again, taking its Courſe towards *Anke*, had not received any Harm: But kept its Courſe uninterrupted.

The *Tommagon Porbo Nata* in his Going towards the Mountains, Heard a *Noiſe* like unto Thunder; and Fearing that a *Sinking down* of the Ground, or an *Eruption* of Water would Follow, he ſtood ſtill with thoſe that were about him, and ſaw afterwards that the *Earth* from the Top of the Mountains *Sunk* down; and Hearing no further *Noiſe*, he went on his Journey, having in Going and Coming back ſpent 19 Days by the Way, and felt 40 times an *Earthquake:* And ſince his Return from the Mountains, he hath felt the like *Shakings* 208 times.

The Cauſe *of* Earthquakes *and* Vulcano's; *by Dr.* Mart. Liſter. n. 157. p. 512. *De Font. Med.* Angl.

XXII. I have elſewhere ſhewn that the *Breath* of the *Pyrites* is *Sulphur ex tota Subſtantia*; Alſo that it naturally Takes *Fire* of it ſelf; Again that the Material Cauſe of *Thunder* and *Lightning*, and of *Earthquakes* is one and the ſame; *viz.* the *Inflamable Breath* of the *Pyrites*; the Difference is, that one is *Fired* in the Air, the other Under Ground: Of which laſt, theſe (I think) are ſufficient Arguments; A Thing burnt with *Lightning* Smells of very Brimſtone; again the Subtilty and Thinneſs of the *Flame*; alſo the Manner of its *Burning*, which is often obſerved to be *particulatim* or in ſmall Spots, Vapour like. And of *Earthquakes*, the Sulphureous Stink of Waters ſmelt before, and of the very Air it ſelf after them: Of which innumerable Inſtances occur in the Relations of them.

They alſo Agree in the manner of the *Noiſe*, which is to be carried on, as in a Train Fir'd; the one Rowling and Ratling through the Air, taking *Fire* as the Vapours chance to Drive; as the other Fir'd Under Ground in like manner Moves with Deſultory *Noiſe*, as it ſhall chance to be continued.

That the Earth is more or leſs Hollow is made probable, by what is found every where in the Mountains; *viz.* Natural *Cavities* or *Chambers*, which the Miners of the North call *Self Opens*. Theſe they meet with frequently, ſome vaſtly Great, and others leſs, running away with Small *Sinus's*: And I doubt not, but upon diligent Inquiry, a great Catalogue of ſuch might be had, diſcovered in the Memory of Man. Beſides, many there are, which are known to open to the Day, and to diſcover themſelves without Digging, as *Pools Hole*, *Okie-Hole*, *&c.* Again, the Great and Small *Streams*, which do

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ariſe from under the Mountains do evidence the *Hollowneſs*, and *Sinouſneſs* of them. Add to theſe that many *Sinus*'s are made in that Inſtant, and are continued by the *Exploſion* and Rending of the firſt Matter *Fired*; which may, and do very probably, cloſe again, when the Force of that *Exploſion* is over; but are ſufficiently Open to continue the *Earthquake*.

That theſe *Subterraneous Cavities* are at certain times and in certain Seaſons full of *Inflamable Vapours*, the *Damps* in our *Mines* ſufficiently witneſs; which *Fired* do every thing as in an *Earthquake*, ſave in a leſſer Degree.

Now, that the *Pyrites* alone (which is our preſent Task) of all the known Minerals, yields this *Inflamable Vapour*, I think highly probable, for theſe Reaſons.

1. Becauſe no Mineral or Ore whatſoever is *Sulphureous*, but as it is wholly, or in part, a *Pyrites*: I have carefully made the Experiment in very many of the Foſſils of *England*, and do find them all to contain *Iron*, wherever there is *Brimſtone*.

2. Becauſe there is but one Species of *Brimſtone*, that I know of, at leaſt with us in *England*: And ſince the *Pyrites* Naturally and Only yields it, it is but Reaſonable wherever *Brimſtone* is found, though in the Air, or Under Ground in Vapour, to think that alſo proceeds from it. The *Sulphur Vive* or *Natural Brimſtone*, which is found in and about the *Burning Mountains*, is certainly the Effects of *Sublimation*; and thoſe great Quantities of it ſaid to be found about the Skirts of *Vulcano*'s, is only an Argument of the long Duration, and Vehemency of thoſe *Fires*. And though the *Sulphur-Vive* or *Rough Brimſtone*, as they call it, had from *Hæcla* and *Italy* is Opake, and agrees not with the Tranſparent and Amber-like *Sulphur-Vive* of the Antients; yet it does not follow, that that alſo was not Produc'd by *Sublimation*, no more, than that the *Stalactites*, or Water wrought Stone, is not ſo made, for that ſome of it is Opaque and ſome Chryſtaline.

But poſſibly the *Pyrites* of the *Vulcano's*, or *Burning Mountains*, may be more *Sulphureous* than ours. And indeed it is plain, that ſome of ours in *England* are very Lean, and hold but little *Sulphur*; others again very much. And this may be one Reaſon, why *England* is ſo little troubled with *Earthquakes*, and *Italy*, and almoſt Round the *Mediteranean Sea* ſo very much. Another Reaſon is, the Paucity of *Pyrites* in *England*; where they are, indeed, ſome little in all places, but moſtly *Sparſim*: and if perchance in *Beds*, thoſe are comparatively Thin, to what probably they are in the *Burning Mountains*, as the vaſt Quantity of *Sulphur* thence *Sublim'd* doth ſeem reaſonably to Imply. Alſo, if we compare our *Earthquakes*, and our *Thunder* and *Lightning* with theirs; there it *Lightens* almoſt Daily, eſpecially in Summer-time, Here ſeldom; There *Thunder* and *Lightning* is of Long Duration, Here ſoon over; There the *Earthquakes* are Frequent, Long, and Terrible, with many *Paroxiſms* in a Day, and that for many Days, Here very Short, a Few Minutes and ſcarce Perceptible. To this Purpoſe, the *Subterraneous Cavities* in *England* are Small, and Few compar'd to the Vaſt Vaults in thoſe Parts of the World; which

which is Evident, from the Sudden Diſappearance of whole Mountains and Iſlands.

There are indeed other *Inflamable* Minerals beſides the *Pyrites*: But by the Providence of God not to be found in *England*, that I know of, and not in any Quantity in any Place of the World, that I can Learn; Which is well for Mankind, becauſe they are very *Poyſons* as the *Orpiments*; but they are Specifically Diſtinct from *Brimſtone* which no Ore yields but *Iron*; ſo the *Orpiments* are all *Gold Ore*. And by the by, ſome Authors have aſſign'd this as a Good Reaſon, againſt any Medicine, that ſhall be made out of *Gold* (as fond as we are of an *Aurum Potabile*) as having naturally a Deleterious Quality.

It may be Objected that no Body is *Kindled by it ſelf*: But it ſeems to me apparently otherwiſe; for that *Vegetables* will Heat and *Take Fire* of themſelves, as in the frequent Inſtance of Wet Hay; And *Animals* are Naturally on *Fire*, and *Man* doth then ſufficiently Demonſtrate it, when in a *Fever*: And amongſt *Minerals*, the *Pyrites*, both in Groſs and in Vapour, is actually of its Own Accord *Fir'd*. Dr. *Power* has recorded at large, in his *Micrographia*, a famous inſtance of it; and the like not very Rarely happens. And that *Damps* Naturally *Fire* of themſelves, we have the General Teſtimony of *Miners*, and the ſame *Author*.

Again, the *Vulcano's*, all the World over, Argue as much; for we, with great Probability, Believe them to be Mountains made up in great part of *Pyrites*, by the Quantities of *Sulphur* thence *Sublim'd*, and the Application of the *Loadſtone* to the *Ejected Cinder*. I go further,

That theſe *Vulcano*'s were *Naturally Kindled* of themſelves, at or near the Creation is Probable: Becauſe there is but a certain Known Number of them which have all continued *Burning* beyond the Memoirs of any Hiſtory; Few or none of them that I know of, have ever Totally Decay'd or been Extinct, unleſs poſſibly by the *Submerſion* of the Whole, being Abſorpt in the Sea. Though they indeed, do *Burn* more Fiercely ſometimes than at others for other Reaſons So that it ſeems to me as Natural to have *Actual Fire* in the *Terreſtrial* World from the Creation, as to have Sea and Water.

Again if theſe *Vulcano's* did not *Kindle of themſelves*, what Cauſe can we imagine to have done it. If the *Sun*; we anſwer, *Hæcla* placed in ſo Extream Cold a Climate was *Kindled*, for ought I can ſee by the Natural Hiſtory of both, as ſoon as *Ætna* or *Fuegos*, or the moſt Southerly.

Not the Accidents happening from Man; for, if Man was (as we muſt Believe) Created Solitary and Topical, they were none of his *Kindling*, becauſe they ſeem to be *Fired* before the World could be all over Peopled: Beſides, they are moſtly the very Tops of Vaſt High Mountains, and therefore the moſt unfit for the Habitation of Man.

If we ſay *Lightning*, and *Thunder*, or *Earthquakes*; we beg the Queſtion: For the Cauſe of the one is the Cauſe of the other; and they are one and the ſame. It remains therefore (very probably) that they were *Kindled of themſelves*.

I for my part know no Subject in the whole Mineral Kingdom ſo general and Laſting for the *Fuel* of theſe *Mountains*, as the *Pyrites*; which I have ſaid Alone does Yield *Sulphur*, and Naturally Reſolves it ſelf into it, by a kind of Vegetation.

About the *Durable Burning* of the *Pyrites* theſe are Inſtances. *Scotch Coa* hath leſs of the *Pyrites* in it, being moſtly made up of *Coal Bitumen*, and therefore it Burns and Conſumes Quickly, and leaves a White Cinder. *Sea-Coal*, or that Coal which comes from *Newcaſtle* by *Sea* to us, and for that Reaſon ſo called, Burns ſlowly; and the *Sunderland Sea Coal* ſo ſlowly, that it is ſaid, by Proverb, to make Three Fires; this hath much *Pyrites* mixt with it, and Burns to a Heavy Reddiſh Cinder, which is *Iron*, by the *Magnet*. But I have ſeen, and have a Specimen by me of a *Coal* from *Ireland*, (the Proprietor of the Pits is Sir *Chriſtopher Wandsford*) which is ſaid to be ſo Laſting, that it will continue 24 Hours Red Hot, and almoſt Keep its Figure: This ſeems to be in great part *Pyrites* by the Weight and Colour.

XXIII. In the *Moores* from *Yeovil* towards *Bridgewater*, in the extreme Drought we have endured this Summer 1666, ſome Lengths of Paſture grew much ſooner withered and Parched, than the other Paſture. And this Parched part ſeemed to bear the Length and Shape (in groſs) of *Trees*. They Digg'd and found in the place, *Oaks* indeed, as Black as *Ebony*. And hence they have been Inſtructed to find and take up many Hundreds of *Oaks*.

Subterraneous Caks *in* Somerſetſhire; *by* *Dr.* J. Beal. n. 18. p. 323.

XXIV. In that *Fenny Tract*, called the *Iſle of Acholme*, lying part in *Lincolnſhire*, and part in *Yorkſhire*, has been abundance of *Oak*, *Firr*, and other *Trees*, of late frequently found in the *Moore*; whereof ſome *Oak* are 5 Yards in Compaſs, and 16 Yards Long; others Smaller and Longer, with good quantities of *Akorns* near them, lying ſomewhat above 3 Foot in Depth, and near their Roots, which do ſtill ſtand as they grew, *viz.* infirm Earth below the *Moore*. The *Firrs* lie a Foot or 18 Inches Deeper, more in Number than *Oak*, and many of them 30 Yards Long; one of them being, not many years ſince, taken up of 36 Yards long beſides the Top; lying alſo near the Root, which ſtood likewiſe as it grew, having been Burnt and not Cut down; as the *Oak* had been alſo. Mr. *Dugdale* concludeth that this *Moore* hath been ſo for Divers Hundreds of Years; and that the Cauſe thereof has been the Muddineſs of the *Tides*, which flowing up *Humber* into *Trent*, left in time ſo much Filth, as to Obſtruct the Currents of *Idle*, *Dun*, and other Rivers, which thence flowed back and Overwhelmed that Flat Country.

Wood *found* Underground *in* Lincolnſhire; *by*---- n. 67. p. 2050.

Of Draining the Fenns.

XXV. At *Youle* about 12 Miles below *York*, near the place where the *Dun* empties it ſelf into the *Humber*, There are ſeveral Perſons which are call'd *Gryers*, who, with a long piece of Iron, ſearch in the ſoft and Boggy Ground for *Subterraneous Trees*; and by this way of Tryal, can in a great Meaſure, diſcover the Length and Thickneſs of theſe Trees, and get a Livelyhood by it.

Foſſile Wood *near* York; *by* *Dr.* Richardſon. n. 228. p. 526.

Some

Some are ſo large, that they are uſed for Timber in Building Houſes, which is ſaid to be more Durable than *Oak* it ſelf; others are ſplit into *Laths*; others are cut into Long *Chips*, and tied up in Bundles, and ſent to the Market Towns, ſeveral Miles off, to Light Tobacco. Thoſe that I viewed, were all Broken off from the *Roots*; I ſuppoſe by violence of Storm or Water, or both; and upon enquiry do find, that they are all after the ſame manner. Theſe *Tryers* do affirm, that at three or four Yards Deep they find *Stumps* of *Trees* broken off; ſome Two, Three or Four Foot from the Ground, and to be exactly the ſame *Wood* with the *Subterraneous Trees*. The *Bate* or Texture of this Wood is the ſame with *Firr*, eaſily *Splitting*: If Burnt it ſends out the ſame *Reſinous ſmell*, and it affords the ſame *Coal*. The Branches generally grow in Circles, as the Knots do Teſtifie: The Knots do eaſily part from the reſt of the Wood, as is uſual in *Firr wood*. The Straightneſs and Length of theſe *Trees*, are alſo a Preſumption, that they muſt be ſuch; if one conſider that ſome of theſe are nigh 100 Foot Long; and at the Bottom, not much above a Foot in Diameter. They affirm'd to me, that their Tops lay all one way, *(viz.)* with the Current of the Water. There are alſo *Oaks* found there, though not in ſo great Quantity. The *Vitriolick* parts of the *Earth* (in which they have Lain, hath given them a Black Tincture quite through, which (when Wrought and Poliſhed fine) is not much inferiour to *Ebony*. This Wood doth not emit the ſame *ſmell* when Burnt, with that call'd *Firr wood*; therefore I hope the *ſmell* of that *Wood* will not be attributed to the *Bituminous* parts of the Earth in which it hath lain. About 60 or 70 Years ago, ſeveral *Dutchmen* undertook to *Drain* a Large Marſh in that place; and in Cutting a Channel in the Dry Ground betwixt the *Fen* and the *River*, at the firſt they threw up a *Rich* and *Firm* Soil, afterwards they met with a Stratum of *Sand*, under that a Stratum of *Boggy* Ground, in which they found of theſe *Subterraneous Trees*, and under that *Firm* Ground; and a Gentleman atteſted unto me, who had it from ſeveral Perſons then living, that were Eye-Witneſſes, that the *Firm* Ground in ſome Places lay *Ridge* and *Furrow*. There are ſeveral of theſe *Roots* of *Trees* to be ſeen in the Channel at Low-Water to this Day, and yet there are neither *Firr* nor *Pine* growing naturally here, nor have been in the Memory of any Man; neither doth there remain any Tradition of the Growth of any ſuch.

Foſſile Wood *in* Craven; *by Dr.* M. Liſter. n. 224. p. 381.

XXVI. *Pimco* is one of the Higheſt Mountains in *Craven* in *Yorkſhire*, lying on the Southſide of that Country, ſome 2 Miles above *Carleton*. On the Southſide of the *Pike*, (as they call the very Top of that Mountain) is a place where the *Water* ſtands; this is called a *Moſs*, and is ſome Fathoms perhaps Deep in Black Mud. Here are Dug up, if we will believe the Inhabitants, not only *Roots*, but whole *Trees* of *Fir*.

I ſaw there no ſmall Marks of a *Wood* in former Ages; as the *Roots* or *Stumps* of *Trees* appearing Above ground; which upon due examination of the Grain and Bark, I found to be the *Roots* of *Birch*. Theſe *Roots* ſplit eaſily and ſoon Dry, and when Dryed they burn with a *Laſting Flame*: and for this purpoſe

purpoſe they uſe them upon any ſudden Occaſion about their Houſes. And altho' the *Flame* be Great, yet it is without any *Reſinous ſmell*: However, it ſeems, that their having Lain ſo long Under Ground has prepared the Juice for *Burning*. There have been *Oaks*, as I have been told, Dug up hereabouts alſo, but I ſaw none.

XXVII. On the South ſide of *Mendipp Hills*, at a place call'd *Doulton*, there are great Quarries of *Freeſtone*, where the Workmen at Five or Six Fathom deep, Sawing *Stones* of Four or Five Tun Weight, have often found large pieces of *Cleft* and *Fair Oak* in the Midſt of them.

Wood *found in* Stone *by Mr.* J. Beaumont. *Ph.Coll.* n.2. p.6.

XXVIII. *S. Septali*, in a Voyage he made a few Years ſince over ſome *Mountains* to *Genoa*, met with ſome Peaſants who Digging on the ſides of an Hill, had found and Gathered very many *Cockle Shells* of Divers Kinds, which he wonder'd at, and therefore went to the very place: where he was ſatisfied of the Truth of the Relation, finding great ſtore of different *Shells*, as the *Turbinets*, *Echini*, and ſome *Pearl-Shells*, whereof one had a fair *Pearl* in it.

Foſſile Shells *in* Italy; *by S.* Manfredus Septalius. n. 27. p. 493.

XXIX. Upon the Way of *Beziers* to *Narbonne*, in a place pretty large, raiſed by Eſtimation above the *Level* of the *Sea*, (which is two Leagues diſtant from it) about 15 or 16 *Fathoms*, *I* ſaw *Rocks*, which incloſed a good number of Big *Oyſters Petrified*: And upon the ſame Way above the place, which is called *Nice*, at the Higheſt place of the Deſcent, very Cragged, where the Rock is Cut to make a paſſage, is ſeen a *Bed* two foot large, of many *Cockle-ſhells Petrified*, Heaped up, as ordinarily they are on the *Sea-ſhore*; which notes ſufficiently, that the *Sea* formerly covered this Place.

Foſſile-Shells *in* France; *by M.* de Martel. n. 58. p. 1183.

XXX We will eaſily believe (what I have Read in *Steno's Prodromus*) that all along the *Shores* of the *Mediterranean Sea*, there may all manner of *Sea-ſhells* be found promiſcuouſly included in *Rocks* or *Earth*, and at good diſtances too from the *Sea*. But for our *Engliſh* Inland *Quarries*, *I* am apt to think, there is no ſuch matter, as *Petrifying* of *Shells* in the buſineſs: but that theſe *Cockle-like Stones* ever were as they are at preſent, *Lapides ſui generis*, and never any part of an *Animal*. It is moſt certain that our *Engliſh Quarry Shells* (to continue that Abuſive name) have no Parts of a Different Texture from the *Rock* or *Quarry* where they are taken, that is, that there is no ſuch thing as *Shell* in theſe *Reſemblances* of *Shells*, but that *Iron ſtone Cockles*, are all *Iron Stone*; *Lime* or *Marble*, all *Lime-ſtone* or *Marble*; *Sparre* or *Chryſtalline Shells*, all *Sparre*, &c. and that they were never any Part of an *Animal*. My reaſon is: That *Quarries* of Different *Stone* yield us quite Different ſorts or Species of *Shells*, not only One from another (as thoſe *Cockle-ſtones* of the *Iron-Stone-Quarries* of *Adderton* in *Yorkſhire*, Differ from thoſe found in the *Lead Mines* of the Neighbouring Mountains, and both theſe from that *Cockle Quarry* of *Wansford Bridge* in *Northamptonſhire*, and

Foſſile-Shells *in ſeveral places of* England; *by Dr.* M. Liſter. n. 76. p. 2282.

all three from thoſe to be found in the *Quarries* about *Gunthrop* and *Beavour-Caſtle*, &c.) but, I dare boldly ſay, from any thing in Nature beſides, that either the *Land* or *Salt*, or *Freſh Water* doth yield us. 'Tis true that I have pick'd out of that one *Quarry* of *Wansford* very reſemblances of *Murices*, *Telinæ*, *Turbines*, *Cochleæ*, *&c.* and yet I am not convinced, when I particularly Examined ſome of our *Engliſh Shores* for *Shells*, alſo the *Freſh Waters* and the *Fields*, that I did ever meet with any one of thoſe *Species* of *Shells* any where elſe but in their Reſpective *Quarries*, whence I Conclude them *Lapides ſui Generis*, and that they were not Caſt in any *Animal* Mold, whoſe Species or Race is yet to be found in Being at this Day. I have two or three ſorts of our *Engliſh Cockle-Stones* of different *Quarries*, nearly reſembling one the other, and all of them very like a common ſort of *Sea ſhell*; and yet there is enough in them ſpecifically to diſtinguiſh them, and hinder them from being ſampled by any thing of the Spoils of the *Sea* or *Freſh Waters*, or the *Land-Snails*.

Foſſile Shells *in* Kent, *by Dr.* Griff. Hatley. n. 155. p. 463.

XXXI. At *Hunton*, 5 Miles from *Maidſtone* in *Kent*, and about a quarter of a Mile from the River *Medway*, after the Coping of a piece of Ground was taken off, (which was of a Clay about 3 Foot deep) we came to a very good *Blew Marle*, which continued ſuch three Feet and a $\frac{1}{2}$ deep more; and then there appeared a Hard Floor or Pavement compoſed of *Shells*, or *Shell-like Stones*, crowded cloſely together; the Interſtices whereof were filled up with the ſame *Marle*. This Layer (which runs as the Veins of Flints do in Chalky Earth) was about an Inch deep, and ſeveral Yards over, and we could walk on it as on a Beach; Under this Layer we came to *Marle* again. I cannot upon Inquiry, find that in the Memory of any Man thereabouts, any Floods from the River have reached ſo far as this place.

Theſe *Stones*, (for I take them to be *Lapides ſui Generis*) are of that ſort which is call'd *Conchites*; and reſemble *Sea-Fiſh* of the *Teſtaceous* kind Moſt of them are *Turbinated*, or Wreathed, the reſt are of the *Bivalvular* ſort, but I have not found any of them with *Valves* Cloſed together, but Single.

The bigneſs of the *Turbinated*, is from a *Vetch* to a Haſſel Nut; they are fill'd with a *Terra Lapidoſa*, like the *Marle*, and are of that Colour till you have Waſhed and Rubbed them, and then they appear of the Colour of *Bezoar*, and of the ſame Poliure. After they have been Boiled in Water, they are Whitiſh, and leave a Chalkineſs upon your Fingers, which when it is rubbed off, gives you a view of very fine Black *Striæ*, thick ſet on the outſide. Theſe *Wreathed Stones* are all perfectly formed; they Differ not in Figure one from another, but that ſome have their ſides a little depreſſed; upon a few of them there Adhered a little proportion of a Glittering Mineral like *Iron*. In *Vinegar*, they made a ſtrong and a Boiling *Effervеſcence*.

The *Bivalvular* are moſt of them no bigger than a Kidney Bean, ſome Leſſer, a few as broad as the Largeſt ſort of Beans, but the *Valve* much Thinner than any of that kind, which had been the *Exuviæ* of an *Animal*; the Gibbous part of the *Valve* is Smooth, and of the ſame Colour with that of the *Turbinated*. In a few there are ſome Oblong Lineations bent Circular-

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ly to the Commiſſure of the *Valve*: I have a piece of ſuch an one by me, conſiſting of ſeveral *Lamellæ*; which hath this further obſervable in it, that the Gibbous part is of a moſt beautiful Black ſhining Colour, and the Inner part of a Shining Pearl-Colour'd Subſtance.

Of this *Bivalvular* ſort, many of them ſeem to be *in fieri*, not as to their Shape, but as to their Hardneſs and Thickneſs, there being in ſome only the *prima ſtamina* and in others, the ſeveral Steps and Progreſſes toward a perfect *Figuration*, which ſeems to me an unanſwerable Argument, for their never having been the *Spoils* of *Animals*. Some of theſe appeared in the Inner ſide White, and it came off upon the Fingers like Chalk, and ſeemed as if a Depreſſion had been firſt made in the Bed of the Shape of a *Valve*, and then the Convex ſide rubb'd with Chalk or painted White.

Thoſe Pieces of this odd *Concretion*, which *I* keep by me (now the *Marle*, which is in the Interſtices, is grown hard) appear much like that Courſe ſort of *Marble-Stone* which is dug about *Pluckley* in the *Wild* of *Kent*. Which *Marble* ſeems to be a *Coagmentation* of ſuch *Shell like Stones*, the *Marle* betwixt them having acquired a firm Solidity and Hardneſs. With this *Stone* they make their Cauſeys in that part of the County: and they are apt to be worn into little Cavities, or Holes, where they have lain long expoſed to the Air; the Rains, in length of time, Waſhing away the portions of *Marle* (which is leſs Hard than the reſt) from the Orifices and Interſtices of thoſe *Shell like Stones*. I am much confirmed in this Opinion by a piece of *Marble*, Inlaid, as it were, with ſuch *Stones*, which was dug out of a Marle Pit, at a little diſtance from, and on the ſame level with that at *Hunton*.

The Imperfect as well as the Complete Formation of ſome of the *Bivalvular* kind (the *Valves* being only found ſingle, and both ſorts in a ground never heretofore diſturbed) are no Light Arguments for their being *Stones*. Perhaps the *Salts* of *Plants* or *Animal* Bodies, waſhed down with Rains, and Lodged under ground, may be there Diſpoſed into ſuch like *Figures*, as well as Above it:

Vid. Muſ. Reg Societ. part. 3 Cap. 1.

Foſſile-ſhells; *In* Barkſhire; *by Dr.* Ja. Brewer. n. 26. p. 484.

XXXII. Near *Reading* in *Barkſhire*, for many ſucceeding Generations, a continued Body of *Oyſter-Shells* has been found through the whole Circumference of 5 or 6 Acres of Ground. The Foundation of theſe *Shells* is a Hard Rocky Chalk, and above this Chalk the *Oyſter-Shells* lie in a Bed of Green Sand upon a Level, as nigh as can poſſibly be judged; this *ſtratum* of Green Sand and *Oyſter-ſhells* is (as I meaſur'd) nigh Two Foot deep. Now immediately above this Layre, or *ſtratum* of Green Sand and *Shells*, is a Bed of a Bluiſh ſort of Clay, very Hard, Brittle and Rugged, they call it a Pinny Clay, and is of no uſe. This Bed, or Layre of Clay, *I* found to be nigh a Yard Deep; and immediately above it, is a *ſtratum* of *Fuller's Earth*, which is nigh two Foot and a half Deep; this Earth is often made uſe of by our Cloathiers: And above this Earth is a Bed or Layre, of a Clear, Fine White Sand, without the leaſt Mixture of any Earth, Clay, *&c.* which is nigh 7 Foot Deep: Then immediately above this is a ſtiff Red Clay, (which is the uppermoſt *ſtratum*) of which we make our Tiles. The Depth of this cannot

be convenienrly taken, it being ſo high a Hill, on the top of which hath been, and is dug up a little Common Earth about 2 Foot Deep.

I have, with a Mattock, dug out ſeveral *Whole Oyſters* with both their *Valves*, or *Shells* lying together, as *Oyſters* before Opened: In their Cavity there is got in ſome of the forementioned Green Sand. Theſe *Shells* are ſo very Brittle, that in digging for them, One of the *Valves* will frequently drop from its Fellow; but 'tis plainly to be ſeen that they were United together, by placing the *Shell* that drops off to its *Fellow Valve*, which exactly Correſponds: But I dug out ſeveral that were *Entire*; nay, ſome *Double Oyſters* with all their *Valves* United.

Foſſile-ſhells *and* Fiſhes *in* Lincolnſhire; *by Mr.* Abr. de la Pryme. n. 266. p. 678.

XXXIII. In a *Quarry* at the Eaſt End of *Broughton* in *Lincolnſhire*, they get a Clayie Subſtance or Earth that lies under the *Stone* in which are innumerable Fragments of the *ſhells* of *Shell fiſh* of various ſorts, of *Pectinites*, *Echini*, *Chonchites*, and others, with ſome Bits and Pieces of *Coral*, and there are ſometimes found *Whole Shell-fiſh*, with their Natural *Shells* on, in their Natural Colours, moſt miſerably Crack'd, Bruiſed and Broken, and ſome totally ſqueez'd Flat by the great Weight of the Earth that yet lies, and that was caſt upon them in the *Noachian Deluge*

There is another *Quarry* in the Field on the South ſide of the Town, of a Hard Blue *Stone*, which was moſt certainly a pure fine Blue Clay in ſome *Antediluvian Lake*, in the Stones of moſt of which are innumerable *Petrify'd Shell Fiſh* of various ſorts, but ſo United to the *Stone*, that it is very difficult to get them whole out, and *I* have always found that they lie in the Superficies of the *Quarry*, within a Foot of the Top thereof, and few or none deeper therein. In many Places of the Surface of the *Quarry*, (which looks Rugged and Drifted, as Snow does after a Storm, and by which one may find what Quarter the Storm or Wind was then in;) there are many *ſhell fiſh* half *in* the Stone, half *out*. That part which is *within* the *Quarry* is Entire and whole, but a Hard *ſtone*, and that part which is *without*, which the *Petrifick* Effluviums did not Touch, is Conſumed and gone, all but a little of the Edges which are Plain *ſhell*, and have all the *Radii* and *Striæ* on them that the Common *Shells* of thoſe ſorts of *Fiſhes* have.

All theſe *Fiſhes* have their *Shells* on, ſome of which *ſhells* are exceeding thin, to what otherſome are Sometimes the *ſhells* of ſome of them are in their *Petrifaction* ſo throughly United unto and Incorporated with the *Stone*, that they are ſcarce Vifible. Others in the ſame *Quarry* have a thick White *ſhell* on them *Petrifyed*, but not Incorporated and Turned into the Subſtance of the Bed in which they Lie As you get that *Fiſh* out, all the *ſhell* ſticks ſo faſt to the Rock, that moſt commonly it is left behind, but ſometimes the *ſhell* Cleaves in two, one Half of the *ſhell* on both ſides of the *Fiſh* ſticks thereto, and the other Half to both ſides of the Bed, but others come out by Lying in the Air in Froſty Nights, with the whole *Natural ſhell* on them, and the *Radii* or *Striæ* very exact. Other *Fiſh* there are here, that have a Black ſmooth *ſhell* on them, with ſeveral *Striæ* but no *Radii*, very like if not the ſame with the *Concha Nigra Rondel.*

I have alſo ſeen in this *Quarry* ſome *ſhell-fiſh* half open and fill'd with the Matter of the Bed in which they Lye, and *Petrify'd* with it. Others being in Heaps together, *I* have found ſome of them Broken; others Bruiſed; and the Edges of one *Fiſh* thruſt into the ſides of another; ſome with the One *ſhell* thruſt half way over the other, *&c* and ſo *Petryfy'd* in the Bed together. Others in the ſame Bed have been ſo Cloſe, that the Matter of the Bed could not inſinuate it ſelf into them. Theſe that are thus found, are ſome of them totally Empty, others are filled with *Criſtaline Fluors*; others *I* have ſeen half full of the ſaid Blewiſh Clay of the Bed, and half full of the ſaid *Criſtallizations*, which have ſtuck therein, from nothing but *ſubterraneous Heats* and *Effluviums*.

Amongſt theſe *Fiſh* in this Quarry, *I* have ſeen ſeveral great *Horſe Muſcles*, ſuch as breed in *Freſh-water Rivers* and *Ponds*, which are exactly like the *Concha Longa Rondel*, but are more Thick, Full, and Pubble, than Ours commonly are at this Day; which Greatneſs and Largeneſs proceed from nothing but the Fertility and Fatneſs of the Bed on which they Bred; and at This Day in an Old Pond beyond *Broughton Hall*, there are ſome of the Largeſt of this ſort of *ſhell fiſh* that ever *I* ſaw, as if this Soil agreed better to the Breeding of this ſort of *Fiſh* than any elſe, juſt as the *Cornu Ammonis*, *Nautili*, and others Breed Beſt upon *Allum Soils*: And that is the Reaſon that they are found ſo much at *Whitby*, *Rochel*, *Lunenburg*, *Rome*, and other places, where are Famous *Allum-Mines*. And if any one would find any of thoſe ſorts of *Fiſhes* (which ſome Learned Men have Ridiculouſly thought to be Species totally Loſt) they ought in all Probability to ſeek for them upon *Allum Soils* in the Sea, and there they would undoubtedly find them.

Others love an *Oazey* Soil, a ſort of a Confuſed Mixture of ſeveral *Soils* together, as part of the Country about *Frodingham*, *Brambee*, *Aſhbee*, *Botſworth*, *&c*. Seems to be; in the Fields and Stones of which Towns is one particular ſort of *Fiſh*, which I know not what *Genus* or *Species* to compare to, bending ſomewhat like a *Ram*'s *Horn*, and exactly Creaſed like one on the outſide, with an *Opuſculum* thereon, which the *Fiſh* opened and ſhut as it had Occaſion. The Bed whereon the ſaid *Shell fiſh* Bred in the *Anti-diluvian Sea*, is not over a Foot Thick (to the beſt of my Memory) in all which, but for the moſt part in the Superficies thereof, are Millions of the ſaid *Fiſh* ſticking half within the Stone, half without; which *Shell fiſh* having a moſt durable *Shell*, that part which ſticks out of the Stone, is not conſum'd, as in the *Shell-fiſh* of *Broughton*, but remains Whole and Entire. And yet *I* have ſeen and found whole Lumps of them, that by ſome Huge Weight caſt or fallen upon them, in the *Noachian Deluge*, have been miſerably Broken and Shattered in pieces, and ſo *Petrify'd* in the Bed as they lay.

In the Pariſh of *Broughton* aforeſaid in the looſe Earth above the aforeſaid Blue *Quarry*, and elſewhere, I have found in a Whitiſh Stone, the *Echini Galeati Puncticulati Lluydii*, the *Turbinites Major Lluydii. Tab.* 7. *N.* 341. the *Coclites Lævis Vulgatior Lluydii. T.* 7. *N.* 322.; in Blue Stone, the *Concha altera Longa Rondeletii*, exactly agreeing to the Picture and bigneſs thereof

In

in *Geſner de Piſcibus. p.* 231. only the *Neb* is much Longer: I have found alſo multitudes of *Belemnites*, great and little, Perforated and Flat at the Root, by which they grew in the *Antidiluvian Sea*, unto ſome of which I have found little *Shell-Fiſh Sticking*.

There have been many Conteſts and Diſputes amongſt the Learned concerning theſe Appearances; But my Notion of them is, that the *Antidiluvian World* had an External Sea as well as Land, and Mountains, Hills, Rivers, and Fruitful Fields, and Plains; that it was about the bigneſs that our Earth is at preſent of; and that when God had a Mind, for the Wickedneſs of the Inhabitants that Dwelt thereon, to Deſtroy the ſame by *Water*, he broke the *Foundations* and *Subterraneous Caverns* and *Pillars* thereof, with moſt Dreadful *Earthquakes*, and cauſed the ſame to be for the moſt part, if not Wholly *Abſorb'd* and Swallow'd up, and Covered by the Seas that we now have, and that this Earth of Ours Riſe then out of the Bottom of the *Antidiluvian Sea* in its Room; juſt as many Iſlands are Swallowed up, and others thruſt up in their ſtead.

From this Happy Syſtem of the *Deluge*, which is the moſt Concordant to the *Scriptures* of all others, all thoſe things are eaſily Solved that were Hard and Difficult before. It is no longer a Wonder that *Shells*, and *Shell-Fiſh*, and the *Bones* of other *Fiſhes* and *Four Footed Creatures*, and *Fruits*, *&c.* are found (as they commonly are) in Beds and *Quarries*, in Hills and Mountains, and in the Bowels of the Earth; for here they *Bred* in the *Antidiluvian Sea*, thither they were Elevated with the Hills and Mountains in the Time of the *Deluge*, there they Fell into, were Abſorb'd, and Bury'd in Chaſms, and Holes, and Clefts that would neceſſarily happen in the Thruſting up of the Earth, and are found in the Soil that was Flung and carried with wonderfu Violence and Confuſion from one place to another, by the working of the Waters, and the Ferment and Hurry that they were put into.

And as all Countries were thus Raiſed out of the Bottom of the *Antidiluvian Sea* and *Lakes*, ſo that Part of the Country about *Broughton* aforeſaid, appears manifeſtly in the *Antidiluvian World* to have been the Bottom of ſome *Freſh-Water-Lake*, becauſe that thoſe are *Freſh-Water Shell-Fiſh* that are found there, and the Bed upon which they Bred, was a Fine Blue Clay, which is the Colour of the Stone to this Day: Which Bed being *Elevated* and liſted up (and Daſhed over with other Earth in the Workings of the Waters, and the great Hurry and Confuſion that then happened) the ſaid Bed by the Power of the *Subterraneous Elevating Heats*, *Steams*, and *Effluviums* was Turned by Degrees into *Stone* with all the *Fiſhes* therein.

I have before told you, that ſome of the *Shell Fiſh* in the ſame Bed, are not Full of the Matter of the Bed, but of *Fluors*, tho' ſuch are not very common: Some might wonder, ſeeing that the *Shells* are Cloſed, that the Matter of the Bed could Inſinuate it ſelf into them; but that is nothing but what is common in like Caſes, for I have frequently ſeen in the Bottoms of Ponds and Rivers, where ſuch *Shell-Fiſh* in plenty are, that when the Fiſh is Dead and Conſumed, and the *Shell* in the *Mud*, with the Edges as Cloſe as if the Fiſh was Alive, that nevertheleſs the Mud or

Clay

Clay will by Degrees inſinuate and Fill the ſame, and now if the Bottom of any one of the ſaid Rivers or Ponds was Raiſed by *Earthquakes*, and Turned into *Stone* by *Petrifick Effluviums*, they would exactly be found as theſe are.

That many *Shell Fiſh* ſuffered ſuch wonderful great Violence and Force in the ſaid great *Flood*, in ſo much as to be Cruſhed, and Bruis'd, and Squeez'd Flat, as ſome of thoſe manifeſtly are, is likewiſe nothing Strange or Wonderful, if we do but conſider the great pieces of Riſing Rocks, and Hills, and Mountains, that muſt needs Roll down, and Fall, in ſuch a general Hurry and Confuſion as that muſt needs have been in the *Quarry*, at the Eaſt End of this Town of *Broughton*: where Fragments of Innumerable *Shells* are found, and ſome *Shell Fiſh* Squeezed Flat, all which are Natural, and not *Petrify'd*. There was in the *Deluge* Flung upon the ſame a Huge Bed of a Mix'd Confuſed Subſtance, now turned into a Whitiſh Soft Canckr'd *Stone* and upon that was Caſt vaſt Quantities of Earth, all which Weigh'd and Preſſed the tender *Shells* ſo much, that they Squeez'd ſome Flat, and Broke others to Pieces, as we find them to be at this Day.

I have a hard *Stone*, part of the aforeſaid Blue Quarry, with little Bits of *Wood Coals* therein, and whole *Leaves* of *Vaccinia*, or *Whortle Berries*, ſuch as grow upon Heath very Exact: And Mr. *Llwyd* and others have given us ſeveral large Accounts of whole *Leaves* and *Plants* found in *Stones* and *Rocks*, and Deep in the Bowels of the Earth, ſome Folded, ſome Plain, ſome Imperfect; all which is very eaſily Solvable, having in that General Confuſion and Hurry been Seized upon and Embody'd in Lumps of Clay and other Matters, and others Catched and intercepted in Rolling Beds of Earth, as they Tumbled down from Riſing Hills and Mountains, and ſo Lodg'd deep in Chaſms of the Ground and *Petrify'd*, and ſo Preſerv'd unto this Day.

XXXIV. *I* have had out of the Iſle of *Sheppy* in the River of *Thames*, very *Sharks Teeth* dug up there; which could not be ſaid to be *Petrifyed*. They were ſomewhat Guilded with a *Vitriolick* Tarniſh at our firſt receiving them; but they were White, and in a Short time came to their Natural Colour. Gloſſopetræ; *by Dr.* Liſter. n. 110. p. 223.

In the *Stone Quarries* in *Hinderskelf-Park* near *Malton* in *Yorkſhire*, I took out of the Rock my ſelf a Fair *Gloſſopetra with* 3 *Points* of a black liver Colour, and Smooth; its Edges are not *Serrate*; its Baſis is (like the *True Teeth*) of a Rugged ſubſtance; it is Carved round the Baſis, with Imboſſed Work: it hath certain Eminent Ridges, or Lines like Rays, drawn from the Baſis to each Point.

XXXV. Dr. *Tancred Robinſon* received lately from *Maryland* a conſiderable Number of *Foſſile Bones* and *Shells* of ſeveral ſorts. Some of them had received little Alteration in the Earth, others more, and ſome were ſo Changed as to be Stony: But all of them Retained their Ancient Shape. One of theſe *Foſſiles I* compared with the *Tongue* of a *Fiſh I* had Obſerv'd in *Jamaica*, and with *The* Foſſile Tongue *of a* Paſtinaca Marina; *by Dr.* Hans Sloane. n. 232. p. 674.

with another of the ſame *Tongues* in Pieces which *I* ſaw in Mr. *Charleton's* moſt Uſeful and Admirable Collection of *Natural Curioſities*, and found a Perfect Agreement. Another of theſe *Foſſiles I* ſuppoſe is the Upper *Mandible* or Palate of this *Fiſh*, which is Oppoſite to, or Anſwers this *Tongue*: The Agreement of this in all parts with the *Tongue* making it very likely to belong, if not to this ſame, yet to this Kind of *Fiſh*.

A Part of one of the Joynts of this *Tongue* was dug up in *England*, and given to Mr. *Charleton*, by Mr. *Llwid* of *Oxford*, by the Name of *Siliquaſtrum Subnigrum Pectinatum maximum*.

Fig. 87, 88. Dr. *Robinſon* thinks the *Foſſile Palate* or *Mandible Fig.* 87 and 88. may be of the ſame kind with that taken Notice of by *Lachmund*, in his Book *de Lapidibus p.* 17. where 'tis call'd *Pentacrinos*.

Fig. 75. *Fig.* 75. Is the *Whole Tongue* of a *Flat Fiſh* a kin to a *Thornback*, which *I* call *Paſtinaca Marina, Lævis, Livida, Albis Maculis notata.* It is made up of many Bones (about 19 in this) which are each of them Crooked, their two ſides making an obtuſe Angle, ſuch as the ſides of the *Under Mandible* of a *Man* does; the *Uppermoſt* ſides of theſe ſeveral *Bones* have *Furrows* and Pieces ſtanding together after the manner of the Teeth of a ſhort Small Toothed Comb, the Extant Ends of which Anſwer the like Parts in the *Bones* of the *Upper Jaw* of this *Fiſh*, between which and this *Tongue* the *Food* of this *Fiſh* is to be Cut, Torn, or Ground to Pieces.

Fig. 76. *Fig.* 76, Is the *Underſide* of the ſame Divided into ſeveral Pieces alſo, but having no *Furrows* or *Teeth*, as thoſe of the *Upper ſide* have.

Fig. 77, 78, 79, 80. *Fig.* 77, 78, 79, 80. Shew the *Joynts* or Pieces of the ſame *Tongue*, Separated in ſeveral Poſitions of their Upper and Under ſides, to ſhew the Perfect Agreement is between the Pieces of the *Tongue* of the *Fiſh* taken lately from it, and thoſe taken *Out of the Earth*, which are Figur'd in the like Poſitions.

Feg. 81, 82, 83. 84, 85, 86. *Fig.* 81, 82, 83, 84, 85, 86.

Fig. 87, 88. *Fig.* 87, 88. Are the Upper and Under ſides of what, *I* ſuppoſe is the *Upper Mandible* or *Palate* of this *Fiſh*, which is Oppoſite to, and Anſwers this *Tongue*.

Mr. *Willoughby* and Mr. *Ray* call this Fiſh *Nari-Nari*; and *I* am apt to believe the Anonymous *Portugal*, whoſe Deſcription of *Brazil* is Publiſhed in *Purchas, Lib.* 7. *Cap.* 1. *p.* 1313. Means this, when he ſays there were *Rays, having in their Mouth* 2. Bones *breaking* Wilks *with them.*

Horns *of* American Deer *found under Ground in* Ireland; *by Dr.* Tho. Molineux. *n.* 227. *p.* 489.

XXXVI. *I* had lately an Opportunity of particularly Examining a compleat *Head*, with both it's *Horns* entirely Perfect, not long ſince *Dug up* in *Ireland*, and given to my Brother *Will Molyneux*, as a Natural Curioſity, by Mr. *Henry Oſtorn*, that lives at a place call'd *Dardiſtown*, in the County of *Meath*, about two Miles from *Drogheda*. This is the *Third Head* which hath been found by caſual Trenching in his Orchard; they were all *Dug up* within the Compaſs of *an Acre* of Land, and lay about 4 or 5 Foot *Under ground*, in

a

a ſort of *Boggy Soil.* The Firſt Pitch was of *Earth*, the next Two or Three of *Turff*, and then followed a ſort of *White Marle*, where they were found.

I took the *Dimenſions* of this *Head* carefully as follows; from the extream Tip of the Right *Horn*, to the extream Tip of the Left *A B* was 10 Foot 10 inches; From the Tip of the Right *Horn*, to the Root where it was faſtened to the *Head C D* 5 *Foot* 2 Inches; from the Tip of the Higheſt Branch (meaſuring one of the *Horns* Tranſverſe, or directly acroſs the *Palm*) to the Tip of the loweſt Branch *G F* 3 Foot 7½ inches; The Length of one of the *Palms* within the Branches *G H* 2 Foot 6 inches; The Breadth of the ſame Palm, ſtill within the Branches, *I K.* 1 Foot 10½ inches; the Branches that ſhot forth round the Edge of Each *Palm*, were 9 in Number, beſides the *Brow Antlers*, of which the Right *Antler D L.* was 1 Foot 2 inches in Length, the other was much ſhorter; The *Beam* of each *Horn M* at ſome Diſtance from the *Head*, was about 8 inches in Circumference; at the Root where it was faſtened to the *Head*, about 11 inches in Circumference. The Length of the *Head* from the Back of the Skull to the Tip of the Noſe, or rather the Extremity of the upper Jaw-bone *N O* 2 Foot; the Breadth of the Skull where largeſt *P Q* was a Foot. There were two *Holes* near the Roots of the *Horns* that look'd like *Eyes*, but were indeed Large Open Paſſages, near an inch in Diameter in the *Forehead Bone*, to give way to great *Blood Veſſels*, that here iſſue forth from the *Head*, and paſs between the Surface of the *Horn*, and the Smooth Hairy Skin that covers them whilſt they are growing, (which is commonly call'd the *Velvet*) to Supply the *Horns* with ſufficient Nouriſhment, while they are Soft, and till they Arrive at their full Magnitude, ſo as to become perfectly Hard and Solid.

Theſe Veſſels, by reaſon of their Largeneſs and great Turgency of the Humour in them, whilſt the *Horn* is Sprouting and Pliant, make Deep and Conſpicuous Furrows all along the outſide of it where they paſs; which may plainly be ſeen after the *Horn* is bare and come to its full growth; at which time all theſe Veins and Arteries, with the outward *Velvet* Skin, Drying by the Courſe of Nature, Shrivel up and Separate from the *Horn*, and the Beaſt Affects Tearing them off in great Stripes againſt the Bows of Trees, expoſing his *Horns* Naked, when they are throughly Hardned, without any Covering at all.

Such then were the Vaſt *Dimenſions*, according to which the Lofty Fabrick of the *Head* and *Horns* of this Stately Creature was built: And yet it is not to be Queſtion'd, but theſe Spacious *Horns*, as Large as they were, like others of the *Deer-kind*, were Naturally *Caſt* every Year, and Grew again to their Full Size in about the ſpace of 4 Months. For all Species of *Deer*, yet known, certainly *Drop* their *Horns* yearly; which I conceive to Proceed from the ſame Cauſe, that *Trees* annually caſt their Ripe *Fruit*, or let fall their Withering *Leaves* in Autumn: That is, becauſe the Nouriſhing Juice, ſay it is *Sap* or *Blood*, is ſtop'd and flows no longer, either on the Account it is now Deficient, being all Spent, or that the Cavous Paſſages which Convey it, Dry up and Cool; ſo as the *Part* having no longer any Communication with, muſt of Neceſſity by Degrees Sever from, the *Whole*; but with this Difference, that *Horns* by

Reaſon of their Hard Material and Strong Compoſition, Stick faſt to the *Head* by their Root 7 or 8 Months after all their Nouriſhment perfectly Retires, whereas *Leaves* and *Fruit*, conſiſting of a much more Tender Subſtance, and a Finer Texture of parts, Drop ſooner from their Native Beds where they Grew, when once the Supply of uſual Nouriſhment is Stopt, This Analogy that Nature Obſerves in *Caſting* the *Horns* of *Beaſts* and *Dropping* the *Fruit* of *Trees*, will appear much more Evident to any one that will obſerve the end of a Stalk, from which a *Ripe Orange* or any Large Fruit, has been lately Sever'd; and the Butt-End of a *Caſt Horn*, where it faſten'd to the *Os Frontis*; For by Comparing them together, he ſhall Find ſo great a Congruity in the Shape of both, that 'twill be apparent Nature Works according to the ſame *Mechaniſm* in One as in t'other.

Such another *Head*, with both the *Horns* Entire was found ſome Years ſince by one Mr. *Van Delure* in the County of *Clare*, Buried 10 Foot *under Ground* in a ſort of *Marle*, and was Preſented by him to the Late *Duke of Ormond*: In the year 1691. Major *Folliot* told me, that Digging for *Marle* near the Town *Ballymackward* near *Ballyſhanon* in the County of *Farmanagh*, he found Buried 10 Foot *under* plain Solid Ground, a Pair of theſe ſort of *Horns*. In the Year 1684. There were two of theſe *Heads* Dug up near *Turvy* within 8 Miles of *Dublin*.

Not long ſince a *Head* of this Kind, with its *Horns*, was found near *Portumny*, ſeated on the River *Shannon*, in the County of *Gallaway*. Such a *Forehead* with two extraordinary *Beams* of theſe Kind of Horns, may be now ſeen faſtened againſt one ſide of the Common-Hall of his Grace *Michael* Lord Archbiſhop of *Ardmagh's* Houſe here in *Dublin*; they are both Imperfect and want their *Palms*, yet by the vaſt Thickneſs and Length of the *Beams*, I judge when Entire they much *Exceed* the Size of thoſe I have given the *Dimenſions* of above. The Primate told me, they were found ſome where in the Province of *Ulſter*.

To theſe I might add many more Inſtances of the like; as thoſe found by the late Lord *Mountjoy*, near his Houſe at *Newton Stewart*, and thoſe kept at *Stockallen* in the County of *Meath*; for to my *Knowledge* within leſs than 20 Years, above 20, I might ſafely ſay, 30 Pair of theſe ſort of *Horns* have been Dugg up in ſeveral Places of this Country, all Found by Accident; and we may well ſuppoſe vaſt Numbers ſtill Remain Undiſcovered: But theſe may ſuffice plainly to ſhew, this Creature was formerly *Common* with us in *Ireland*; and an *Indigenous Animal*, not Peculiar to any Territory or Province, but Univerſally met with in all Parts of the Kingdom. We may alſo reaſonably gather, that they were a *Gregarious Animal*, as the *Naturaliſts* Call them, or ſuch a ſort of Creature as Affect naturally keeping together in *Herds*; as we ſee the *Fallow Deer* with us, and as 'tis Reported of the *Elches* in *Sweden*, and the *Rain-Deer* in the Northern Countries of *Europe*; for otherwiſe we cannot eaſily Fancy it ſhould Happen, that three of their *Heads* ſhould be all found within the Narrow Compaſs of *One Acre* of Ground.

That

That theſe and ſeveral others, and indeed I think *I* may ſay all that *I* have been particularly inform'd of, though *Dug up* in far diſtant Places of *Ireland*, ſhould be conſtantly found Buried in a ſort of *Marle*, ſeems to me to intimate, as if *Marle* was only a Soil that had been formerly the *Outward Surface* of the *Earth*, but in Proceſs of Time, being Covered by Degrees with many Layers of *Adventitious Earth*, has by Lying under Ground a certain Number of Ages acquired a peculiar *Texture*, *Conſiſtence*, *Richneſs* or *Maturity* that gives it the Name of *Marle*. For of Neceſſity we muſt allow the place where theſe *Heads* are now Found, was certainly once the *External* Superfice of the *Ground*, otherwiſe it is hardly poſſible to ſuppoſe How they ſhould come there.

And that they ſhould be ſo *Deep* buried as we at preſent find them, appears to have happen'd, by their Accidentally falling where it was Soft Low Ground; ſo that the *Horns* by their own conſiderable Gravity might eaſily make a Bed where they ſetled in the yielding Earth; and in a very long courſe of Time, the Higher Lands being by Degrees Diſſolved by Repeated Rains, and Waſh'd and brought down by Floods, Covered thoſe Places that were Scituated lower, with many Layers of Earth: For all High Grounds and Hills, unleſs they conſiſt of a Rock, by this means naturally loſe a little every Year of their Height; and ſometimes ſenſibly become Lower even in one Age; of which we may ſee ſeveral Satisfactory inſtances related by Dr. *Plot* in his *Natural Hiſtory* of *Staffordſhire*. *Chap.* 3. *Page* 113. As for all ſuch *Heads* that might Chance to fall on High or Hard Grounds, where they could not poſſibly be covered, or Defended, theſe muſt of Neceſſity Rot, Periſh, and be Deſtroyed by the *Weather*.

By what Means this *Kind* of Animal, formerly ſo *Common* and Numerous in this Country, ſhould now become utterly Loſt and *Extinct*, deſerves our Conſideration.

Some have been apt to Imagine this, like all other Animals, might have been Deſtroyed from off the Face of this Country by the *Deluge* in the Time of *Noah*: But if we conſider what a Fragil, Slight, and Porous Subſtance theſe and the *Horns* of all *Deer* are, we cannot well ſuppoſe they could by any means be Preſerved Entire and Uncorrupt from that *Flood*, now above 4000 Years ſince; and I have by me ſome of the *Teeth*, and one of the lower *Jawbones* of this Creature ſo Perfect, Solid, Ponderous and Freſh, that no one that ſees them can poſſibly Suſpect they could have been in Nature ſo many Ages paſt: And therefore it ſeems more likely to me, this *Kind* of Animal might become *Extinct* here, from a certain ill Conſtitution of Air in ſome of the paſt Seaſons long ſince the *Flood*, which might occaſion an *Epidemick Diſtemper*, if we may ſo call it, or *Peſtilential Murren*, peculiarly to Affect this ſort of Creature; ſo as to Deſtroy at once great Numbers of 'em, if not quite Ruine the *Species*. For this Iſland may very well be thought neither a Country nor Climate ſo truly proper and Natural to this Animal, as to be perfectly agreeable to its temper, ſince for ought I can yet learn it neither is, nor ever has been an Inhabi-

tant of any of the adjacent Kingdoms round about us. And beſides the three Heads above mentioned, found ſo cloſe to one another in the County of *Meath*, and the Two near *Turvy*, ſeems not a little to Countenance this Opinion, as if theſe Animals *Dyed* together in Numbers, as they had lived together in *Herds*. To this Purpoſe *Scheffer* in his *Laponia* ſpeaking of the *Rain-Deer*, an Animal that agrees in *Kind* with ours, though it be a quite different Sort of *Deer*, ſays, That whole *Herds* of them are often Deſtroyed by a *Raging Diſtemper*, like a *Plague*, common amongſt them; and, that ſometimes they All Dye, ſo that the *Laplander* is forced to ſupply himſelf with new.

'Tis probable however, that ſome of them might have Eſcaped this *Common Calamity*: But theſe being Few in Number, I imagine as the Country became Peopled, and thickly Inhabited, they were ſoon Deſtroy'd, and Kill'd like other *Veniſon*, as well for the ſake of *Food*, as Maſtery and Diverſion. And certainly theſe Savage Ages of the World would not have ſpared the reſt of the *Deer Kind*, *Stags* and *Hinds*, *Bucks* and *Does*, which we ſtill have, but that theſe, being of much ſmaller ſize, could Shelter and Conceal themſelves eaſier under the Covert of Woods and Mountains ſo as to Eſcape Utter Deſtruction.

And here I cannot but obſerve, that the *Red Deer* in theſe Our Days, is much more Rare with us in *Ireland*, than it has been formerly, even in the Memory of Man: And though I take it to be a Creature, naturally more peculiar to *This* Country than to *England*, yet unleſs there be ſome Care taken, to preſerve it, I believe in proceſs of time this *Kind* may be loſt alſo, like the Other ſort we are now ſpeaking of.

It remains that we Enquire what *Species* of *Animals* it was, to which theſe ſtately *Horns* formerly belong'd. I know it is an Opinion generally received, that they belonged to the *Alche*, *Elche*, or *Elende*, and therefore are vulgarly call'd *Elche*'s *Horns*: But *I* have ſeen a Pair of Genuine *Elche*'s *Horns* brought out of *Swedeland*, and they differed extremely both in *Figure* and *Size*, from Theſe we have now Deſcribed. They were abundantly *ſmaller*, and quite of another *Shape* and Make; not *Palmed*, or Broad at the End fartheſt from the *Head*, as Ours, but on the contrary, Broader towards the *Head*, and growing ſtill Narrower towards the Tips End, the ſmaller Branches not Iſſuing forth from Both Edges of the *Horns* as in Ours, but growing along the Upper Edge only, whilſt the other Verge of the *Horn* was wholly plain without any Branches at all. The Faithful *Geſner* ſpeaking of the *ſize* of them ſays, *Cornua ſingula Libras circiter Duodecem appendunt, Longitudine fere duorum Pedum*: Whereas the *Horns* we find here in *Ireland* are near Thrice that Length, and above double that Weight, though Dryed and much Lighter from their being ſo long Kept. Moreover the *Elche*, as deſcribed by *Apollonius Menabenus*, who had ſeen many of them, is no larger than a middling Horſe. And Mr. *Duncombe* told me, when he was Envoy in *Sweden*, he had ſeen there above 100 *Elches* together in a *Herd*, and none of them above 5 Foot High: And if ſo, we cannot imagine a Creature of that ſmall ſize, could poſſibly ſupport ſo Large and Heavy a *Head*, with ſo Wide and ſpreading a Pair of

De Quadrup. c. 1;

Horns

Horns as theſe we are ſpeaking of; conſidering that exact *Symetry*, and due Proportion of Parts, Nature obſerves in the Formation of all the Larger and Perfecter ſort of Animals.

But the Deſcription of that *Lofty Horned Beaſt* in the *Weſt Indies* call'd a *Mooſe*, much better Agrees with our *Iriſh Animal* than that of the *Elche* does. This Animal *I* find deſcribed by Mr. *John Joſſelyn*, among his *New England Rarities* in theſe Words: *The* Mooſe Deer, *Common in theſe Parts, is a very goodly Creature, ſome of them* 12 Foot high, (*in Height*, ſays another Author more particularly, *from the Toe of the Forefoot to the Pitch of the Shoulders* 12 Foot; *in its full* Growth *much bigger than an* Ox) *with exceeding Fair* Horns *with Broad* Palms, *ſome of them two* Fathom *or* 12 Foot *from the* Tip *of one* Horn *to that of the* other. That is 14 *Inches* Wider than *Ours* was. Another thus deſcribes the Manner of the *Indians* Hunting this Creature: *They commonly Hunt the* Mooſe *which is a Kind of* Deer, *in the Winter, and run him down ſometimes in Half, otherwhile a Whole Day, when the Ground is covered with Snow, which uſually lies here 4 Foot Deep; the Beaſt, very Heavy, ſinks every ſtep as he runs, Breaking down Trees as big as a Man's Thigh with his* Horns; *at length they get up with it, and darting their Lances, wound it ſo, that the Creature Walks heavily on, till Tired and Spent with loſs of Blood, It ſinks and Falls like a* Ruined Building, *making the* Earth ſhake *under it.* So that we have not the leaſt Reaſon to queſtion but theſe vaſtly large *Iriſh Deer* and the *American Mooſe*, were certainly one and the ſame ſort of Animal, being all of the *Deer kind*, carrying the ſame ſort of *Palmed Horns*, which are of the ſame *ſize* and Largeneſs, as well as *Figure*; and the *Bulk* of their Bodies correſponding exactly in Proportion to the Wide ſpreading of their *Horns*. So that we may ſecurely Aſſert, that *Mooſes* formerly were as frequent in *This* Country, as they have them ſtill in the Northren parts of the *Weſt Indies*, *New England*, *Virgina*, *Maryland*, and *Canada* or *New France*.

And leaſt we may think this Animal peculiar to the *Continent*, and not to be found in *Iſlands*, A remarkable Paſſage in *John de Laet's Deſcription* of the *Weſt Indies* clearly ſhews the contrary: *There are found*, ſays he, *great Numbers of theſe Animals in an* iſland *near the* Continent, *call'd by the* Engliſh *Mount Manſell.* This may give us reaſonable Grounds to Believe, that as this *Iſland* of *Mount Manſell* muſt of Neceſſity have had ſome Communication with the *Main-Land* of *America*, to have been thus plentifully ſtockt with this ſort of Beaſts; ſo *Ireland*, for the ſame Reaſon, muſt in the many Paſt Ages, long before the late Diſcovery of that *New World*, have had ſome ſort of *Intercourſe* with it likewiſe, (though 'tis not eaſie, I acknowledge for us at preſent, to explain how) for otherwiſe *I* do not ſee, how we can conceive this Country ſhould be ſupply'd with this Creature, that for ought I can yet hear, is not to be found in all our Neighbourhood round about us; nay, perhaps in any other part of *Europe*, *Aſia*, or *Africa*: And then, 'tis certain, as *Ireland* is the Laſt or moſt Weſtern Part of the *Old World*, ſo 'tis Neareſt of any Country to the moſt Eaſtern Parts of the *New Canada*, *New England*, *Virginia*, *&c.* the great Tract of Land, and the only one I yet know, Remarkable for Plenty of the *Mooſe Deer*.

An Elephant *found under* Ground *near* Erfurt *in* Germany; *by* Wilh. Ern. Tentzelius. n. 234. p. 757.

XXXVII. *Tonna* inter *Thuringiæ* Dinastias haud postrema, *Erfurto* propinqua, Comitibus olim *Glichensibus* paruit, iisque Extinctis varios sortita Dominos Ducatui tandem *Saxo Gothano* annexa est, ex quo sereniſſimus Princeps, *Fredericus*, cujus Filium Cognominem feliciter hodie Regnantem suspicimus, *A.* 1677. jure Emtionis Hæreditario sibi suisque eam comparavit. Binos habet Pagos seu villas ejusdem Nominis, quorum alter appellatur *Burg Tonna*, quasi *Castrum Tonnam*, alter *Grafen-Tonna*, quasi *Comitis Tonnam* diceres. Uter illorum Antiquior sit, definire nequeo: Id saltem constat Annalibus vetustissimum Pagum esse, qui *Dönnaha* audit in Diplomate *Ottonis Magni*, *A. Chr.* 973 dato, meaque Opinione ad *Burg Tonnam* spectat. Proxime Pago huic adjacet Mons sive Collis *Arenosus*, Arenam in fundo præbens puriſſimam albiſſimamque, in variorum Artificium usum longè latèque transportari solitam: Quam effodientes Mense *Decembri An.* 1695. Ossa quædam Maxima reperiunt, ad *Pedes Posteriores* spectantia, unum 19 *Librarum* pondere; deinde Globum sive *Caput Rotundum* Acetabulo insertum, Capite Viri majus, 9 *Librarum*; hinc Majus *Os Femori* simile 32. *Librarum*. Soluto post Novi Anni initium Frigore amplius inquirentes, offendunt *Spinam Dorsi* cum *Costis* adhærentibus, profundiusque in Arena abditos *Globos* longe majores binos, una cum *Ossibus* eo pertinentibus, *Pedum* nempe *Anteriorum*; tum *Os Humeri*, 4. *Pedes* longum, *Duasque Spithamas* latum cum *dimidia*: Mox *Vertebras Colli* cum vertice Acuminato; denique *Caput* prægrande cum 4. *Dentibus Molaribus*, quorum singuli 12. *Libras* pendebant, & Duobus maximis *Dentibus* sive *Cornubus*, $2\frac{1}{2}$ *Spithamæ* Crassitie, & 8. *Pedum* Longitudine ex *Capite* prodeuntibus. Ut *Caput* melius conspiceretur, Collis 12. fere *Cubitorum*, sive 24 *Pedum* Altitudine perforatus est; quo facto ipse sereniſſimus Princeps 10. *Kal. Feb* accessit, meque inter Comites esse clementissime jussit, ubi omnes quidem in magno Hominum Concursu *Caput* illum cum *Dentibus* prægrandibus admirabundi contemplatissimus, maxime autem indoluimus, & *Caput* & Dentes, exceptis *Maxillaribus*, quos integros fere accepimus, & reliqua *Ossa*, adeo Fragilia, consumpta Carie, hinc corrupta jacuisse, ut nullum eorum ex omni parte in contaminatum erui potuerit, sed in plurimas Particulas disjecta fuerint.

Cum primum Fama emaneret, vulgarem simul Opinionem de *Ossibus Gigantis* ea circumferebat, qua tamen nèc mihi, nec aliis prudentioribus arrisit, & Viso *Capite* statim Evanuit. Postea a vero Duæ Opiniones emerserunt, quarum Altera, pro *Elephanti sceleto*, Temporis diuturnitate maximam partem Petrefacto; Altera pro *Uni Cornu Fossili*, ut vulgo vocant, seu Minerali jocantis Naturæ Fœtu, habuit. Prior sententia mihi comprimis placet. Ex Collatione enim *sceleti nostri* cum Anatomia *Elephanti* quam Dublini in *Hybernia A.* 1681. dedit *A. Moulinus* clarissimè liquet omnia huic nostro convenire, quæ ad vera *Elephanti Ossa* requiruntur. Ante omnia Notandum est, quod *Moulinus* refert in *Cranio Elephanti* extare magnum *Cellularum* Numerum, plerumque Triangularium, Membranulis obductarum, in quibus multa sint *Vasa sanguinea* curiose dispositа, istasque *Cellulas* ex Tenuibus Bracteis Osseis factas esse. Enimvero *Cranium Tonnense* non tantum intus *Concavum* & instar Tumuli Formicarum perforatum fuisse referunt Fossores, sed è Fragmentis idem liquet mani-

manifeſtiſſimè, quæ *Cellulas* iſtas, modo oblique modo directe *Cranium* tranſeuntes, nobis ob Oculos ponunt, ex Tenuibus Bracteis conſtantes, & maximam partem Triangulares: Membranulas autem, *Vaſis ſanguineis* exſiccatis firmiſſime agglutinatas deprehendimus, Colore flavo ſubrubicundo tinctas, ſcalpro forte tentatas in fruſtula diſſilire, ſimulque Colorem iſtum auferre, ut Albedo *Cranii* emineat. Præterea quem *Moulinus* in *Crania* obſervat Meatum *Medullæ ſpinalis*, & ſingularem Cavitatem pro *Cerebro capiendo*, in *noſtris* etiam Fragmentis apparet: & quam ille metitur Diſtantiam *Cranii* ab uno extremo ad alterum 20 ¾ *Digitorum*, in *noſtro* dicitur fuiſſe 3½ *Pedum*, qui cum 42 *Digitos* faciunt, tum Conjecturam nobis præbent, *Elephantem Tonnenſem Hiberno* fuiſſe ad minimum duplo majorem; quod ex ſequentibus clarius patebit. De externa *Cranii Elephantini* forma alius *Anglus*, *Joannes Raius*, in *Synopſi Animalium Quadrupedum* obſervat, *Poſticam* ejus partem in duos præ grandes *Sinus* ſeu *Lobos* ita dividi, ut *Clunes Humanos* referre videatur; neque, ut In aliis multis *Quadrupedibus*, *Cerebello* excipiendo Cavitatem, ſeu Alveum productum extrorſum conſpicuum habere, ſed potius *Cranii Humani* Figuram imitari. Obteſtor omnes, qui *Caput* in Arena jacens viderunt, anon hæc Deſinitio ipſi apertiſſime conveniat. Cæterum *Longiſſimi Dentes* illi ſive *Cornua*, præter Craſſitiem & Longitudinem indicatam, ſimul referebant Nativum *Lævorem*, *Colorem Subflavum* nigricantibus Maculis ſubinde conſperſum, *Curvaturam*, & *Strias* nullis aliorum Animalium *Dentibus Cornubuſque* communes: Imo quod maxime notari meretur, ſupereſt adhuc *Cuſpis* Dextri *Dentis*, apertiſſimo *Limationis* ſigno conſpicua, de qua *Plinius Arbore Exacuere Limareque Cornua Elephantos* memorat. Neque præterierim, inter alios, qui ad viſendum *Tonnenſe* ſpectaculum undique adfluebant, veniſſe etiam Mercatorem, qui multos Annos in *India* conſumpſerat, & ſecundum Regulas *Indorum*, quas ſibi probe cognitas dicebat, ex *Dentibus* ſive *Cornubus* judicabat *Elephantem noſtrum* pluſquam 200 *Annos* vixiſſe. Quam in rem *Aldrovandus* allegat *Aloyſii Cadamuſti* Teſtimonium, vidiſſe ſe aliquando *Elephantem* occiſum perquam Mediocrem, cujus *Dentium* amplitudo *Palmos* (*i.e. Spithamas*) *Ternos* excedebat, eminebat ad *duos Palmos*, verum *Palmus* contectus Carne *Maxillæ* immergebatur, ut totus occultaretur, ut ſunt aliorum *Radices Dentium*; & quoniam eorum *Senecta Dentibus* cognoſcitur, aiebant Argumento *Dentium* fere deſpicabilis, ipſum haud quaquam *Annoſum* fore, ſi conferretur aliis Procerioribus, quorum *Dentes* tantæ ſunt Magnitudinis, ut vicem *Poſtium* ſuppleant, & pro *Palis* ſepes muniant, Teſte *Plinio*, & ut *Nigritæ* referebant, nonnullis eo Amplitudinis creſcunt *Dentes*, ut 12. *Palmorum* Menſuram excedant. Ultima Verba cum primis ad Propoſitum noſtrum faciunt: *Palmum* enim *Cadamuſtus* intelligit *majorem*, quem *Spithamam* alioquin dicimus; 12. igitur *Palmi* 8 faciunt *Pedes*, quæ Longitudo eſt *Dentium Tonnenſium*. Non multum hinc abit *Deus Harduino*, Commentatori *Plinii* noviſſimo, *Dieppæ viſus*, *ſeptenum* fere *Pedum*, *Centum* & amplius *Librarum pondere*; Præterea *Gillius* adſerit, eos ſæpe ad Longitudinem 10 *Pedum* augeſcere. Nec eſt quod Pondus *Centum* & amplius *Librarum* in *Dentibus Tonnenſibus* quenquam deterreat: Reperiuntur enim, quorum ſinguli pendent 140 *Libras*, qualem apud *Batavos* vidit Amicus; vel 150. ſive 200 *Romani Ponderis Duodecim unciarum*, *quales Eraſmus Franciſci memorat*, *vel* 160. qualem in *Muſæo Septali-*

Lib. 18.

ano deſcribit *Terzagus*; quin *Vertomannus* in *Sumatra* duos vidit, qui appenſi *Libras* 336 pendebant. Nobis interea ſufficere poteſt certum Miniſtri cujuſdam *Ducalis* Teſtimonium qui aliquot Annos in *Sumatra* aliiſque *Indiæ* Regionibus vixit, Teſtaturque *Dentes* ſibi viſos fuiſſe Longitudine *ſex* vel *Octo Pedum*, Craſſitie *Duarum & Dimidiæ Spithamarum*, Pondere *Centum & 125. Librarum*. Veterem Diſputationem, *Cornua Denteſve* ſint appellandi, non Definio; neque tamen negaverim, placere mihi *Aldrovandi Bochartique* de Media illorum Natura Sententiam, quam Origo confirmat. *Pauſaniæ* pridem notata, quia Temporibus ſupérne deſcendere, & ita foras tendere, non Auritus, ſed Oculatus Teſtis ſcripſit, viſo in *Campanio Elephantis Cranio:* Eundemque Situm *Tonnenſes* præ ſe ferebant, quibus non obſtare poteſt *Moulini Raiique* Obſervatio, è *Maxilla Superiore* eos derivantium, internamque eorum Conſtitutionem ita nobis depingentium, quod *Intus* concavi *ſint, & quadam Velut* Medullâ, *verum Compactiore, quæque* Glandularum *aliquam Mixturam habere videbatur, repleti*: addit *Raius*, ex Obſervatione *Lewenhoeckii*, *Eos ex conjunctis iiſque admodum Exilibus* Tubulis *conſtare, ex intima parte ſeu Cavitate* Dentis *Originem trahentibus, & ad Circumferentiam ejuſdem terminatis.* Cæterum hos *Tubulos* manifeſtiſſime in qualibet *Dentium Tonnenſium* parte conſpicimus, una cum *Corticibus* quaſi illis in rotundum extenſis, quibus *Elephantorum Dentes* ſingulis vel *Annis* vel majoribus *Vitæ* interſtitiis, diſtingui videmus; verum, ne quid Diſſimulem, Neuter *Noſtrorum* latiori poſſet *Cavitate*, quam quouſque *Capiti* ſeu *Tempori*, vel potius *Maxillæ Superiori*, inſerti fuerunt; nec majorem *Cardanus Aldrovanduſque* in omnibus agnoſcunt, & quanquam ea à *Moulino Raio*que latius extenditur, non alios tamen, quam *Juniorum Elephantum Dentes* producere poterunt, *Seniores* autem non alio modo comparatos puto, quam *Tonnenſes*, ejuſque differentiæ Cauſam in eo ſitam eſſe, quod in *Senioribus Tubuli* iſti Corticeſque non tantum ad Extra augeantur, ſed etiam ad intra magis magiſque conſtipentur & Coaleſcant, ac ſimul *Medulla* compactior *Glanduliſque* mixta ſenſim Congloberur & Condenſetur.

Progredior ad *Dentes Molares*, quorum quatuor Stupendæ Magnitudinis Ponderiſque in *Capite Tonnenſi* reperti fuerunt, iiſque exactiſſime convenit *Raii* Definitio, his Verbis concepta: Os *Bestiæ quatuor in utraque* Maxilla Dentium Molarium *Maſſis inſtructum. Siquidem plurimi* Dentes *in* Os *Solidum & Durum ita infixi ſunt, ut cum eo & inter ſe unum & continuum Corpus efficiant.* Dentes *hi Lineas Parallelas undulatas* octo *vel* novem *in ſuperficie Maſſæ efficiunt, ſuntque reliquo oſſe* Candidiores. *Maſſæ integræ* Dentium *ſingularium modo per* Gomphoſin Maxillis *inſeruntur*: *anterior tamen in* Superiore Maxilla *extremitate altera in* Maxillam *infigitur, deinde* Palato Oris *Parallelos Antrorſum productа, in acutum tandem Mucronem deſinit, qui in Sinu ad id facto in extremitate* Maxillæ *excipitur.*

Inciſoribus *omnino caret.* Equidem his caret etiam *noſter Elephas Tonnenſis*, ſingulæ vero Maſſarium *Molarium* conſtant Oſſe Duro & Vitri inſtar candenti, nucleoque; tum in Superficie *duodecim* Lineas Parallelas *Undulatas*, ſive *Strias Molares* habent, reliquo Oſſe Candidiores; in quolibet latere *Sedecim Striæ* expreſſæ ſunt, totidemque Cavitatibus per *Gomphoſin Maxillis* inſerti fuerunt, quas ubi Scalpro perfoderis, repletas invenies Dura quadam ac Rubicunda Materia

teria, *Medullæ Vaſorum Nervorumque* Petrefactæ ſimillima: Præterea parte illa qua ex *Maxilla* prominuerunt, luculenter apparet *Lævitas duorum* fere *Digitorum*, qualem in *Hibernicis* notavit etiam *Moulinus*. Nec eſt, quod deterreri nos patiamur octonario *Hibernicorum* Numero, quanquam eundem in alio *Elephanto Peireſcium*, Brachio ſuo in Os Belluæ ingeſto, deprehendiſſe *Gaſſendus* narrat: pro *Quaternario* enim ſtant non tantum ex Antiquis *Ariſtoteles* & *Plinius*, ſed & ex Recentioribus *Walter Schultze*, qui diu in *India* verſatus eſt, ipſeque, ut videtur, *Raius* qui alioqui non *in utraque* ſed *in ſingulis Maxillis* Quatuor *Dentes* dicere debuiſſet. Cauſam differentiæ quærere licet vel in Naturæ Varietate, quæ ut in aliis Animalibus, Homineque ipſo, ita etiam in *Elephantis* Numerum *Dentium* non ſemper eundem producat; vel in Ætatis differentia, ita ut *Dentibus Poſterioribus* in juventute exciſis *Anteriores*, copioſo adfluente Nutrimento, ſpatium expleant. Certe *Quatuor Tonnenſes* in Poſteriore ſui parte manifeſtiſſimas habent Extremitates proceſſuſque incurvatos, ex quibus liquet, in *Maxillæ* extremitate illos conſtitiſſe; eoſdem pars Anterior oſtendit, & qui *Superiori Maxillæ* inſerti fuerunt, non ſolum Longiores ſunt Inferioribus, ſecundum *Moulini* Obſervationem, ſed in Acutum quoque Mucronem deſinunt a *Raio* obſervatum: Imo omne fere *Maxillæ* explent ſpatium, quod *Octo* iſti apud *Moulinum*; metitur enim Longitudinem *Anterioris Dentis* in *Maxilla inferiori* ſex *Digitis* cum Dimidio *Poſterioris* tribus; Totius vero *Maxillæ* $21\frac{1}{4}$ *Digitis*, uti *Superioris Maxilla* 18 Foſſores *Tonnenſes* Diſcrimen hoc non ſatis obſervantes eandem utriuſque *Maxillæ* Longitudinem dixerunt, Trium nempe *Pedum*, ſive Triginta ſex *Digitorum*; *Dentes* autem *Maxillares* ſibi invicem inſiſtentes repererunt, Longitudinem ſingulis Unius & Dimidiæ *Spithamæ* adſignantes, quam tamen accuratiori examine diverſam reperi; *Superiorum* quidem propter Acutum Mucronem Quindecim fere *Digitorum Inferiorum* vero Quatuordecim. Accipimus autem Diſtantiam *Maxillarum*, quam iidem dederunt Foſſores, Trium & Dimidii *Pedis*, ſive 42. *Digitorum*: eaque cum Diſtantia 21 *Digitorum*, quam inter *Oſſa Lygomatica* ſive *Jugalia* ſtatuit *Moulinus*, collata, denuo deprehendimus Magnitudinem *Elephantis Hiberuici Tonnenſem* Bis æquaſſe: idem confirmat diſtantia *Cranii* ab uno Extremo ad alterum, in *Hibernico*, $20\frac{1}{2}$ *Digitorum*, in *Tonnenſi* Trium & Dimidii *Pedum*.

Repertæ fuerunt etiam *Vertebræ Colli*, ſeu Cervicis (juxta Dimenſiones a Foſſoribus indicatas) Craſſitie Quatuor *Spithamarum* in Circumferentia, Duarum altitudine; quarum adhuc Tres optime ſibi reſpondentes ſuperſunt, earumque præcipua monſtrat Verticem Acuminatum. Repertum eſt *Os Humeri* cum *Acetabulo* & *Capitibus* ſive *Globis* duobus Maximis adhuc reſiduis, *Pedumque Anteriorum Oſſibus*, *Ulnæ*, *Radii*, *Carpi* & *Metatarſi*, quorum nonnulla tantæ fuerunt Cavitatis, ut manus tota inſeri potuerit; ſingula autem referta non Arenis, ſed minutiſſimis *Medullæ* Petrefactæ particulis, quæ *Ori* indita non Stridorem Dentium cauſantur, Arenæ inſtar, ſed in Lingua liqueſcunt Guſtaque Terreo Tranſmutationem iſtam produnt. Repertæ ſunt *Vertebræ Dorſi* cum *Coſtis* adſtantibus, ſed nihil ex iis integrum evaſit; Duo tantum Fragmenta *Coſtarum* exigua vidi, alterum Craſſitie Undecim, alterum plus quam 7. *Digitorum*. Repertum porro eſt *Os Coxendicis* $2\frac{1}{2}$ *Pedis* Longitudine

cum *Acetabulo* & inſerto *Femoris* Capite ; *Moulinus* Longitudinem illius non exprimit, ſed *Oſſis Innominati*, 25. *Digitorum* : at *Os Coxendicis* tertia tantum pars eſt *Oſſis Innominati*, reliquas duas, *Os Ilion* & *Pubis*, Foſſores dimetiri neglexerunt. Reperta ſunt *Oſſa Crurum Pedumque Poſteriorum*, *Tibiæ*, *Fibulæ Tarſi*, & *Metatarſi* ; e quibus adhuc ſuperat pars *Tibiæ*, Principio & Fine carens, Craſſa tamen ſuperiori parte 22. *Digitos*, quibus ſurſum verſus ſex alios facile accreviſſe ἀυτοψία docet ; inferiori parte habet Craſſitiem 17 *Digitorum*, indeque rurſus Duplex emergit Craſſities, ac Longitudo *Hibernici*, cujus *Tibiam* dicit *Moulinus* Longam 19. *Digitos* ; Rotundam, ubi *Craſſiſſima*, pluſquam 14. & ubi Tenuiſſima, $7\frac{1}{2}$ *Digitos*. Hic notanda eſt major *Pedum Anteriorum* præ Poſterioribus Validitas & Craſſities *Elephantis* propria, & ab *Alberto Aldrovandoque* explicata. Neque enim tantæ Capacitatis eſt *Tibia*, ut Manum intrudi patiatur, quod in quibuſdam *Oſſibus*, *Ulnæ* ſine dubio, licuiſſe Foſſores aliique memorant. Denique ſuperſunt Bina ex *Tarſi* Oſſibus ſibi invicem contigua, ne quiſquam dubitet, illa etiam adfuiſſe. Omnia iſthæc Oſſa Poroſa & Rimoſa ſunt, ut in reliquis Animalibus, alteriuſque Planæ Formæ, ac *Dentes*, tam *Maxillares*, quam Exerti.

Situm quoque Totius Animalis attendere juvat. *Cornua* ſive *Dentes* Maximos verſus Ortum ac ſeptentrionum protendebat; *Pes Anterior ſiniſter* Lateri *Capitis* adjacebat extenſus ; *dexter* ſub Corpore deorſum inclinatus ; *ſiniſter Poſterior* in *Acetabulo* incurvatus, *Dexer* denique initio ſtatim repertus & hinc inde diſtractus fuit. Quæ omnia ſitum minime naturalem vel Ordinarium, ſed Extraordinarium plane violentumque produnt. Tandem Foſſores referunt, *Oſſa* quidem illa jacuiſſe debita ſeries; ſed ubi ſunt Inarticulationes, partim *Palmi*, partim *Semipalmi* [*Palmum* Minorem Quatuor *digitorum* intelligo] ſpatio diſtincta fuiſſe. Quorum Rationi *Pinguedine*, *Cartilaginibus* ac *Ligamentis*, *Carne* denique ac *Inteſtinis* ſita eſt, quibus Putrefactis vacuum Locum Arena occupavit, *Artuſque* Pondere ſuo magis magiſque disjunxit.

Nunc ad aliam Diſquiſitionem venio, An illa ſint *Unicorum Foſſile* ſive *Minerale* in Teriæ Gremio Generatum, vel potius *Animal* Putrefactum ? Equidem nemo Rerum *Phyſicarum* non prorſus Imperitus inficias iverit, dari ejuſmodi *Foſſilia* ſeu *Mineralia*, *Calvariarum* Prægrandium, *Dentium* Oſtiumque ſpecie efficta : Et quomodo Natura tam Immanes *Calvarias*, tam Immania *Humani* (adde & *Animalis*) Corporis Membra, ad *Femorum*, *Tibiarum*, *Coſtarum*, *Dentium*, ſimilitudinem producat, omnium optime clariſſimeque explicatum dedit *Kircherus* dicens, *Latere in ſubterreſtribus viſceribus intra ſaxoſorum Montium Iliatus*, *Terram quandam Limoſam*, *quam* Margam *cum* Agricola *ſupra nominavimus*, Gypſeæ *Materiæ miſtam : quæ Terra ubi per Rimas Montium* Nitroſum Fluorem *receperit*, *fit*, *ut illa veluti Cortici quodam* Gypſeo *induatur*, *qui uti cum Tempore Lapideſcit*, *ita quoque* ſalis N.tri *ſplendore Albedine ſua* Os *proxime æmulatur*, *utpote Candidum*, *Rimoſum*, *& friatile. Si itaque intra Torræ Concavitatis Rotundæ locum invenerit*, *naſcetur Pila Rotunda*, *quæ diſcuſſa* Calvariam *proximæ æmulatur* ; *ſi Matrix fuerit diſpoſita ſub Forma* Femoris Humani (*alteriuſve Animalis*) *aut* Coſtæ *aut alterius Membri*, Marga *in ea contenta ſuper affuſo*

Mund ſubter lib. 8. c. 4.

Sal

Sal Nitroſo *Liquore*, Femur Humanum *Minus*, *Majus*, *Maximum*, & *prorſus*, Giganteum, *pro Matricis Magnitudine exprimet*. *Atque hæc ſunt* Oſſa *iſta*, *quæ Natura producit*, & *paſſim* Oſſa Gigantum *communi Hominum perſuaſione dicuntur*; *quæ tamen ſi confregeris*, *nulla in eis nec* Medulla, *nec* Medullæ Fiſtuloſus Meatus *reperitur*, *quod fieri deberet*, *ſi* (Hominum *Animaliumque*) Oſſa *forent*. Has Obſervationes ſuas certiſſima Experientia *Kircherus* ipſe confirmat, Viſis abs ſe in Pariete *Antri Panormitani* Dentibus *Parvis Mediocribus*, *Maximis & Exceſſivæ Magnitudinis*, *ea ſerie*, *qua Natura* Maxillis Animalium *inſerere ſolet*, *infixos*, *tanta Copia*, *ut centum Carros inde onerari poſſe facile crediderit*: *alibi protuberabant* Vertebrarum, Genum, Tibiarum & Calvariæ *Veſtigia*, *nullo tamen Ordinis nexu*, *nec quidquam inter omnia Oſſeæ ſubſtantiæ veſtigia*, Organizatum, *uti ſunt* Caput, Manus, *Pedeſque reperiebatur*; Unde Luculenter admirabilem Naturæ in *Oſſibus*, aut Oſſibus ſimilibus *Saxis* formandis Induſtriam primo ſe cognoviſſe fatetur *Kircherus*, in *Marchione Ventimiglia*, Luſtrationis Comite, duo edoctus, nobis maxime proficua; quorum Alterum eſt, In *Agro Solonio* juxta Mare, *Drepanum* & *Panormum* inter, ab Agricolis vera adhuc erui *Oſſa Elephantum*, qui præteritorum ſeculorum Temporibus ab *Afris* in *Siciliam* contra Hoſtes in Bellum educti, ibidem interfecti Tumulati ſunt, poſſens Temporibus tandem detectis *Oſſibus*, quæ & imperiti paſſim pro *Gigantium Oſſibus* venditant: Alterum, hoc diſcrimen eſſe inter *Oſſa vera* & a *Natura Minorali producta*, quod Illa ſemper *Tibiarum Canales*, *Fiſtuloſque Meatus* olim *Medulla* refertos retineant, Hæc vero *ſolidum Lapidem* ſine ulla *Tibiarum Concavitate* mentiantur. *Tonnenſia* verum, tantum abeſt ut *Meatibus Medullaribus* careant, aut, ne reliquas *Kircheri* Regulas omittamus, *nullo Ordinis Nexu* inter ſe jaceant, nihilque *Oſſium Organizatorum* contineant, ut potius ea omnia ibi Luculentiſſime extent omniumque Oculos incurrant.

Quæcumque enim in *Elephanto* ſunt *Oſſa Concava* & *Fiſtuloſa*, *Medulliſque Referta*, ea in *noſtro* etiam *Sceleto* paria faciunt: Nec Turbare nos debet *Exertorum Dentium* Soliditas ad eam uſque partem, qua in *Maxilla* figuntur, quippe in Maximis Nativis etiam deprehenſa. Omnia porro iſto *Ordine* inter ſe connexa ſunt, quem Natura requirit, ſitu Violenta & Extraordinario non Impedita, *Oſſa* quæ *Kircherus Organizata*, vocat, & inter *Mineralia Antri Panormitani Oſſa* fruſtra quæſivit, *noſtro Sceleto*, ne Minimo quidem Excepto, quod ex Reliquiis colligitur, Perfectiſſime comparuerunt.

Cranium ſane *Cellulis* pro *Vaſis Nerviſque* Tranſmittendis curioſiſſime diſtinctum eſt, nec *Cavitate Cerebri*, *Medullæve Spinalis Proceſſu* deſtituitur: *Dentes Exerti* nativum *Colorem*, *Lævorem*, *Strias*, *Tubulos*, *Interſtitia* ſive *Cortices*, referunt, imo Dexter ab Animali Vivo *Limatum* ſe prodit: *Maxillaris* Deſcriptioni *Raianæ* optime convenientes ſuâ gaudent *Gomphoſi*; ſeu Cavitatibus Sinuibuſque, quibus *Maxillæ* inſerti fuerunt, *Medulla Rubicunda* Petrefacta adhuc repletis: *Vertebræ Colli* Acuminato Vertice præditæ, & *Oſſa Tarſi*, ſibi invicem reſpondent: Capita Maxima ſeu Globi *Acetabilis* ſuis, *Coſtæ Spinis Dorſi*, juncta fuerunt. Nec plura ex præcedentibus repeto, cum hæc altius expenſa cuilibet perſuadeant, non poſſe *Naturam Ludentem* ſibique relictam, nec *Animali* cujus Partes ſunt concurrente, Corpus ejuſmodi *Organicum* omnibus Numeris abſo-

lutum formare: aut ſi quis regere Soluerit, dari nonnulla *Unicornua Foſſilia* vulgo dicta, & *Mineralia*, quæ *Fiſtuloſos Meatus* habent, illi ex *Kircheri* Principio, in ipſa Experientia Fundato, facile reponerem, *Foſſilia* iſthæc non ex *Mineralium*, ſed *Animalium Genere* eſſe, contrariam Sententiam probandi Onus eidem relinquens. Invictum enim Argumentum eſt, quod in Conjecturis de Antiquiſſimo Statu *Helmſtadii* p. 13. proponit *Conringius*: *Poſſe vero* Naturam, *Relictum Sine Omnibus Adminiculis*, Oſſa *undequaque Perfecta condere qualia in* Fœtu *primum conformantur*, *deinde in* Adultis *diuturna Nutritione Animali perfici ſolent*, *id vero eſt* ἐν τῶν ἀδυνάτων. *Eoque Solius* Naturæ Luxuriantis Luſui *tribuere*, *confectionem tot in Uſus Vitæ conformatorum & omnibus modis abſolutorum* Oſſium, *utique ſine Nota* Summæ Abſurditatis *haud licuerit.*

Accedit alterum Argumentum non Minoris Ponderis, quod eodem loco *Kircherus* nobis ſuppeditat, dicens, *Margam* pro diverſa Cavitatis, ſeu *Matricis* in Terræ Viſceribus Diſpoſitione, diverſa *Oſſium Simulacra* producere. Licet itaque in Arenis *Tonnenſibus Margam* Succumque ſeu *Aquam Lapideſcentem*, quæ *Kirchero Fluor Nitroſus* audit, recondi facile conceſſerim, tamen quis unquam ſibi imaginabitur, Cavitatem ſeu *Matricem* ita ibi olim diſpoſitam, ut *Sceleton Elephanti* Situ Extra ordinario ſupra Deſcripto injectum repreſentarit, quam poſtea *Marga* Fluens fortuito deprehenſam repleverit, Temporiſque Succeſſu in iſtam excreverit Molem? Certe influit eadem Natura, eadem Materia, idem Calor, idem Humor, idem Fomentum Terræ, eadem Generandi Ratio, ſed Diverſiſſima Producta ſunt pro diverſitate *Oſſium Elephanti* Genuina; quatenus ſunt in *Capite* Cellulis Diſtincta; in *Dentibus Maxillaribus* Vitri inſtar Dura & Candentia Striis undulatis prædita; in *Cornubus* ſive *Dentibus Prominentibus* Lævia, Flaveſcentia, in Cuſpide *Limata*, Striata, Tubulis ac interſtitiis conſpicua; in reliquis *Oſſibus* Poroſa: & planæ ad Normam Rationemque Corporis Organici formata? Quis inquam, rebus ſic ſtantibus, illam in Sententiam ſe unquam abduci patietur? Nonne multo eſt veriſimilior Altera *Anſelmi Boetii de Boodt*, *Rudolphi II.*

Imperatoris Archiatri, in *Hiſtoria Gemmarum & Lapidum Lib.* 2. *Cap.* 242. qui poſtquam docuerat, Margam *Lapideſcente & Subterranea Aqua fluente irrigatam vel ſolutam*, *Lactis inſtar Fluere per Terræ Cavitates*, *abſorptaque Serofiore Aquæ parte*, *craſſiorem Cavitates implendo ſiſti*, *& abſumpto Humore omni coaleſcere*, *Lapidiſque Formam &* Cornuum *præ ſe ferre*; quæ *Kircheri* aliorumque communis eſt Opinio: Subjicit; *Verum ſi Lacteus hic Humor non in Cavitatem*, *ſed in* Lignum *aliquod vetuſtate arefactum incidat*, *illiuſque Corpus jam Leve & Poroſum ſubeat*, *tandemque vel exhalata Aquæ Tenuioris portione Craſſior remaneat*, *tandem coagulata* Lignum *tranſmutat ejuſque partes ſibi aſſimilat*, *ita tamen*, *ut Species* Ligni *noſci & interdum Odor deprehendi poſſit. Quod* Ligno *contingit id etiam* Cornubus Cervinis Dentique Elephantis *aliiſque Quadrupedum partibus*, *ſi in hujuſmodi loca decidant*, *contingere poteſt. Hinc fit*, Cornua *iſta* Foſſilia *inter ſe multum Differre*, *& Pauca eandem Faciem oſtendere*, *imo aliqua* Dentes, Tibias, Maxillas, *aliaſve Corporis Partes referre.* Hanc Sententiam proxime ad Veritatem accedere judicat *Olaus Wormius* in *Muſeo pag.* 54. Quid igitur vetat, Epicriſi horum Doctiſſimorum Medicorum acquieſcere, modumque, quo in *Petram* converſa ſunt *Oſſa Elephanti Tonnenſis*,

verbis

verbis eorum exprimere, præſertim cum non ſolum *Dentes Elephantis*, ſed alias quoque Partes Quadrupedum, (quidni & omnium maximi?) hac ratione *Mutari* poſſe diſertiſſime fateantur?

Devenerat igitur quovis Modo ac Tempore (de quo infra diſpiciemus) in Collem Arenoſum *Tonnenſem Elephas*, cujus *Oſſa* Temporis longitudine Arefacta calcinavit Ignis Subterraneus, eaque jam Levia & Poroſa ſubiit *Lacteus* ille *Margæ* Humor, & exhalata Aquæ tenuioris portione Craſſior remanſit, [cujus particulas in *Oſſibus* Poroſis ob majorem Albedinem ab eorum Subſtantia facillime diſcernere licet,] & tandem Coagulata totum *Elephanti Sceleton* Tranſmutavit, ejuſque Partes ſibi Aſſimilavit, ita tamen ut *Species Oſſium* interna & Externa noſci, & ſorte etiam *Odor* deprehendi poſſit. Ultimum de *Odore* ſubdubitans adjeci, quoniam tentare nondum licuit. Si tamen *Boetius Odorem* intelligit, quem *Ligna* & *Oſſa Petrefacta* in *Furno Chymico* ſpargunt, id de noviſſimo Examine adſeverare poſſum, quod Nares propius Admoventium idem prorſus adflaverit *Odor*, quem *Oſſa Cornuaque* Aduſta dare ſolent. Aliquot *Eboris* ſive *Dentium Elephanti Foſſilium* Exempla protulit *Bartholinus* poſtremo de *Unicornu* Capite, in medio quidem relinquens, num *Dentes* fuerint in *Lapideam* duritiem compacti Ætatis Moræque Ambitu, an ex prima *Lapidum* Mole incertam tantum *Dentis Cornuve* figuram effecti à Natura; Faſſus tamen, utrique ſuam eſſe Rationem, ſi alterutrum Nolis; neque ſpernenda *Petrefactionis* Exempla Cauſaſque adjiciens. Ad eundem modum hæſitabundus pronuntiat de *Dente Maxillari Elephantis*, alteroque *Roſmari* in *Petram* ſeu *Silicem* converſis: Noſtram tamen Sententiam diſerte amplectitur alioque *Roſmari Dente* illuſtrat Medicus *Iſlandus Arngrimus*. Eidem apertius favet *Antonius de Pozzis*, Archiater *Cæſareus*, in Epiſtola ad *Lambecium*, quam ipſe Lambecius una cum Figura *Dentis Elephantini Maxillaris Tomo VI. Commentariorum de* Bibliotheca Cæſarea *appendit p.* 315, 316. Is enim non ſolum *Dentem* iſtum, ſed & *Femoris Tibiarumque Oſſa Badenæ* reperta, pro veris *Elephanti*, ſed *Petrefactis*, habet; addito Ratiocinio, *quod ſi* lapideam *Mentiatur Naturam*, *hoc accidit a Terræ*, *cui ſepeliuntur*, *occultis Conatibus*, *quæ ſuo concentrato* Archeo *Semina extrahit* Lapidi ficationis *atque Indurat*. Plura ejuſmodi *Oſſa Elephantina Petrefacta* in *Romanis Cimeliis* ex Celeberrimi *Ciampini* Obſervatione colligo, quam in *Ephemeridibus Naturæ Curioſorum An.* 1688. *p.* 446. deprehendi.

Act. Med. Hafn. Tom. I. pag. 83, 84.

ib. Tom. IV. pag. 182.

Refert enim *Oſſa* quædam miræ Magnitudinis effoſſa, *Femoris*, *Scapulæ*, & *Vertebrarum* quinque, inter quas erat illa *Cervicis*, quæ Pondere ſimul 180 *Libras Romanas* excedebant; & a pleriſque pro *Giganteis* habita, cumque aliis ejuſmodi in Urbis *Cimeliis*, *Chiſiano* præſertim, collata, omnium Maxima erant. Dubio autem exorto, an revera *Gigantis*, aut potius *Elephantis* eſſent, ad Eruditum Amicum *Florentiæ* commorantem datæ fuerunt Literæ, ut Exemplar *Sceleti Elephantis*, qui in Celebri *Medicorum Muſeo* viſitur, mittere non dedignaretur; qui Petitioni benigne annuens, optatum tranſmiſit Exemplar, quare facta cum *Oſſibus* Collatione Unanimi Conſenſu judicatum fuit, tam illa noviter reperta, quam in *Cimeliis* aſſervata *Elephantum* eſſe, & pro certo habuimus, illorum *Elephantum* fuiſſe,

quorum

Lib. VIII. Cap. 2. & 6. quorum *Plinius* meminit; Addit *Ciampinus*, varia deinde alia *Ossa Lapidefacta Denteſque Foſſiles* collata Fuiſſe.

Non diffiteor, *Optime Magliabechi*, cum mihi de *Oſſibus Tonnenſibus* cogitanti hæc in mentem redirent, primum inde ortum Conſilium, rem totam tibi exponendi, quod ſpe tenerer haud infirma, Litis *Romanæ Sceleto Mediceo* feliciter ſopitæ Exemplo, noſtram quoque terminari poſſe. Ratum interim firmumque eſto, *Sceleton Elephanti Tonnenſis* priſtinam *Oſſium* Naturam Calcinatione Subterranea, Philoſophicæ Analoga, maximam partem perdidiſſe, adeoque *Oſſium* Calcinatorum inſtar Friabile eſſe, ac inſigni Adſtringendi Robore pollere. Equidem ſi *Ebori* nativo Adſtringens vis eſt, quæ tamen Guſtu non percipitur, ut *Aldrovandus* adnotavit quidni ea potius ſe exerat Linguæque adhereat in *Ebore*, tot Annis in Terræ Gremio latente, Calcinato & Maximam partem *Petrefacto*? Neque enim *Oſſa Noſtra* in *Lapidem* ita converſa ſunt, ut nulla Oſſe Naturæ intrinſeca remanſerint Indicia, quæ *Examinæ Chymico* per ignem inſtituto extorqueri poſſunt. Id ſane cum apud nos ſuſciperetur, non ſolum in Vaſe Fictili, quod *Retortam* vocant, remanſerunt fruſtula *Oſſium* injecta, & Colorem Figuramque *Spodii*, & *Odorem Oſſis Cornuque* aduſti manifeſte referentia; ſed etiam *Plegma* vitreo Vaſe, cui *Recipientis* Nomen, exceptum, *Sal Volatile* Guſtu, & *Oleum* Pinguedine tenui innatante prodiderunt. Poſtea Particulæ iſtæ *Oſſium* in Figuli Fornace fortius Calcinatæ, Albo Colore præditæ, Tubulos Striaſque *Dentium Elephanti* aperte monſtrabant; tam Elutriatæ & Inſpiſſatæ, ut *Chymicorum* Vocabulis utar, tam in Sedimento, ſeu Lixivio, *Sal Chryſtallinum* continebant, quam in *Phlegmate* Saporem multo Acriorem Linguæ Guſtandum præbebant, Oculis jucundo Spicularum *Salinarum* innatantium Spectaculo relicto. Quæ omnia quidem ex *Oſſibus Cornubus* que Animalium quotidie eliciuntur, nulla tamen hujus Generis ex *Lapidibus*, *Margis* aut *Oſteo Collis* erui poſſunt, cum *Lapides* ne Calcinnari quidem ſeſe patiantur, ſed in *Calcem* Igne degenerent; cujus Rationem *Kircherus* in *Exigua Humiditate* quærit, *qua fit, ut partes Spirituoſæ* Lapidum *ob* Sulphuris Pinguidinem *partes Fixas in* Calcem *reſolvant.* *Mund. Subt. Lib. X. Cap. IV.* Quis igitur amplius dubitaverit meæ ſubſcribere Sententiæ, faterique, Vera *Elephanti Oſſa Tonnæ* reperta, ſed *Igne Subterraneo*, quem ſatis prodit *Odor Sulphuris Terreſtris* in *Phlegmate* Reſiduiſque Particulis, Calcinata, & maximam partem *Petrefacta?* quæ Cauſa eſt, quod nec *Sal Volatile* nec *Oleum* ea Quantitate ſperare inde liceat, quam *Oſſa* Recentia ſuppeditant; idque magis, cum in his etiam, ex Medici *Angli Cloptoni Havers*, in noviſſima *Oſteologia*, Obſervationibus, *Sal Volatile* vix Trigeſimam, *Oleum* non multum ultra Vigeſimam quartam, *Oſſium* partem conſtituant; tantillum vero in *Oſſibus Lapidefactis* fere abſorptum, ejuſque vix ſuper eſſe Veſtigia, quis iverit inficias?

Cæterum alius nonnullis Eximendus reſtat Scrupulus, qui negant, ullum in Rerum Natura *Elephantem* unquam fuiſſe, cui tantæ Magnitudinis *Oſſa* conveniant. Enim vero hos ego Jubeo ſecuros eſſe, & *Indiæ Africæ* que Itineraria adire, in quibus non ſolum Tantæ, ſed Majoris etiam Proceritatis *Elephantos* reperient. *Hibernicus* quidem *Moulini*, ad cujus Normam

mam *Noſtrum* ſæpius exegimus, vix major fuerit *Antwerpienſi*, quem *Goropius Becanus* apud *Aldrovandum* accurate Dimenſus eſt, ejuſque Altitudinem *octo Pedum* reperit. In *Scceleto autem Hibernico* Longitudo *Oſſis Innominati* eſt 25. *Femoris* 28, & *Tibiæ* 19 *Digitorum*, qui ſimul efficiunt 72. *Digitos*, ſive *Sex Pedes*: his *Duos* addo *Pedes* pro explendo ſpatio, quod *Plantæ Pedum*, *Curvatura Dorſi*, *Cartilagines*, *Caro* denique & *Cutis* requirunt: indeque colligo, quam dixi, *Hibernici Elephanti Octopedalam* Altitudinem. Cum vero Collatio ſupra inſtituta docuerit, *Tonnenſis Oſſa* ad minimum altero tanto majora fuiſſe, inde ſimul conſicitur, *Sedecim* circiter *Sedum* Altitudine illum eminuiſſe. Hæc autem tantum abeſt, ut inſolita ſit, ut potius *Julius Cæſar Scaliger* Exercitatione 204. eandem diſerte notaverit, ex *Indicarum* Navigationum Scriptoribus referens, *Elephantos Senum Denum Pedum* excedere Proceritatem. Sed dantur longe Majores *Joannes Jacobus Saar* in *Itinerario* refert certum Menſuræ Genus, *Gobdel* appellatum, Tres partes *Ulnæ* (*Norinbergenſis*, ut arbitror, propter Auctoris Patriam) æquans, & Trecentorum ſive Quadringentorum *Imperialium* Prætio æſtimatum, cui vendibiles Inſulæ *Ceylon Elephantes* ſubjiciunt, Altitudine 7. 8. 9. 10. & *undecim Gobdel*: neque Majores ſibi viſos eſſe. *Ulna* autem *Norinbergenſis* 4 circiter *Digitis* ſuperat Duos illorum *Pedum* quos hactenus adhibui: unde ſequitur Menſuram *Gobdel* circiter eſſe 21. *Digitorum*, adeoque Maximum *Elephantorum Saario* viſum, pluſquam 19. *Pedum* Altitudinem habuiſſe. *Philippus Pigafetto* in Deſcriptione Regni *Congenſis Africani* fidem facit, Veſtigia Maximorum ibi *Elephantorum* in Diametro 4. *Spithamas*, quæ *Duos Pedes*, & 8. *Digitos* referunt, excedere; in *Elephanti Antuerpienſi* Calcis ſive Plantæ Imæ Diameter *Pedis unius* & *Duorum*, paulo plus minus, *Digitorum* erat. Collato utroque Diametro Deprehendemus, Maximorum in *Africa Elephantum* Altitudinem 18. *Pedes* ſuperare. Sed inde ſimul liquet, Hodienum *Elephantos Judicos Africanis* Majores eſſe; quod *Aldrovandus* & *Bochartus* ex antiquis probant Scriptoribus. Nec dubito, quin ex *India* fuerit allata *Coſta Elephanti*, quæ *Anatomico* Academiæ *Leidenſis* Theatro oſtenditur, juxta Exteriorem Flexuram 8 admodum *Pedes* longa, & ubi Spiſſiſſima eſt, circa *Oſſis Sterni* Commiſſuram, *Pedem unum* cum *tribus unciis* Circuitu ſuo implens, a *Theodoro Rickio* in Oratione de *Gigantibus* deſcripta; at Longiſſima *Elephanti Hibernici Coſta* vix 32. *Digitorum* erat; cumque 8. *Pedes* 96. *Digitos* contineant, ſequitur *Elephantum* iſtum cujus *Coſta Lugduni Batavorum* ſervatur, 24. *Pedes* Altitudine æquaſſe; ac Tales profecto ad minimum fuerint *Elephanti Coſrois*, *Perſarum* Regis, ab Anonymo *Arabe* apud *Bochartum* Celebrati: *Nonnulli* duodecim Cubitos *Proceri erant*, *quod valde rarum eſt*; *quia plerique non ſuperant* 7. Cubitos. Si *Cubitus* in ſenſu Vulgari apud nos accipitur, vix *duos Pedes*, *i. e.* 24. *Digitos* æquat, eoque Pacto hi *Elephanti* ejuſdem cum *Leidenſi* fuiſſent Proceritatis: Sed mihi videtur *Coſroes Elephantos* ſuos Dimenſus Antiquis *Perſarum Cubitis*, a *Golio* in Notis ad *Alferganum* p. 74. 75, ex Scriptore *Arabi Geodætico* explicatis, quorum ſinguli *Digitos* 27. comprehendebant. Hoc autem modo quilibet iſtorum *Elephantum* fuiſſet Altitudine 27. *Pedum*. O Stupendam vereque Rariſſimam

&

& Regio ſtabulo dignam illorum Proceritatem! Quâm quicunque conſideravit, *Tonnenſem* noſtrum, pluſquam Dimidia parte Minorem, non adeo mirabitur.

Verum *Unde* tandem in has Terras, Collemque hunc Arenarium pervenit *Elephas* hic, ſolito ſaltem Major? Hæc ſane Quæſtio, *Eruditiſſime Magliabechi*, plurimas Curioſorum Conjecturas peperit, quorum alii a *Romanis* Mercatoribus, alii ab *Attila*, alii a *Carolo Magno*, alii a *Comitibus Glichenſibus*, alii ſuperiori Demum Sæculo, in hanc Regionem Delatum Tumulatumque finxerunt. At præterquam, quod earum ſingulæ ſuis laborant Difficultatibus, quas nunc enarrare ſuperſedeo, omnes certe variis Argumentis ſimul infringi poſſunt. Cujuſmodi eſt, quod *Eboris* uſus Antiquiſſimos credere non permittit, Defoſſo ibi *Elephanto Dentes* Preſtantiſſimos, ac Longiſſimos, haud fuiſſe ademptos; nec tantæ Proceritatis Bellua ex *India* vel *Africa* facile transferri Antiquioribus Temporibus, aut Recentioribus circumduci potuit; & ab aliis obſervatum eſt, non Seniores Ætate, ſed Juniores, in *Europam* deportari; multo minus quiſquam in Mortui *Elephantis* Gratiam tantæ Profunditatis, 24. *Pedum*, foveam fieri curaverit. Maximè autem illis adverſatur ipſa Montis Arenoſi Ratio, quæ diligentius inſpecta nunquam ſe Perfoſſam, & deinceps rurſus Repletam, manifeſtiſſime prodit. Primum ſtratum ſuppeditat Humus Atra 4 *Pedum*; ſuccedit *Glarea* Friabilis *duorum* & *dimidii Pedis*, cujus Medium *Oſteo collæ Tofaceique Lapides duorum Pedum* altitudine explent, ut & ſub ea *dimidii Pedis* ſpatium; ſequitur *Argilla* Arenoſa 6 circiter *Pedum*, in qua iterum *Oſteo colla* duorum *Digitorum*, & infra unius *Pedis* Altitudine occurrit; hanc excipit alterum *Glareæ* ſtratum 6. circiter *Pedum*; eique demum ſubjacet Arena Alba & Pura, cujus Profunditas nondum explorata eſt, quod in ea, vix Tres *Pedes* effoſſa, *Elephanti Sceleton* apparuit. Enim vero ſi unquam perfoſſus injectoque *Elephante* repletus iterum fuiſſet hic Collis, minimè ſtrata ſtratis ordine impoſita; ſed omnia illa Arenarum genera Terræ Nigræ permixta inveniremus; ut quotidie in *Tumulis* Fodiendis fieri ſolet. Multo minus *Tofacei Lapides*, in hanc duritiem coaleſcere, aut *Oſteocollæ* Radices ſuas venaſque, per totum Montem ad ipſum uſque ſuperficiem conſpicuas, ſpargere, tantave Quantitate creſcere, potuiſſent, ut ſtatim in medio Primæ *Glareæ*, quæ Atram Humum proxime contingit, *duos Pedes*, & ſub ea *Dimidium* explerent ſeque inferius in *Argillam* Arenoſam extenderent, ſpatium *duorum Digitorum* & ſub ea *Pedis unius* occupantes. Nihil igitur ſupereſt, præterquam *Univerſale Diluvium*, in quo Periit cum aliis ſui Generis diverſique Animantibus, *Elephas noſter*, Undique immanibus Raptus & Jactatus, Aquis tandem decreſcete incipientibus, fundum petiit; cui Aquæ iſta diverſarum Arenarum Strata induxerunt; iiſque in ſuperficie exſiccatis, *Atra* tandem *Humus* ſenſim accrevit. Quemadmodum enim *Diverſa Arenarum ſtrata* ſatis probant, Collem *Tonnenſem* ex *Diluvio* Originem trahere; ita Altitudo *Terræ Nigræ* idem confirmat. Utrumque breviter oſtendendum mihi video.

Prius faciam præclaris Obſervationibus, a *Nicolao Stenone*, Medico apud Vos quoque Celebri, in Diſſertatione de Capite *Canis Carchariæ* Diſſecto, quam *Myologiæ Specimini* adjecit, ſuppeditatis, quas tamen omnes deſcribere vetat Epiſtolæ Ratio. Loquitur quidem ille præcipuè de *Aquatilium* Animantium

tium *Partibus*, uti ſunt *Oſtreorum Teſtæ* & ſimilia, cum ex Terris Eruuntur: Sed nihil prohibet de *Terreſtrium* quoque Animantium *partibus* eo modo *Effoſſis* idem pronuntiare. Etenim Colli *Tonnenſi* applicari plane poſſunt, quæ *Steno* refert de Terra, unde Corpora hæc Eruuntur. Nam & iſte quibuſdam in locis durior eſt, *Tophumque* & *Oſteocollam* continet, in aliis Mollior, *Argilla* Sabuloque refertus, compoſitus ex *ſtratis* ſibi mutuo impoſitis, & ad Horizontem obliquis. Bene autem Arguit *Steno*; *Terram Mollem ſpectat, cum eo Molliora ſint* Corpora *illa*, (nos *Elephantis noſtri Oſſa ſubaudiamus*) *minuſque contactum ferant, quo Profundius latent*; *tantum abeſt, Producat ea Terra, ut potius eadem deſtruat*: *Nec eſt, quod quis credat, ideo Molliora ea eſſe quia nec dum Perfecta ſunt*; *quæ enim Mollia ſunt, dum Generantur, quodam quaſi Glutine unitas inter ſe Partes continent*, [*ut videre eſt in Recentibus Pinearum & Amygdalorum Corticibus*:] *at Hæc Corpora omni Glutine privata in Pulverem dilabuntur, adeoque Mollities ea deſtructionis, non Productionis, Argumentum videtur.* Quæ in ſequentibus diſputat *Steno*, Terram iſtam non fuiſſe Compactam, cum prædicta Corpora ibi Producta ſunt; eamque Aquis olim non ſolum Tectam, ſed plane Immiſtam, imo pro Aquæ ſedimento ſenſim congeſto, habendum eſſe nullo Negotio ad Collem *Tonnenſem* referri poſſunt: Mihi tantum Excerpere Quædam placet ex *p.* 211. 212 *Quod* Argilla & ſabulum Aquæ *vehementius agitatæ immiſceantur, præceps Torrentium per id Generis Terras prolapſus, & Aquarum a ventis agitatio, notius reddidere, quam quod pluribus exponi mereatur. Nec prolatu difficile eſt, in Aquis Stagnantibus, imo in Limpidiſſimis Aquis*, Sabulum Argillam, & Tophos, *omniſque generis Solida ſæpius deliteſcere.* Quis ergo amplius dubitaverit, Collem *Tonnæ* Arenarium ex *Diluvii Sedimento* ſupereſſe? Plura hanc in rem ex Terræ viſceribus petita Argumenta ſuppeditat *Jacobus Grandius*, Medicus *Venetus*, in Epiſtola de veritate *Diluvii Univerſalis*, & *Teſtaceorum*, quæ procul a *Mari* reperiuntur, Generatione, e quibus tantum Tria priora excerpere juvat. I. *In multis Montibus Altiſſimis, non ſolum* Europæ & Aſiæ, *ſed etiam* Africæ & Americæ, *extant certa veſtigia* Maris, *quod illic* ſedimenta *deponens* ſtrata *produxit uniformia, & Horizonti Parallela, quod nulla Ratio ſuadet contingere potuiſſe, niſi Tempore* Diluvii univerſalis. II. *Idem Teſtantur longiſſimi Terrarum Tractus, obducti variis Collibus* Arenoſis, *ex Alluentis* & *Turbidi Fluidi* ſedimento *ortis, & magnam cum* Maris *Fundo Similitudinem habentes.* III. *Magnæ Aperturæ Montium, Fluminum atque Torrentium Coroſione factæ, oſtendunt diverſa ſolida ex affuſo & ſupernatante Fluido, diverſis modis diverſa Corpora comprehendente atque* Lapideſcente, *producta*; *Itemque varia* Sedimenta *ſibi invicem impoſita, Veris* Conchis, *& aliis* Marinis *abundantia.*

Cæterum, de *Atra Humo* poſt *Diluvium* Terræ adnaſcente, multa Peculiaria obſervavit *Olaus Rudbeckius*, Medicus *Suecus*, Tom. I. *Atlanticæ*. Cap VI. quæ aliis quoque Doctiſſimis probata Viris, nunc Tranſcribere nihil attinent: ad noſtrum tamen *Collem Arenarium* ſi applicare placuerit, ſciendum prius eſt, in illis quidem Sylvæ *Thuringicæ* Montibus, qui Metalla continent, & ex duriſſimo conſtant ſaxo, *Atram* iſtam *Humum* duorum circiter *Pedum* deprehendi, multoque Tenuiorem pro Montium

Declivitate: Aliis vero in locis quatuor *Pedes* æquare vel excedere, cum primum in Vallibus, quæ illam Pluvia ex Montibus ad ſe derivatam exceperunt. Quod uti facit ad *Rudbeckii*, deſiderium, Altitudinem *Nigræ Terræ* in Regionibus *Suecia* Calidioribus, & Pluvia copioſiori irrigatis noſſe cupientis; ita viciſſim Oſtendit, Altitudinem ejus quatuor *Pedum* in Colle *Tonnenſi* à *Diluvii* Tempore haud fruſtra derivari, indeque evinci, nullum *Elephantem* ibi Poſtea ſepultum eſſe. Quid autem vetat, his Exteris Medicis *Germanum* jungere, *Hermannum Conringium*, qui in Conjecturis de Antiquiſſimo Statu *Helmſtadii* & Viciniæ, Noſtras quoque Regionis *Diluvio* inundatas probaturus, Triplici potiſſimum Argumentorum genere pugnat, ex *Marinis Conchyliis*, *Oſſibus Belluarum*, & *Arboribus* ſive Integris ſive Partibus, quæ cum in Altiſſimis Montium jugis tum Sub Terra locis Profundiſſimis reperiuntur, petito: nec ea inter præterit *Sudem in Sepis uſum paratam*, *Cornu item uri*, *quæ* Thuringi *profundiſſimis Saxorum Cavernis repererunt*, quorum iſtam *Salze*, quæ vix unius Horæ ſpatio *Tonna* diſtat hoc in Monte *Seebergenſi*, *Gothæ* Noſtræ Vicino (unde etiam *Conchylia* elegantiſſima Eruuntur) extitiſſe memorat *Albinus* in *Miſnenſium Montanorum Chronico* Tit. 22. n. 7. quibus addi forſan merentur *Arborum Folia*, *Lignorum Faſciculi*, & *Spicæ Culmis Adherentes*, quæ omnia *Petrefacta* in *Lapidicina Tonnenſi*, non admodum procul à Monte noſtro, Reperta ſunt. Singularis quoque eſt *Conringii* Obſervatio, his Verbis. p. 37. expreſſa: *Sunt porro* Arbores *illæ fere omnes uno quaſi eodemque collocatæ Situ*, *Radice nempe inter Septentrionem & Occaſum*, *Cacumine inter Orientem & Meridiem porrectis cujus Cauſam non profecto ulla vere ſimilitudine dixeris* Jocantem Naturam. *At Proſtratas* Arbores *à Paludoſa Terra*, per Oceani Septentrionalis Cæcia *aut* Cauro *Ventis agitati ſuperjecta*, *id ſaltem quam ſimillimum eſt Vero*: *Præſertim quum ex illa Cæli Plaga & illis Ventis Sævientibus*, *hodieque omni* Germanicæ Maritimæ *Oræ pericula Inundationum plerumque creari ſoleant*. Novum hinc Meæ Sententiæ accedit Argumentum, quoniam *Elephas noſter Cornua* ſua verſus *Ortum* ac *Septentrionem* protendebat; & quanquam id paulo diverſum videtur a *Conringiano*, Notandum tamen eſt, tantum *Belluam* Mari Abreptam ſeſe Varie Moviſſe, *Arbores* autem Eodem, quo proſternuntur, Situ obrutas jacere. Cæterum *Elephantem* Undis immanibus agitatum non mirum eſt, Situm plane Extraordinarium Violentumque tandem acquiſiviſſe, ejuſque membra Putrefacta latius extenſa: nec alia forſan de Cauſa *Dentes Exerti* ſive *Cornua* Introrſum incurvata fuerunt, quanquam eorum ſitus in Delineatione Capitis *Hibernici* apud *Moulinum* ſimilis fere deprehendirur; accuratius procul dubio expreſſus, niſi pleraque eorum pars Aduſta fuiſſet; ut proinde potius à Morte vel Putredine, quam Undis Fatalibus id derivandum videatur.

Mineral Maps; *by Dr.* M. Liſter. n. 164. p. 739.

XXXVIII. We ſhall then be better able to judge of the Make of the Earth and of many Phænomena belonging thereto, when we have well and duly Examined it, as far as human art can poſſibly Reach, beginning from the *Outſide* downwards. For this purpoſe it were adviſable, that a *Soil* or *Mineral Map*, as I may call it, were Deviſed. It might be Diſtinguiſh'd into *Countries*, with the *Rivers* and ſome of the noted *Towns* put in. The *Soil* might either

be

be *Coloured*, or otherwiſe diſtinguiſhed by Variety of *Lines* or *Etchings*; but the great Care muſt be, very exactly to Note upon the *Map* where ſuch and ſuch *Soils* are Bounded. As for Example in *Yorkſhire*. 1. The *Woolds*; *Chalk*, *Flint* and *Pyrites*, &c. 2. *Blackmoore*; *Moores*, *Sandſtone*, &c. 3. *Holderneſs*; *Boggy*, *Turf*, *Clay*, *Sand*, &c. 4. *Weſtern Mountains*; *Moores*, *Sandſtone*, *Coal*, *Iron-ſtone*, *Lead-Ore*, *Sand*, *Clay*, *&c.* *Nottinghamſhire*; moſtly *Gravel*, *Pebble*, *Clay*, *Sand-ſtone*, *Hall-Playſter*, *or Gypſum*, &c. Now if it were Noted, how far theſe Extended, and the limits of each *Soil* appeared upon a *Map*, ſomething more might be Comprehended from the whole, and from every part, than I can poſſibly foreſee; which would make ſuch a Labour very well worth the pains. For I am of the Opinion, ſuch *Upper Soils*, if Natural, infallibly produce ſuch *Under Minerals*, and for the moſt part in ſuch Order.

Schemes of *Sands*, *&c.* Clays; *by Dr.* Liſter. n. 164. p. 740.

XXXIX. I have ſome Reaſon to think that *Sand* was once the moſt *Exteriour* and General *Cover* of the Surface of the whole Earth: Becauſe all our *Northern Mountains* are more or leſs *Covered* with it at this Day, and the Higher the Mountains, ſtill the more, and the Courſer the *Sand*: Becauſe the Rivers ariſing in the *Mountains* do yet daily bring it down in great Quantities; and that it has been ſo in all probability, in all Ages, ſince the firſt Rains fell upon the Face of the Earth, ſeems to me to be Truth like, in that the Sea ſhores, or Mouths of Rivers, are uſually *Barr'd* with it; Beſides the *Sandy* Sea grounds in moſt places of the Sea; and which ſeems a clear Evidence for the length of Time) for that the Low-ground near theſe Rivers (which have been in all Ages upon Record, *Moſſes*) if you pierce ſo Deep into them, as to diſcover their bottom, you meet with this *Mountain Sand* in great Quantities, and in ſome places a *Moſs* under that, and the ſame *Sand bed* under that. Now if we conſider how long theſe *Moſſes* or *Turf* is in growing, it being moſtly the *Leaves* and *Roots* of *Plants*, we muſt allow very many Ages for this purpoſe And although *Herodotus*, one of the moſt Ancient Hiſtorians that are, boldly conjectures that the *Nyle* in *Egypt*, long before our times, would be Dammed up and Uſeleſs by the great Plenty of *Mud* yearly brought down that vaſt River; yet it does not appear, that the Country is much Different from what it was in his Time; ſo that the *Sand* and *Mud* is ſtill carried to *Sea*.

Another Argument of the *Sand*'s being the *Univerſal Cover* of the face of the Earth is, from the great *Hardneſs*, and conſequently the *Durableneſs*, and unalterable Quality of this *Mineral*, above any other in Nature. For though many things are Called *Sand*, from the ſmallneſs and little *Coheſion*, or Dryneſs of the Grains, yet this kind of *Mountain-Sand* above all others, keeps its Natural and Original Magnitude; and is not made (as moſt *Sand* is) by the Attrition or Wearing of one Particle of *Stone* againſt another, but is of a conſtant and durable Figure; and therefore, I ſay, it ſeems to me for this Reaſon, to be the moſt fit for an *Outſide* or Cover to the Globe of the Earth.

It may be *Objected*, that the Uppermoſt Beds of *Stone* on the *High-Woolds* all over *England*, are ſoft *Chalk*, and on the ſmooth Surface no Appearance of *Sand* This indeed is in part granted; but that there is no where any *Sand* upon the *Chalk Mountains*, is not true; for to inſtance in thoſe Inland *Sand Hills* above *Bulloigne* in *Picardy*, which *Sand* is the very ſame with that on the *Sea-ſhore* at *Calais*, and although this is not *England*, yet the *Sea* hath but accidentally Divided us For from *Dunſtable* in *England*, even as far as the Walls of *Paris* by *Calais*, is, as it were a continued *Woolds* of *Chalk* and *Flint*. What difference there is betwixt the *Woolds Mountain ſand*, and that of the *Northern Mountains*, will beſt appear in the *Table*. Now the Nakedneſs of the *Woolds* is from the ſmallneſs of its *Sand*, which readily yielded not only to the *Rain* that fell, but to the *Wind* alſo. Which is Evident from that vaſt Tract of *Sandy Hills*, which bound the Coaſts of *France*, *Flanders*, and *Holland*, and which have made their Coaſt ſo *Shallow* in reſpect of ours, as being in great part blown off the *Yorkſhire*, *Lincolnſhire*, *Suffolk*, or *Eſſex*, and *Kentiſh Woolds*, and Wrapt up upon their Coaſts; and the Reaſon of this is partly from the more conſtant *Weſterly Winds* blowing over from our Coaſts; and alſo from the *Meeting* of the 2 *Tides*, *viz.* That of the *Channel*, and that other of *North Flood* upon their Coaſts.

I am very well aware, thar the finding of *Cockles* or *Shells*, as moſt Writers are pleaſed to Call them, upon *Mountains*, and *Sand* alſo there, is by the ſame *Herodotus* uſed as an Argument of a great *Deluge*, or Inundation of Waters; but as I have elſewhere, I think, Demonſtrated, that the *Rock Cochlites* are no *Shells*, ſo neither can I grant that the *Sand* was Adventitious to the *Mountains*, but Naturally Originated there; for that it is there plainly to be found, ſome Looſe, and the reſt in Beds, yet Unlooſened, as I could name very many Places; for inſtance, on *Silden* and *Thorp Fells* in *Craven*, this *Mountain-Sand* is a White and Tranſparent *Pebble*; and as ſome of it is Small, and eaſily ſwept and blown away, ſo is there much of it upon the *High Mountains* mixt with White *Pebbles* of Greater ſize.

'Tis the Character of this *Sand*, not to *Yield to Fire*, as *Flint* will do; and though it Agree with *that* and ſome other *Metals* to *ſtrike Fire* from *Steel*, yet it does not *Calcine*, as *Flint* will be brought to do. And therefore this *Sand* is the True *Tarſo* of the *Italian Mountains*, of which the Fine *Venetian Glaſs* is made; and for this Reaſon the *Flint Glaſſes* were here in *England* ill compounded, the Foreigners miſtaking the Materials, which yet our Country affords in Plenty, all over the *Northern*, and (I doubt not) the *Weſtern Mountains* too: I have ſeen from the *Scotch Mountains* very Excellent and Large.

A Table of Sand (drawn up about the Year 1673.) Such chiefly as I have found in the Northern Parts of England.

- *Sharp*, or *Rag-Sand*, compoſed of ſmall Tranſparent *Pebbles*, naturally found upon the *Mountains*, not *Calcinable*.
- *Soft*, or *Smooth* with *Flat* Particles.
  - *Fine*
    - *White*
      - *Stitneham-Moor*, in the Road waſh'd up very *White Pebble*.
      - *Flamborough Head*, of which the Light Houſe there is cemented.
      - *Calice Sand*; burns *Reddiſh*, but falls not in Water.
    - *Fine Grey*
      - *Seaton-Banks* near *Hartlepool*, or the *Tees Mouth*; *Eſcrick* in the Gravel Pit there, A Vein of exceeding *fine Sand*.
    - *Reddiſh*
      - The *Pillow Sand* in the *Baltick*.
    - *Brown*
      - In a Spring at *Heſlington*.
      - The *Sand* at the *Bath* in *Somerſetſhire*.
  - *Sand*
    - *Acome* near *York*; Drifted Sand.
    - *Greiſly*
      - *Hutton Moor* Waſht.
      - *Throp* Fells.
    - *Courſe*
      - *Owze* at *York*.
      - *Nid* at *Mountain*.
      - Dug up at *Rawcliff* near *Snath*.
      - *Wharfe* at *Ickly* and *Denton*.
      - *Air* at *Carleton* in *Craven*.
      - *Eure* at *Bolton*.
    - *Brown*
      - *Gauton*.
      - *Santon* in *Lincolnſhire*.
      - *Bromeby Common*.
      - *Skipwith Common*.
  - From *Lime-ſtone* with *Mica* of *Glit-tering* Particles.
    - At —— in *Yorkſhire*.
    - A Vein at *Oſwell-Beacon* in *Lincolnſh*.

Of

Of *Westmorland.*
- *Silver-like.*
  - *Sea-Sand* about the *Scilly-Islands.*
  - In *Cleveland* and about *Scarborough.*
  - *Ouze* Dust, or Sediment, at *Rawcliff.*
  - A Vein of *Mica* in *Heslington* Gravel Pit.
  - *Mica Argentea* in *Red Sand Rock* near *Rippon* plentifully.
- *Gold-like.*
  - *Mica Aurea* of *Cleveland.*

Clay seems to be another *Coat* of the Terrestrial Globe in the more Depressed and Hollow Parts thereof. The mixture of *Sand* and *Clay* is not unusually called *Earth*: Yet this Term being too large it will be convenient, as I think, to Limit it to such a Mixture as we usually find upon the Surface of the Ground, which hath ever in it, besides such *Sands* and *Clays*, as either the *Soil* naturally Produces, or have by *Floods* and *Winds*, or other Accidents, been brought thither, a great part of the Rotten parts of *Plants* and *Animals*; And in this Sense *Turf* is *Earth*, which is mostly where the *Erica* or *Heath* grows, because 'tis made up of the Diciduous Leaves of that *Plant*, which being by the Current of Showers brought together, make up the *Moors*, *Mosses*, and *Fens*, and in the *Mountains*, in Hollow Basons or Depressures without Vent, *Mosses* of incredible Depth; 1. or 2. Fathom ordinarily in the same kind of Black Earth, called *Peat* or *Turff.*

A Table of Clays.

- *Pure*, that is, such as is *Soft* like butter to the Teeth, and has little or no *Greetiness* in it.
- *Greasy*, to be Reckoned amongst the *Medicinal Earths*, or *Terræ Sigillatæ.*
  - 1. *Fuller's Earth.*
  - *Clay*
    - *Yellowish*
      - At *Brickhill* in *Northamptonshire.*
      - At ..... under the *Yorkshire-Woolds.*
    - *Brown*, about *Halifax.*
    - *White*, in *Darbyshire Lead-Mines.*
  - 2. *Boli*
    - In *Cleveland.*
    - At *Linton* upon *Wharfe.*
  - 3. *Pale Yellow*, in the *Marle-Pit* at *Ripley.*
  - 4. *Cow-shot Clay*, or the *Soap Scale* lying in *Coal-Mines.*
  - 5. A *Dark-Blew Clay*, or *Marle* at *Tolthrop.*

Harsh

Clay { *Harsh* and *Dusty* when Dry.
- 6. *Creta* properly so called, or the *Milk White Clay* of the *Isle of Wight*.
- 7. The Potter's *Pale Yellow Clay* of *Wakefield-Moor*.
- 8. The *Blew Clay* of *Billingbrook Pottery* in *Lincolnshire*.
- 9. A *Blew Clay* in *Bugthorp Beck*, in which the *Astroites* are found.
- 10. *Yellow Clay* in the Seams of the *Red Sand Rock* at *Bilbro*.
- 11. *Fine Red Clay* in *Red Sand Rock* at *Bilbro* and *Rippon*.
- 12. A Soft *Chalky Blew Clay* } at *Buttercrain*.
- 13. A Soft *Chalky Red Clay* }

Stony when Dry.
- 14. A *Red-Stone Clay*. } In the Banks of *Whitear-*
- 15. A *Blew-Stone Clay*. } *Beck*, near *Leppington*: and at *Housam* in the *Milsear*.
- 16. *Clunch*, a *White Stone Clay* in *Cambridgeshire*.

With *Round Sand* or *Pebble*.

Mixt {
- 17. The *Yellow Loame* of *Skipwith Moor* in *Yorkshire*.
- 18. A *Red Sandy Clay* in the right hand bank of the Road beyond *Collingham* near the *Lime Kilns* going to ——
- 19. A *Red Sandy Clay* in the *Red-Sand Rock* near *Rippon*.

With *Flat* or *Thin Sand*, Glittering with *Mica*.
- 20. *Crouch White Clay* in *Derbyshire*, of which the Glass-Pots are made at *Nottingham*.
- 21. *Grey* or *Blewish Tobacco Pipe Clay* at *Hallifax*,
- 22. A *Red Clay* in the *Red Sand Rock* at *Rotherham*.

XL. These Wonderful *Sands* have not yet exceeded one *Century*, since they first broke Prison. Their *Original* is in a Warren in *Laken heath* (a Town belonging to the *Dean* and *Chapter* of *Ely*, distant not above 5 *Miles*, and lying *Southwest and by West* of this place); where some Great *Sand Hills*, (whereof there is still a Remainder) having the Superficies, or *Sword* of the *Ground* (as we call it) Broken by the Impetuous *Southwest Winds*, Blew upon some of the Adjacent grounds; which being much of the Same Nature, and having nothing but a Thin Crust of Barren Earth to Secure its Good-Behaviour, was soon Rotted and Dissolved by the Other *Sand*, and thereby easily fitted to Increase the Mass, and to bear it company in this strange Progress.

A Sand-flood at Downham in Suffolk; by Mr. Tho. Wright, n. 37. p. 722.

At the First *Eruption*, I suppose the whole Magazin of *Sand* could not Cover above 8 or 10 *Acres* of ground, which Increased into 1000 *Acres*, before the *Sand* had Travail'd 4 *Miles* from its aboad. All the opposition it met with

in

in its Journey hither, was from one Farm-Houſe, which ſtood within a *Mile* and a *half* from its firſt *Source*. This the Owner at firſt endeavoured to have Secured by Force and building of Bulworks againſt the Aſſaults thereof; but this Wing'd Enemy was not to be ſo Oppoſed: Which, after ſome Diſpute, the Owner perceiving, did not only Slight the former Works, but all his Fences, and what elſe might Obſtruct the Paſſage of this unwelcome Gueſt, and in 4 *Years* Effected that by a Compliance and Submiſſion, which could never have been done upon other Terms; In which he was ſo Succeſsful, as that there is ſcarce any Foot Steps left of this miſchievous Enemy.

'Tis between 30 and 40 *Years*, ſince it firſt Reach'd the Bounds of this Town; where it Continued for 10 or 12 *Years* in the Out Skirts, without doing any Conſiderab'e Miſchief to the ſame. The Reaſon of which I gueſs to be, that it's Current was then Down-Hill, which Sheltered it from thoſe Winds, that gave it motion. But that Valley being once Paſt, it went above a *mile* (Up Hill) in 2 *Months* time, and Over-ran 200. *Acres* of very good Corn that ſame Year. 'Tis now got into the Body of this little Town, where it hath Buried and Deſtroyed divers Tenements and other Houſes, and has inforced us to Preſerve the Remainder at a greater Charge than they are Worth. Which doubtleſs had alſo Periſhed, had not my Affection to this Poor Dwelling obliged me to Preſerve it at a greater Expence than it was Built. I have at laſt given it ſome Check; for by Stopping of it 4 or 5 *Years* (what I could) with *Furze* hedges ſet upon one another as faſt as the *Sand* Levell'd them (by which I have Raiſed *Sand-Banks* near 20. *Yards* high) I brought it into the Circuit of about 8 or 10 *Acres*: And then in *One Year* by laying ſome Hundred Loads of Muck and good Earth upon it, I have again Reduced it to *Terra Firma*, have Cleared all my Walls, and by the aſſiſtance and kindneſs of my Neighbours (who Helped me away with above 1500 Loads in one Month) Cut a Paſſage to my Houſe through the Main body thereof.

At the other End of the Town divers Dwellings are Buried or Overthrown, and our Paſtures and Meadows (which were very Conſiderable to ſo Small a Town, both for Quantity and Quality) Over run and Deſtroyed: And the Branch of the River *Ouſe* upon which we Border, (being better known by the Name of *Thetford* or *Brandon River*, between which Two Towns we Lye,) for 3 *Miles* together is ſo Filled with *Sand*, that now a Veſſel with two Load Weight Paſſeth with as much Difficulty as before with 10. But had not the Stream interpoſed, to Stop its Paſſage into *Northfolk*, doubtleſs a good part of that Country had ere now been left a Deſolate Trophy of this Conquering Enemy. For according to the proportion of its Increaſe in theſe 5 *Miles*, which was from 10 *acres* to 1500 or 2000; in 10 *Miles* more of the Same *Soil* it would have been Swell'd to a great Vaſtneſs.

It is Obſervable that the Situation of the Country, in which this Troubleſome Gueſt firſt took his *Riſe* lyes *E. N. E.* off a part of the *Great Level* of the *Fenns*, and is thereby fully Expoſed to the Rage of thoſe Impetuous *Blaſts* we

we yearly Receive out of the Oppoſite Quarter: Which I ſuppoſe acquire more than an Ordinary Vigour by the *Winds* paſſing through ſo long a Tract, without any Check. Another thing which Contributes to it, is, the Extream *Sandineſs* of the *Soyl*, the *Levity* of which, I believe gave occaſion to that Landſtory of the *Actions* that uſe to be brought in *Northfolk* for *Grounds blown out of the Owners Poſſeſſion.*

XLI. Beſides the *Bolus Armenus*, and the *Terra Sileſiaca*, there is an *Earth* found in *Hungary* about the River *Tockay*, thence called *Bolus Tockavienſis*, having as good Effects in *Phyſick* as either of the former.

An Hungarian Bolus; *by* .... n. 1. p. 11.

XLII. *Soap Earth* is found only in two places near *Duraclea*, a large open Village, about 6 *Leagues* to the Eſtward of *Smyrna*; and in a very Flat Plain, about a *League* Weſtward of the River *Hermus* and ſeveral *Leagues* from the Sea. 'Tis a Fine *Soap*, and at the firſt gathering *Whitiſh Earth*, which Boileth or ſhoots up out of the *Earth*. 'Tis gathered always before *Sun-riſe*, and in Mornings when there falls no *Dew*, ſo that a Stock muſt be laid up for the whole Year in the Summer Months. It comes up in ſome places an *Inch* or two above the Surface of the *Ground*. But the Sun Riſing upon it, makes it to Fall down again. Every Morning there is a New Crop, tho' all be taken away which the preceeding Day afforded. The *Earth* Producing it lies low in both places, and is in the Winter *Waſhy*; 'tis Cover'd, tho' but thinly, with Graſs.

The Soap-Earth *from* Smyrna; *by Dr.* Edw. Smith. n. 220. p. 228.

Three Hundred *Drams* of this *Earth* put into a *Retort in Balneo Arenæ* for 12 Hours *cum Igne Violento*, gave between 5 or 6 *Ounces* of an *Inſipid Phlegma*, the Smell only ſuch as Proceeds in ſuch Operations from the Fire.

Finding therefore no *Volatile Salt*, as what muſt have come over by the foregoing Experiment; 200 *Drams* Calcin'd at a *Bagnio Fire*, in a *German Crucible*, were Diſſolved in *Water*. The Compoſition of *Earth* and *Water*, Boil'd into a *Lixivium*, made 500 *Drams*.

It was Boil'd for 3 Hours, ſtill Scuming off the Froth, then *Filtrated*, after *Evaporated* over a Gentle Fire, it was kept to *Chryſtalize*, and appear'd of a *Fix'd Salt*.

At the *Soap Houſes* they mix ¾ of *Earth* with ¼ of *Lime* and Diſſolve the Compoſition in Boyling Water; where ſtirring it often with a Stick there Floats a Top a thick *Browniſh* Subſtance, which *Scumming* off they preſerve in Baſons a part, and this *Scum* is much Richer than the *Liquor* underneath: yet both are uſed in making the *Soap*. Into a large Copper Caldron they put 50 *Kintals* of *Oyl*, applying a very Hot Fire, which Burns continually until the *Soap* is made. When the *Oyl* has Boil'd, they begin to throw in of the *Scum*, and ſometimes of the *Liquor* from which the *Scum* was taken. They often Repeat this Throwing in of the *Scum* and *Liquor* for 13 or 14 *Days*, in which time the *Soap* is uſually Perfected. The *Browniſh Scum*, and what is uſeful of the *Liquor*, incorporating with the *Oyl*, what is uſeleſs Sinks to the Bottom of the Caldron, where it is let out to make Room for Throwing in

more. The *Water* thus let out is again Thrown upon a new Compoſition of *Earth* and *Lime*, but when the *Liquor* becomes wholly *Inſipid*, 'tis then judged to be Exhauſted. After 13 or 14 *Days* when the *Soap* is Finiſhed, 'tis laded out of the Boiler, and laid upon a Lime Floor to Dry.

They proportion two *Load* of *Earth* of 5 *Kintals* each, to 50 *Kintals* of *Oyl*; the Produce is between 70 and 80 *Kintals* of *Soap*.

The *Earth* is bought at a Dollar a *Load*, and the *Soap* when this Account was made, at $6\frac{3}{4}$ a *Kintal*. There is employ'd in making *Soap Yearly* at *Smyrna* 1000 *Kintals* of *Oyl*.

Bringing *Soap Earth* employs 1000, or 1500, Camels *Dayly* for 8 *Months*; the 4 *Summer Months* being too Hot for Camels to Travel.

An ordinary *Soap Houſe* produces 1000 *Dollars* a *Year* cle r Profit, *communibus Annis*.

The Uſe of Turkiſh Ruſma; *by Mr.* Smith, n. 243. p. 295.

XLIII. This *Black Earth*, which is call'd *Ruſma*, and ſeems as if it were Burnt, muſt be Beaten in an Iron or Marble Mortar to a fine Powder, and Sifted diligently; when you uſe it take one part of the ſaid Powder, and two parts of unſlacked Lime, put theſe mix'd together into a Linnen Rag, which Infuſe in Warm Water the Space of a *Quarter* of an *Hour*, or till it becomes of a Black Colour, then apply it to the Place from whence you would Take the *Hair*; as ſoon as the *Hair* begins to be looſe, the Part muſt be Waſhed with *Warm Water* and *Soap*.

Coal-Mines *in* Somerſetſhire; *by Mr.* J. Beaumont. *Ph. Coll.* n. 1. p. 6.

XLIV. Within 5 Miles Northward of *Stony Eaſton*, there are 6 diſtinct *Coal-Works*. The Chiefeſt Obſervables I met with in them are.

1. The *Branched Clift*, which uſually lies over the *Coal*, and is all wrought with the *Repreſentations* of Sundry Sorts of *Herbs*.

2. A *Clift* all Intervoven with *Arboreſcent Marchaſites*, which commonly lies Over the Former, and is call'd by our *Colliers* the *Thorny Clift*.

3. We here Obſerve, that ſome *Coal Veins* are much more Tinged with *Sulphur* than others; a *Vein* being wrought in one of theſe Works ſome Years ſince, which received ſuch a Reſplendency from its *Sulphury* Tincture, that in all its Joynts it ſeem'd as though it were Cover'd with *Leaf Gold*, and hence by the Colliers it was call'd the *Peacock Vein*.

4. I may here take Notice that about 4 Years ſince in one of theſe Works was found about 2 or 300 Weight of very good *Lead Ore* growing to a *Vein* of *Coal*, the Ore being Tinged ſomewhat Yellow by the *Sulphur*: We look upon this as a Rarity with us, None ever having been found in a *Coal Pit* before; the *Sulphurous* Spirit being there generally too ſtrong for the *Generation* of that *Metal*.

A Subterraneous Fungus; *by Mr.* Jeſſop. n. 100. p. 6179.

XLV. 1. The *Fungus Subterraneus* I ſent you a large Quantity of, was gotten in a Rocky Lime-ſtone Ground, on a Common about two Miles diſtant from *Caſtleton* in the *Peak* of *Darbyſhire*, 15 or 16 Yards Deep, in the *Old man* (as they call a Mine formerly wrought and Stopt up) cover'd with *Earth*, and

that

that had either Fallen or was Thrown in. There is no *Coal-Bed*, that is known of, within 5 or 6 *Miles* of the Place.

2. The Pieces of this *Fungus* which I received, are much like, *Peats*, or *Turff*, cut up in the *High Moors*, both in the Sooty Colour and Inward ſubſtance; This only is more Clammy and Tough, and Dries not. And ſome of this *Fungous Subſtance* is very Soft and like Gelly, In and about the more Solid Pieces, (of which I have ſome, half a Foot ſquare,) are many big Lumps of a *Bituminous Subſtance*. This *Bitumen* is very Inflamable like Roſin; it is very Light, it breaks Firm, and Shines like good *Aloes*; and for Colour it is not much unlike it, Save that it is more Dark Colour'd and Purpliſh; yet there is much of it of a Dark Green Colour. We Diſtill'd a parcel of it, which Yielded us an *Acidulous Limpid Water*; then a *White Liquor*, which was, I gueſs, from ſome of the *Oyly* parts Precipitate; And in the laſt place, a Copious *Yellow Oil*, not unlike that of *Succinum*, or *Pitch*. In the Neck of the *Retort* we could diſcern no *Volatile Salt*, as in the like Proceſs upon *Amber*. I have not Read of any ſuch *Fungous Earth*, in which *Bitumen* naturally Grows and Adheres: And the finding of it in an *Old Mine* doth much favour an Opinion of its being a *Vegetable Subſtance:* either the very Subſtance of the Props of *Wood*, they make uſe of in Lining and Supporting the *Grooves*, thus Altered, or certain *Fungus's* Growing out of them. That *Birch*, (of which there is great Plenty, and hath been vaſt Woods, all theſe Mountainous Parts of *England* over) will yield a *Bitumen*, as *Limpid* as the Sap is which runs from it by tapping, if we now had the Skill to extract it, *Pliny* is very expreſs *l.* 16. *c.* 18. *Bitumen ex Betula Galli excoquunt*: And moreover it is certain, that much of that *Wood*, if not all, which is Dugg up in the *High Moors* of *Craven*, and which the People there call and uſe for *Candle Wood*, is no other than *Birch*, as it appears from the Grain and Bark; and yet this Wood Kindleth, Flames, and Exudates a *Roſin*, which makes many pronounce it very *Firr Wood*. Whatever this *Bitumen* is, which this *Fungus Subterraneus* Yields, it much Differs from the *Aſphaltum* of the Shops.

By Dr. Liſter. *ib.* p. 6180.

XLVI. Mr. *Jeſſop* ſends me word, that Capt. *Wain* has given him a *White Liquor* reſembling Cream both in Colour and Conſiſtence, which he found in great Quantities at the Bottom of a *Coal Pit* 49. Yards Deep. And Mr. *Geo. Planton* Writes from *Sheriff-Hales* in *Shropſhire*, that in the *Iron-Mines*, eſpecially that which the Country People there call the *White-Mine*, which yields the beſt *Iron-Stone*, the Miners do commonly, upon the breaking of a Stone, meet with a great Quantity of *Whitiſh Milky* Liquor, incloſed in the Center of it; they ſometimes find a *Hogſhead* contained in one Cavity. 'Tis in Taſte Sweetiſh; only it hath a *Vitriolick* and Iron-like Twang with it.

A Mineral Juice; *by Dr.* Liſter. *ib. p.* 6181.

XLVII. In *Broſely*, *Bently*, *Pitchford*, and other Places adjacent in *Shropſhire*, there lies over moſt of the *Coal-Pits* or Mines, a *Stratum* or Layer of a *Blackiſh*

A Blackiſh Stone in Shropſhire, *yielding* Pitch, Tar, *and* Oyl; *by Mr.* Martin Ele. n. 28. p. 5442.

Blackiſh Rock, or *Stone*, of ſome Thickneſs, which is Porous, and Contains in it great Quantities of *Bituminous* Matter.

This *Stone* being brought to the Work Houſe is Ground ſmall by Horſe Mills, ſuch as are uſed for grinding Flints to make Glaſs of; the Powder is thrown into great Coppers of Water, where by Boiling, the *Bituminous* Matter is Separated from the *Stony* or Gritty, this laſt ſinking to the bottom, the other Swimming at the top of the Water.

This *Bituminous* Subſtance being Gathered together and Evaporated, comes to the Conſiſtence of *Pitch*, and with the help of an *Oil* Diſtill'd from the ſame *Stone*, and Mixed with the *Pitch* comes to be Thinner, or like *Tarr*; the Uſes of both which Materials, either for Shipping or otherwiſe, Theſe Subſtances are ſaid to ſupply, nay even go Beyond. And this has been Tried on ſeveral Boats this 3 or 4 Years paſt, and does not Crack as the ordinary *Pitch* or *Tarr*, but always keeps Black and Soft, and therefore is propoſed to hinder the *Worm* from Getting into the Ships *Pitched* with it.

There is likewiſe Diſtill'd from this *Stone*, an *Oil* which may be uſed for *Oil* of *Petre*, or *Turpentine*, and has been Tried by divers Perſons in *Aches* or *Pains*.

A Mineral Balſom *in* Alſatia; *by* .... n. 8. p. 135.

XLVIII In the Valley call'd *Liberthal*, near *Geesbach*, (an ancient Mine work in *Alſatia*) there runs out of a Cavern a Foul, Fattiſh, *Oyly* Liquor: Which affords an excellent *Balſom*, by taking a Quantity of it, and putting it in an Earthen Pot well Luted, that no Steam may Exhale; and then with a Gentle Fire at firſt, but a Stronger afterwards, Boiling it for 3 *hours* together, in which ſpace it will boil in a *4th* part, and an Earthen matter, like *Pitch*, will ſettle it ſelf at the Bottom; but on the Top thereof, when cold, there will ſwim a Fatty ſubſtance, like *Line Oyl*, Limpid and ſomewhat Yellowiſh, which is to be Decanted from the Thick Sediment, and then gently Diſtilled in an *Alembick* in *Arena*; by which means there will come over two Differing Liquors, one *Phlegmatick* the other *Oyly*, which Latter ſwimming on the *Phlegm*, is to be ſevered from it. The *Phlegm* is uſed as an excellent Reſiſter and curer of all the *Putrefactions* of the *Lungs* and *Liver*, and it Heals all *Foul Wounds* and *Ulcers*. The *Oily* part, being Diluted with double its quantity of Diſtilled Vinegar, and brought 3 times over the *Helm*, yields a rare *Balſom* againſt all inward and Outward Corruptions, ſtinking *Ulcers*, Hereditary *Scurfs* and *Scabs*. 'Tis alſo much uſed againſt *Apoplexies*, *Palſies*, *Conſumptions*, *Giddineſſes*, and *Head aches*. Inwardly they take it with *Succory Water* againſt all *Corruptions* of the *Lungs*. It is a kind of *Petroleum*, and contains no other Mineral Juice but that of *Sulphur*, which ſeems to be thus Diſtilled by Nature under Ground; the Diſtillation of an *Oyl* out of *Sulphur* by Art, not being ſo eaſy to perform.

A Mineral Balſom *in* Italy; *by* S. M. Antonio Caſtagna. n. 79. p. 3059.

XLIX. In the Territory of *Bergamo*, Sig. *M. Ant. Caſtagna*, upon the Confines of his Juriſdiction, lighted accidentally upon a not ordinary ſweet *Balſamick Scent*, which directed him to a Rocky Hill, where he found the Stones Harbour'd that Fragrancy, which was ſo ſtrong, and by Trials found ſo Friendly to the

Uterus

Uterus, that being applyed they did in a very ſhort time Cure it of any Evil, 'tis ſubject to. Encouraged hereby, he made his Workmen Dig into the very Bowels of the Hill, where he diſcovered Holes in ſome *Stones*, as if Excavated by Art, of a Greeniſh Colour, in which he found, as Diſtilled by Nature and kept in Veſſels, that *Liquor* and *Balſom*, which proved the Source of that *Scent* which was *Limpid* and of a *White* Colour, like the White of an Egg, but ſomewhat *Oleaginous*, Floating upon all ſorts of Liquors like *Oyl*. Beſides, he met in the ſame Cavities ſome ſmall Grains Concreted of the ſame Liquor, reſembling that which they call *White Amber*; which being Chymically Diſtill'd, had the ſame *Odour* with the *Balſom*.

I find that *Oſteocolla* grows in a Sandy, yet not Gravelly Soil, and not at all that (I know) in any Rich or Clayie Ground. It Shoots down 2 Mens depth under ground; the Branches moſt commonly growing ſtraight up, yet ſometimes alſo they Spread ſide ways. The Branches are ſome of them Thicker, ſome Slenderer, and the farther they are Diſtant from the Common Stem, the Thinner they are; the Stalk being Thickeſt of all, uſually equalling the Thickneſs of an ordinary Arm or Legg, and the Branches the Thickneſs of ones little Finger.

Oſteocolla *about* Franckfort *on the* Oder; *by* John Chriſtoph. Beckman. n. 39. p. 771.

Upon the Sand which is here every where Yellowiſh, there appears a Whitiſh, Fatty Sand, which if it be Dug into hath under it a Dark Fatty, and how Hot and Dry ſoever the other Sand be, a ſomewhat Moiſt and Putrid Matter, like Rotten Wood; which Matter Spreads it ſelf here and there in the Earth, juſt as the *Oſteocolla* it ſelf doth, and is call'd by thoſe whom I have employed to look for it, the *Flower* of this Subſtance. The *Oſteocolla* being thus Found, is altogether ſoft yet rather Friable then Ductil: Wherefore if one hath the Curioſity of getting out of the ground a Whole Piece of it with its Branches, he muſt very carefully remove the Sand every way from it, and then let it lye ſo a while; its Quality being, that Remaining expoſed to the Sun for *half* an *hour* or ſomewhat longer, it grows to that Hardneſs as 'tis found in the Shops.

It ſeems to be a kind of *Marle*, or to have great Affinity with it; of which we here have alſo great Store, yet not near thoſe Places where I have found *Oſteocolla*. It requireth alſo time to come to Maturity, which appears from hence, that in the very ſame Place, where I digg'd ſome of it Laſt Year, I this Year found Other, yet with this Difference, that thoſe grew Hard, after the manner before deſcribed, but theſe remain ſtill ſoft and Friable, though now in the 5*th Month*.

The Cauſe of its being Divided into ſo many Branches, I conjecture to be from the Roots, which Spread themſelves here and there in the Earth, ſo that the Matter Gathers and Setleth its ſelf about them, and afterwards according to the Diviſion of the Roots, acquires a *Plantal* Form and Appearance. Whence it ſeems alſo to proceed, that through the Midſt of the *Oſteocolla* there always paſſeth a *Dark Line*, which is thought to be a piece of the Root. And it often happens, that that *Stroke* looſeth it ſelf by little and little, and the *Oſteocolla* in the Middle

grows

grows *Clear*; which comes to pass when the Root by the corruption begun in the *Osteocolla*, is Reduced to Powder. Yet have *I* found a place hereabout, where the *Osteocolla* was not Hollow at all; but there *I* observed, that instead of setling about a Big Root, it had Gathered it self about many small Fibres; whence also this sort had acquired Pores through its whole Length, but no Cavity like the other.

Black-Lead; *by Dr.* Plot. n. 240. p. 183.

LI. The Mineral substance call'd *Black Lead*, found only at *Keswick* in *Cumberland*, and there call'd, *Wadt* or *Kellow*; by Dr. *Merret*, *Nigrica Fabrilis*, from its use in scoring, as the *Rubrica Fabrilis*, or the *Red Ochre* is; is certainly so far from having any thing of *Metal* in it, that it has nothing of *Fusion*, much less *Ductility*; nor can it be Reckoned amongst the *Stones*, for want of Hardness; it remains therefore that it must have place amongst the *Earths*, tho it dissolve not in Water, as most *Earths* will, except stiff *Clays*, and *Ochres*; among the Latter whereof I guess it may be Reckoned, it seeming to be a sort of Close *Earth*, of very fine and Loose Parts, so Burnt that it is become Black and Shining, Discolouring the Hands, as all the *Ochres* do; whence the most Proper Name that can be given it perhaps, may be *Ochra Nigra*, or *Black-Ochre*, being a Stony sort, as there are stony sorts of the *Red* and *Yellow-Ochres*, as well as Clay.

Irish-Slate; *by* ..... n. 243. p. 271.

LII. It having been discoursed to the *Philosophical Society* at *Oxford*, by Mr. *Henwrick* Physitian at *Worcester*, that the *Irish-Slate* Pulveriz'd, and infused in Water for a Night or less, would impart its *Vitriolick* Quality so far forth to it, that it would strike of a *Faint Reddish* Colour with Powder of *Galls* (as the *Vitriolick Waters* of *Tunbridg*, *Astrop*, and divers others do) it Led me to Believe that these *Waters*, some of them, might as well issue from *Salt* as an *Iron-Ore*; unless it should appear, that this sort of *Slat* were an *Iron-Ore* too, which put me upon Calcining it for 3 or 4 *Hours* after the Manner of Dr. *Lister*, to Experiment whether it would then (like other *Iron Ore*) Apply to the *Magnet*; wherein altho' *I* was altogether Unsuccessful, the *Magnet* not taking the least Notice of it, yet it afforded me another Discovery altogether as satisfactory *viz.* that upon Torrefaction it was all become a *Yellow Ochre*, and would *Score* like it; which further perswades me, that the *Yellow*, or rather *Orange Colour'd Sediment* we find at the Bottom of These *Fountains*, comes rather from this sort of *Slat*, than an *Iron-Ore*; for *I* much Question, whether some of the *Yellow Ochres* (tho' its plain the *Red* ones do) come from, or are, *Iron Ores*, because the *Shotover Yellow Ochre* will not Own the *Magnet* after 36 *Hours* Calcination, or better.

Chalk *and some other Bodies not Properly* Stones *though commonly Reputed so*; *by Dr.* Fred. Slare. n. 182. p. 144.

LIII. In a small Treatise of the *Calculus Humanus*, I found reason to complain of the Imposition of our Senses upon our Conceptions, in Calling that a *Stone* by its External Appearance, when it has no Real Properties of a *Stone*. I have also, in this, Reason to except against *Chalk*, commonly taken for a *Stone*) for being brought to the *Hydrostatical Examen*, (if that may be allowed as a *Standard*) it wants much of the True Consistence of a *Stone*, For it

wants

wants much of that *Weight*, which Real *Stones* are proved to have in Water, and it may perhaps be better reckoned amongſt *Boles* than *Stones*. I found this True not only in *Chalk*, but various other Bodies taken for granted to be *Stones* at large: Some of which are nearer *Earths* than *Stones*, others have nothing but *Earth* and *Sulphur* and *Metal*, and yet muſt be called *Stones* (as all *Marchaſites* are; Of theſe the former, (namely the *Boles*) many of them fall ſhort of our *Standard* of *ſtone*, others are more ponderous, and ſo exceed our *Standard*, whereas true *ſtones*, though differing much in Hardneſs, whether *Pebbles*, *Flints*, *Petrify'd Waters*, &c do Anſwer the ſame *Standard* of *ſpecifick Gravity* that a *Diamond* does; which is, as about 2½ to 1.

LIV. Upon the River *Done* near *Aberdeen*, a little below the Bridge near the River's Mouth, there is a Bank, the Face of which is Broken down, and it is full of *ſtones* which one would think were *in fieri*; They are all either Round or Oval, of different Sizes; the Faces of moſt of them are Broken off; they are *ſoft* and will eaſily rub down with your Hand; They are of different Gritts and Colours, and are made up of different Sands and Clays Mingled together; the Clay is ſoft both to Hand and Taſte, in ſome of them White, in others Gray, tho' in ſome places the Clay and Sand are Hardened to the Conſiſtence and Colour of ſuch Oval *ſtones* as we uſually ſee in the Fields; but where they are at the *ſofteſt*, the Bed that each *ſtone* lies in, is always *Hard*, and of another *Grit* and Colonr.

Imperfect Stone *in* Scotland, *by*. *Dr.* George *Garden*. n. 175. p. 1157.

LV. There is an Excellent *Quarry* within Canon ſhot of *Maeſtrich*, lying in a Hill, where there are about 25 Fathoms of Rock and Earth over Head; it hath one Entry towards the River *Maeſe*, where Carts can paſs with great eaſe, and unload the *ſtones* upon the Brink of the River, the *Quarry* within being parallel to the Horizon, and Elevated but very little above the River. It affords one of the moſt ſurpriſing Proſpects, when well lighted with many Torches, that one can imagine. For there are Thouſands of ſquare Pillars in large level Walks, and thoſe almoſt every where, above 20, and in ſome places many more Foot high; and all wrought with much Neatneſs and Regularity.

A Stone Quarry *near Maeſtrich, by*---- n. 67. p. 2051.

This *Quarry* ſerveth the People, that live thereabout, for a kind of impregnable Retreat, when Armies March that way. For being acquainted with all the Ways in it, they carry into it whatſoever they would have ſafe as well their Horſe and Cattle, as their moveable Furniture, till the Danger be over; there being ſo vaſt a deal of Room, that 40000 People may ſhelter themſelves in it.

In this vaſt *Grotto* 'tis Remarkable, that there is but little Rubbiſh: Which ſhews both the goodneſs of the Stone, and the Carefulneſs of the *Workmen*. And in diverſe places there are little *Pools* of Water, perhaps made on Purpoſe for Beaſts to drink, and to ſerve for other Uſes in time of Need: For in no place almoſt are there any *Droppings* to be ſeen; nor are the Walks at all Wet under Foot; only it ſeems, that *Rain* gets in by the *Air ſhafts*, which for ſaving of Labour, and perhaps too, to make theſe *Pools*, are let down from

from ſuch Places commonly, as are the *Pools* thereabout; and ſo the Rain, that falls on the Higher Grounds, does eaſily find the Way thither.

Quarrys *and* Rocks *in* Auſtria *and* Hungary, *&c. by Dr.* Edward Brown. n. 59. p. 1050.

LVI. Upon the North ſide of Mount *Calenberg*, two *German Miles* from *Vienna*, are *Stones* marked with *Trees* and *Leaves*, In the *Hermitage* of the *Camaldulenſes*; ſeated upon a Peak of this Hill, I ſaw fair ones, with which they Paved the Walk in their Gardens.

Not far from *Manners-dorf* is the *Emperour*'s Quarry of *Stone*, out of which are made the beſt Buildings in *Vienna*: In which, whereſoever there is a *Cleft* or ſeperation of one Stone from another, the *Water* falling betwixt them, leaves a *Petrification*, thereby, as 'twere, Healing the *Wound*, by making a *ſtony Callus*, not exactly like the Parts which it joins together.

An *Engliſh Mile* from *Freiſtat* in *Hungary*, Northward, is a Quarry of *ſtone*, out of which many great *ſtones* are digged, *Tranſparent* and reſembling *Sugar candy*.

At *Banca*, two *Hungarian Miles* from *Freiſtat*, Northward, is a *Quarry* of *White ſtone* nigh the *Hot Baths* of that place, over which is a lay of *Chalk* of about a Yard thick, very *Beautiful* to the Eye, as being of all Colours, except *Green*; ſo finely mixt, ſtreaked and ſhaded, that it ſurpaſſeth *Marble-Paper*; and the Water Dropping upon it, doth as 'twere *Varniſh* it

At *Schemnitz* in *Hungary*, famous for *Silver Mines*, is an high Perpendicular Rock, part of which, from the Top to the Bottom, is naturally *Tinctur'd* with a ſhining fair *Blew* and *Green*: And *I* have heard from a *Spaniard*, who lived long in the *Weſt Indies*, that there is alſo a Rock like this nigh to the *Silver Mines* in *Peru*.

The Mountain of *Cliſſura*, being a part of Mount *Hæmus*, as alſo Mount *Pyrlipe* do ſhine like *Silver*, and Day and Night, either by the Light of the Sun or Moon, afford a Glittering pleaſant ſhew, cauſed by the great Quantity of *Muſcovy-Glaſs* wherewith theſe Hills abound. There are alſo *Talcum Rocks* nigh *Spital* in upper *Carinthia*: And a Hill nigh *Sarvizza*, which conſiſts of an *Earth* of a fine *Red* Colour, out of which the *Red Earthen Veſſels* of that Country are made.

White Marble *in* Ireland; *by Dr.* Aſh. *Biſhop of* Cloyne. n. 243. p. 294.

LVII. A *Quarry* of *White Marble* is lately diſcovered in the County of *Antrim*; and tis of an extreamly fine Grain, ſoft at firſt, but grows very hard afterwards, like *Portland Stone*.

Stones *Growing at the End of a Ruſh; by Sir* R. Redding. n. 198. p. 663.

LVIII. I ſend you herewith ſome *Stones* of an *Amber Colour*, taken out of a Spring called *Cranbourn ſpring* near *Lough-Neah*, which the Country People tell us Grow at the End of a little *Ruſh*, and drop off, and are 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* ſhew no Signs thereof by *Crackling*: They are *Electrical* and *Angular*, and being pounded the Powder is White.

LVIII. I ſend

LIX. 1. The Higheſt *Icy Mountains* of *Helvetia*, about *Valeſia* and *Auguſta*, in the Canton of *Bern*, about *Taminium* and *Tavetſch* of the *Rhætians*, are always ſeen covered with *Snow*. The *Snow* melted by the Heat of the Summer, other Snow being faln within a little while after, is hardned into *Ice*; which by little and little, in a long Tract of Time depurating it ſelf, turns into a *Stone*, not yielding in Hardneſs and Clearneſs to *Cryſtal*. Such *Stones* cloſely joined and compacted together, compoſe a whole *Mountain*, and that a very firm one; though in Summer time the Country People have obſerved it to Burſt aſunder with great *Cracking*, Thunder like. Such *Cracks* and Openings being by the Wind covered with Snow, are the Death of thoſe that paſs over them.

The Icy *Mountain* Gletſcher, *by* M. Muraltus. n. 49. p. 982.

At the Foot of theſe *Mountains*, are with great labour digg'd out *Cryſtals*, which are found among other *Foſſiles*, of two ſorts and Colours; ſome of them are *Darkiſh* and Troubled, which by ſome are call'd the *Cryſtal Ore*, to be plenteouſly found in the Aſcent of Mount *Gotthard*; others *Tranſparent*, very Pure, and as Clear as *Venice Glaſs*, *Sexangular* both great and ſmall; as in the Mountains about *Valeſia*, and the Town call'd *Urſelen*, at the Foot of the Hill *Schelenin* they are digg'd out, and Sold at a good Rate; one particularly for 80 *l. Sterling*.

2. This *Icy* Mountain call'd the *Gletſcher*, is very high, and Extends it ſelf every year more and more over the Neighbouring Meadows, by Increments that make a great Noiſe and *Cracking*. There are great *Holes* and *Caverns*, which are made when the *Ice* Burſts; which happens at all times, but eſpecially in the *Dog-days*. Very little of the Surface Melts in the Summer, and all freezeth again in the Night. When the Sun ſhineth, there is ſeen ſuch a variety of Colours as in a *Priſm*.

By---- to Mr. Juſtel. n. 100. p. 6191.

At the Foot of the Mountain, a *Rivolet* iſſues forth from under the *Ice*, which is pretty Deep and extreamly *Cold*.

There is ſuch another *Mountain* near *Geneva* and upon the *Alps*. A certain *Capucin* told me, he had been upon the Higheſt of theſe Mountains with a Trader in *Cryſtal*, who having driven his Hammer in one of theſe Rocks, and found it Hollow and Reſonant, made a Hole into it, and thence drew forth a Subſtance like *Talk*; which to him was a Sign there was *Cryſtal*. After which he made a great Hole with *Gunpowder*, and found *Rock Cryſtal* in it.

LX. Being in the *Val Sabbia*, at a Place call'd *Le Mezzane*, where I knew that *Cryſtals* are Generated, I obſerved in a ſpacious round of a Meadow, ſeated on a Hillock, ſome narrow places bare of all Herbs, in which alone, and no where elſe thereabout, *Cryſtals* are produc'd, being all *Sexangular*, both Points of them Terminating in a *Pyramidal* Figure, *Sexangular* likewiſe.

The Formation of Cryſtals; *by P.* Franciſco Lana. n. 83. p. 4068.

I was told, that they were Produc'd from the *Dews*, becauſe (forſooth!) being Gathered over Night, the next Morning there would be found others at ſuch a Time only, when it was a Serene and *Dewy* Sky. But when I had Examin'd, that in the Neighbourhood of that Hill, there was no Mark at all of any *Mines*, I did conclude that it might be a plenty of *Nitrous Steams*, which might withal

hinder *Vegetation* in thoſe Places, and *Coagulate* the *Dew* falling thereon; for *Nitre* is not only the Natural *Coagulum* of *Water*, as is manifeſt in *Artificial Glaciations*; but alſo it ever Retains the aboveſaid *Sexangular* Figure, altogether like that of theſe *Cryſtals*. Which may alſo be the very Cauſe of the *Sexangular* Figure in *Snow*; this being nothing elſe but Water Concreted by its natural *Coagulum*, which is a *Nitrous Exhalation*. And to make it yet more Manifeſt, that theſe are indeed Expirations of *Nitre*, I digg'd up ſome of the *Earth*, and Drew a *Salt* from it, which had both the Taſte and Figure of *Nitre*; though ſome Grains of it were of a *Square*, others of a *Pyramidal* Figure. And ſince theſe *Cryſtals* are only found in thoſe Narrow places, we may very probably infer, that from thence are raiſed the *Exhalations*, which do Concrete the *Dew*; after ſuch a Manner as the *Vapour* or *Exhalation* of *Lead Coagulates Quickſilver*.

An odd figured Iris; *by Dr.* Liſter. n: 110. p. 222.

LXI. I have not obſerved any Rock or ſort of *Stone*, whether Metalline or more vulgar, which hath not its different ſort of *Sparr* both for *Colour* and *Figure* ſhot in ſome part or other of its Bed or Seams. I have one of a very curious *Figure*, which is very common in our *Blew Lime-ſtone Rocks*, in *Yorkſhire*, out of which Plenty of *Lead-Ore* is got. They are moſtly of a *Black-Water*, like the Black Flint in *Chalk-Hills*; but there are of them, which have a Purpliſh or *Amethyſtine* Colour; and ſome there are as clear as *Cryſtal*. They adhere to the Seams of the *Rock*, be it betwixt Bed and Bed, or wherever there are Croſs and Oblique *Veins* through the very ſubſtance of the Bed. The ſmaller the *Veins*, the leſs the *Iris*. You will find of them as ſmall as Wheat Corns, and others an Hundred times bigger. They ſhoot from both ſides the *Seam*, and mutually receive one the other.

They are *Figured* thus, *viz.* a Column of 6 plains very unequal as to the Breadth; the End Adhering to the Rock is always Rugged, as a thing Broken off; the other End of the Column conſiſts of three *Quinquangular* Plains, very little Raiſed in the middle: Theſe Plains too are very unequal. Let them hug one another, or be any ways Streightned and Compreſſed in their *ſhooting*; yet the Number of Plains mentioned, both of the Column and Top, is moſt certain. The Places where Infinite of them may be had, are *Rainsborough Scarr* upon the *Ribble*; alſo in a ſtone Quarry near *Eſhton Tarne* in *Craven*.

Tranſparent Pebbles; *by Dr.* Liſter. n. 201. p. 778.

LXII. Theſe *Tranſparent Stones* are of a Conſtant ſhape; and in ſome Antient Leaſes of *Royal Mines*, they are called *Rough* or *Mineral Pearl*, being Reſplendent and bright, and figured like a drop of Water. Some of them are exactly *Spherical*, others like a Half Globe, others like a half Oval, with an Edge raiſed on the top. It was not without Reaſon that they were Eſteem'd by the Antients: For their *Natural Poliſh* is not to be *Counterfeited*, but very eaſie to be Diſtinguiſht with 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 many pretences thereunto; as *Gold*, for example, that it will endure the drowning in *Antimony*; *Silver*,

ver, that it abides the *Teſt* of *Lead*; *Diamonds*, for that of themſelves, even without a *Foil*, they caſt a Luſtre; *Pearl*, is Valued, becauſe of its *Figures* and Peculiar brightneſs not to be Imitated.

Theſe *Stones* are of the *Pebble-kind*, that is, not to be *Calcined* by Simple fire; whereas moſt other *Figured Stones* are *Calcinable* with a very eaſy Fire. They are very Hard and Solid, and do not conſiſt within of *Laminæ* or Flakes, but break every way with great Difficulty, and Naturally throughout Smooth.

Their *Figure* 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 *Filo-briggs*, 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*.

I am not Adverſe to think, after ſo Manifeſt and Conſiderable Diſcoveries as *Auguſtino Scilla* hath made in *Sicily*, that moſt of the *Ombriæ* have been *Echini*; and yet ſome of the *Prickled*, which Naturaliſts have hitherto call'd *Lapides Judaici*, may have belonged to ſome of thoſe *Ombriæ*. But there are only 2 or 3. *Echini* yet diſcovered, either in *Ours* or the *Mediterranean Sea*: Whereas of the *Ombriæ* of *Europe*, beſides theſe preſent *Anomalous Stones*, there are at leaſt 20 *Species* Figur'd and Deſcrib'd by *Aldrovandus*, *Auguſtino 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.

LXIII. 1. Amongſt the Excellent *Diamonds* brought from the *Eaſt-Indies* by M. *Tavernier*, there is one weighing 112$\frac{3}{16}$ *Carats*, of a very Fine *Violet* colour, and Two of a *Roſe-Pale* colour; all three of an *Adamantin Hardneſs*, and upon that account eſteemed *Diamonds*.

Diamonds; *by* n. 102. p. 26.

2. The Parts of the World known to contain *Diamonds*, are the Iſland *Borneo*, and the Continent of *India extra & intra Gangem*: *Pegu* is likewiſe Reported to have ſeveral, but the *King* contents himſelf with his Mines of *Rubies*, *Saphires*, *Topaſſes*, *Emeralds*, *Gold*, *Silver*, *Braſs*, *Tin*, *and Lead*.

By the E. *Marſhall of* England. n. 136. p. 907.

The *Diamond Mines* on the Coaſt of *Coromandel* (of which *I* have viſited ſeveral) are generally adjacent to Rocky Hills, or Mountains, whereof begins a great Ledge or Range near Cape *Comorin*, extending in Breadth about 50 *Engliſh Miles*, ſome Conjoyning, others Scattered: and running thence in Length quite through *Bengala*. In, among, and near theſe Hills, in ſeveral places, are known to be (as it is believed moſt of them have) *Mines*.

The Kingdoms of *Golconda* and *Viſiapore* Contain in them ſcope enough of Ground, known to have *Mines*, ſufficient to furniſh all the World plentifully with *Diamonds*; but their *Kings* permit digging only in ſome Places appointed, leſt as it is Imagined, they ſhould become too Common; and withal for fear of Tempting the Threatning Greatneſs of *Aurenge Zebe*; forbidding alſo thoſe places that afford the Largeſt *Stones*, or elſe keeping Workmen in them for their Own Private uſes.

1. In the Kingdom of *Golconda* (as near as I can gather from the beſt acquainted) are 23 *Mines* Now Employed, or that have been ſo lately.

Quolure was the Firſt *Mine* made uſe of in this Kingdom. The Earth is ſomewhat Yellowiſh, not unlike the Colour of our Gravel dryed; but Whiter in ſome places where it abounds with Smooth Pebbles, much like thoſe that come out of ſome of our Gravel-Pits in *England*. They Uſe to find great Quantities in the *Vein*, if it may properly be ſo call'd, the *Diamonds* not lying in Continued Cluſters, as ſome imagine, but frequently ſo very Scattering, that ſometimes in the ſpace of ¼ of an Acre of ground, Digg'd between two or three Fathoms Deep, there hath been nothing found; eſpecially in the *Mines* that afford *Great Stones*, lying near the Superficies of the Earth, and about three Fathoms Deep. The *Diamonds* found in theſe *Mines* are generally well ſhaped, many of them *Pointed*, and of a good Lively *White Water*; but it alſo produces ſome *Yellow* ones, ſome *Brown*, and of other Colours. They are of Ordinary Sizes, from about 6. in a *Mangelin* * (of which they find but Few) to 5 or 6. *Mangelins*, each; ſome of 10, 15, 20, they find but Rarely. They have frequently a Bright and *Tranſparent Skin* inclining to a *Greeniſh* colour, though the Heart of the Stone be purely *White*; but the Veins of theſe *Mines* are almoſt Worn out.

* *A* Mangelin *is four* grains *in weight, ſaith* Linſchoten.

2. The *Mines* of *Codawillikul*, *Malabar*, and *Buttepallem*, conſiſt of a Reddiſh Earth, inclining to an Orange Colour, (with which it ſtains the Cloaths of the Labourers that work in it;) they Dig about 4 fathom Deep. They afford Stones generally of an excellent *Water* and *Cryſtalline Skin*; ſmaller ſizes than thoſe of *Quolure*, *Ramiah*, *Gurem*, and *Muttampellee*; have a Yellowiſh Earth, like *Quolure*; their Stones like thoſe of the Two Former *Mines*, but mixt with many of *Blew Water*. Theſe 5. *Mines* being under the ſame Government with *Melwillee*, where the Governour Reſides; He has lately Forbid their Uſe; and commanded all to Repair to his Reſidence.

Currure (the moſt Famous of them all and moſt Antient) has been under ſubjection of the King of *Golconda*; but about 25. Years ago was taken, with the Country of *Karnaticum*, from the *Hundue-Rajaes*, by the *Nabob Meer Jumla*. In it have been found *Diamonds* of a *Seize* Weight, which is about 9. *Ounces Troy* or 81½ *Pago's* weight. It is only Employed by the *King* for his own Private uſe: The *Diamonds* that are found in it, are very well ſpred, Large ſtones (it yields few or none ſmall,) they have generally a *Bright Skin*, which inclines to a pale *Greeniſh* colour, but within are purely *White*. The Soil is Reddiſh, as many of the others.

About

About 60. or 70. years ago, a *Portugueze* went thither from *Goa*, and having ſpent in Mining all that he had, even to what wearing Clothes he could ſpare, while the Miners were at work for the Laſt Days expence, he had prepared a Cup of Poyſon, reſolving if that Night he found nothing, to Drink his Laſt with the concluſion of his Mony; but in the Evening the Workmen brought him a very Fair ſpread Stone of 20 *Pago*'s weight; in Commemoration whereof he cauſed a great ſtone to be Erected in the Place, with an Inſcription engraven on it, in the *Hundues* or *Tellinga Tongue*, to the following effect, which remains to be ſeen till this Day;

Your Wife and Children Sell, Sell what you have,
Spare not your Cloaths, nay, make your ſelf a Slave.
But Money get; then to Currure *make haſte;*
There Search the Mines, *a Prize you'l find at laſt.*

Not far from *Currure* are the *Mines* of *Lattawaar* and *Ganjeconta*, which are in the ſame Soil as *Currure*, and afford ſtones not Unlike: But *Lattawaar* hath many Repreſenting the great End of a Razor blade, Thin on one ſide and Thick on the other, very *White* and of an Excellent *Water*; but the beſt of the *Mine* is worn out, and *Ganjeconta* employed only to the *King's* Private uſe.

Jonagerre, *Pirai*, *Dugulle*, *Purwillee* and *Anuntapellee*, conſiſting alſo of Red Earth, are now Employed and Afford many Large ſtones; part of them of a *Greeniſh Water*; but the moſt abſolute *Mines* are of *Wazzergerre* and *Munnemurg*, (the other rather Repreſenting Pits than *Mines*;) for there they Sink through High Rocks till they go ſo far below their Baſis, that they can go no further for Water, in ſome places 40. or 50. *Fathom* Deep. The ſuperficies of the Rocks conſiſts of Hard, Firm, White ſtone, into which they cut a Pit, like a Well, of about 4 or 5. in ſome places 6. *Foot* Deep, before they come to the Cruſt of a *Mineral Stone*, like the *Mineral* of *Iron*; then they fill the hole with Wood and keep as hot a Fire as they can there for 2 or 3. *Days*, till they think it ſufficiently Heated; then they Pour in Water till they have Quench'd it, which alſo ſlakes and Mollifies both *Stone* and *Mineral*; both being Cold they Dig again, take out all the Crumbled ſtuff, and dig up what they can beſides, before they Heat it a new; the Cruſt ſeldom is Thicker than 3 or 4 *Foot*, which ceaſing they come to a *Vein* of *Earth*, that Uſually runs under the Rock 2 or 3 furlong; ſometimes much further: This they dig all out and ſearch, and if their firſt attempt prove ſucceſsful, they go to work again (digging after the ſame manner) as deep as they can till they come to Water; for the drawing whereof wanting the help of Engines known in *Europe*, they can go no deeper, although the *Vein* lie lower; all Lumps of the *Mineral* they break in Pieces, and frequently find *Diamonds* encloſed in them. The Earth is Red. Many large ſtones are found here; the ſmalleſt about Six in a *Mangelin*. They are *Mixt Waters*, but the greateſt part Good, only of ill favoured ſhapes, many Cragged pieces of ſtones, ſome as if they had been Parts of very Great ones, others with pieces Broken off them; yet *I* never heard of any

that

that found two ſeeming Fellows, although they do thoſe that look as if they had been Newly Broken.

In *Langumboot* they Dig as they do at *Wazzergerre* and *Munnemurg*; the Rock is not altogether ſo Solid, but the Earth and Stones it produces much alike.

Wootoor lyes near *Currure*, and affords ſtones of a like Magnitude, ſhape and *Waters*; 'tis employed only to the *Kings* uſe: And ſingular, in that its *Diamonds* are found in Black Earth.

Muddemurg far Exceeds all the reſt for *Diamonds* of a Delicate ſhape, *Water*, and Bright Tranſparent *Skin*; yet it has ſtore of Veiny ones, but thoſe likewiſe of ſo Curious Shape and *Water*, that it is difficult to diſcover them from the Good eſpecially the ſmall ones. It produces ſtones of divers Magnitudes, from 10 and 12 in a *Mangelin*, to 6. or 7. *Mangelins* each; and beſides, ſome Great ones. The Earth is Red: But it is ſeated in the Woods, and the Water ſo bad, that to all (except the People Bred there) it preſently occaſions Fevers, and Deſtroys abundance; in ſo much that moſt of the *Adventurers* have forſaken it; notwithſtanding which it had been more Profitable than any of the reſt, the *Vein* frequently lying near the ſuperficies of the Earth, ſeldom running deep, and is better Furniſhed than any one yet diſcovered. The River *Kiſhna*, of excellent Waters, is but 9. Miles diſtant: but the Miners or Merchants will not be at the Charges of fetching their Water from thence. Divers are of the opinion, that, beſides the Water, the Town lying in a bottom, environed with Hills and a Moraſs adjoyning, the Air may be infected, and contribute to its Unhealthfulneſs.

Mellwillee or the *New Mine*, ſo called, becauſe it was but lately Found out (or at leaſt Permitted to be made Uſe of) in the *Year* 1670; it had then a year Employed the Miners, but it was forbidden and lay Unoccupied till 1673, when Complaint being made at *Quollur*, that the *Vein* was Worn out, the *King* again Licenſed its ſettlement. The Earth they *Mine* in is very Red, and many of the ſtones found there have of it ſticking to them, as if it had Clung there while they were of a ſoft Glutinous ſubſtance, and had not attained their Hardneſs, maintaining its Colour on its Skin (ſeeming to be Roughned with it) that it cannot be Fetch'd out by Grinding on a Rough ſtone with Sand, which they make uſe of to Clean them. The *Stones* are generally well ſhaped, their ſize from 5 or 6. in a *Mangelleen* to thoſe of 14 or 15 each, and of ſome Bigger; but greateſt quantities of the Middle ſorts: Moſt of them have a Thick *Dull Skin*, incline to a *Yellowiſh Water*, not altogether ſo ſtrong and lively as of the other *Mines*; very few of them of a *Cryſtaline Water* and *Skin*. They are reported to be apt to *Flaw* in Splitting, which occaſions thoſe People to Eſteem them ſomething ſofter than the product of many of the other *Mines*: Several that Flatter by their ſeeming *Whiteneſs* when Rough, diſcover their Deceitfulneſs having paſt the *Mill*, and too often a *Yellowiſh* Tincture, to the diſappointment and Loſs of them that have cut them; but what they want in Goodneſs, is in part Supply'd by the Plenty they find, which, together with their Properties, make them the Cheaper.

2. *Viſiapore*

2. *Viſiapore* is known to contain *Mines* encloſing *Stones* as Large and Good as thoſe of *Golconda*; but the *King*, makes uſe but of the Meaneſt. There are 15. *Mines* employed in this Kingdom.

In *Ramulconeta-Mines*, in Red Earth, about 15 or 16. foot Deep, they ſeldom find a *Diamond* of a *Mangelleen* weight, but ſmall to 20 or 30 in a *Mangelleen*. They are generally of an excellent *Cryſtalline Water*, have a bright clear *Skin*, inclining frequently to a pale *Greeniſh* colour, are well ſhaped, but few of them Pointed ones There are alſo found amongſt them ſeveral Broken pieces of *Diamonds*, by the Country people called *Shemboes*.

The *Mines* at *Banugunnapellee*, *Pendekull*, and *Moodawarum*; at *Cummervillee*, *Paulkul*, and *Workul*, which are not far diſtant from *Ramulconeta*, afford *Stones* much alike and in the ſame kind of Earth; but in the three laſt are very ſmall ones even to 100 in a *Mangelleen*

Lungepoleur Mines are of a *Yellowiſh* Earth (like theſe of *Quoleur*,) its *Diamonds* are generally well ſhaped, Globular, Few, Pointed, a very good *Cryſtalline Water* and Bright *Skins*; many of them have a thick dark Graſs-Green *Skin*, ſome ſpotted alſo with Black, that they ſeem all Foul, yet are not ſo, but within purely *White* and Clean. Their ſizes are from 2 or 3 *Mangelleens* downwards, but few very ſmall. *Pootloor*-Mines are of a Reddiſh Earth, but afford *Stones* much like thoſe of *Lungepoleur*, only ſmaller; under a *Mangelleen*; the general ſizes are of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$ of a *Mangelleen*.

Punchelingul, *Shingarrampent* and *Tondarpaar*, are alſo of Red Earth, their *Diamonds* not unlike thoſe of *Quoleur*, only rarely or never any Large ones are found there.

Gundepellee hath the ſame Earth with the former, and Produces *Stones* of equal Magnitude; but frequently of a pure *Cryſtalline Water*, wherein they exceed the Former.

Donee, and *Gazerpellee*, dig both in Red Earth likewiſe, and afford *Stones* alike, the greateſt part whereof are of good *Shapes* and *Waters*. They have alſo many *Shemboes*, and ſome of Bad *Waters*, ſome Brown which theſe People call ſoft or *Weak Water'd*, being eſteemed of a ſofter and Weaker body than others, by reaſon they have not ſo much Life, when cut; and are ſubject to Flaw in ſplitting, and on the *Mill*. Their general product is in *Stones* of Middle Sizes: But *Gazerpellee* has beſides many large ones; and is the only *Mine* Noted in the Kingdom of *Viſiapore*.

The *Diamonds* (in all the *Mines*) are ſo ſcattered and Diſperſed in the Earth, and lie ſo Thin, that in the moſt Plentiful *Mines* its rare to find One in Digging, or till they have Prepared the ſtuff, and do ſearch purpoſely for them. They are alſo frequently encloſed in Clods; and ſome of thoſe of *Melwillee* have the Earth ſo Fixt about them, that till they *Grind* them on a Rough ſtone with Sand, they cannot move it ſufficiently, to diſcover they are Tranſparent; or, were it not for their ſhapes, to know them from other *Stones*. Sometimes the Unskilful Labourers, to try what they have found, lay them on a great ſtone, and ſtriking on them with another, to their Coſtly experience diſcover, they had broken a *Diamond*.

Near

Near the Place where they Dig, they make a Ciſtern about 2 *Foot* High, and 6 *Foot* Over, with a ſmall Vent in one of the ſides about 2 *Inches* from the bottom, by which it Empties it ſelf into a little Pit, made in the Earth to receive *Small ſtones*, if by chance any ſhould run through. The Vent being ſtopped, they fill the Ciſtern they have made with Water, ſoaking therein as much of the Earth they dig out of the *Mines*, as it can conveniently Receive at a time, Breaking the Clods, Picking out the greateſt *Stones*, and ſtirring it with Shovels, till the Water is all Muddy, the Gravelly Stuff falling to the bottom: Then they open the Vent, letting out the foul Water, and ſupplying it with clean, till all the Earthy ſubſtance be waſhed away, and none but a Gravelly remains at the bottom. Thus they continue Waſhing till about 10 of the Clock before Noon, when they take the Gravelly Stuff they have Waſhed, and ſpread it on a Place made plain and ſmooth (like a Bowling-Alley) for the purpoſe, near the Ciſtern, which being ſoon dryed by the Heat of the Sun at that time of the Day, they very curiouſly look it over, that the ſmalleſt bit of a Stone can hardly Eſcape them. If they find a *large Stone*, they deliver it not till they have done Work, and then very privately, leaſt it ſhould come to the Knowledge of the *Governour* of the Place, and he require a ſhare, which in the Kingdom of *Golconda* is uſually Practiſed, without Reſpect to any Agreement made with them.

The *Miners*, thoſe that Employ them, and the Merchants that Buy the *Stones* of them, are generally *Ethnicks*; not a *Muſleman*, that ever I heard of, followed the Employment. Theſe Labourers and their Employers are *Tellinga*'s, commonly Natives of or near the Place. The Merchants are the *Banians* of *Guzzarat*, who, for ſome Generations, have forſaken their own Country to take up the Trade, in which they have had ſuch ſucceſs, that 'tis now ſolely Engroſſed by them; who correſponding with their Country-men in *Surrat*, *Goa*, *Golconda*, *Viſiapore*, *Agra* and *Dillee*, and other places in *India*, furniſh them all with *Diamonds*.

The *Governours* of the *Mines* are alſo *Idolaters*: In the *King* of *Golconda*'s Dominions a *Feulinga Brammee* Rents moſt of them, whoſe Agreement with the Adventurer is, that all the *ſtones* they find under a * *Pagoda* Weight, are to be their own; all of that Weight and above it, to be His for the *King*'s uſe. Both Merchant and *Miner* go generally Naked, only a poor Clout about their Middle, and a Shaſh on their Heads; they dare not Wear a Coat, leſt the *Governour* ſay they have Thriven much, are Rich, and ſo Enlarge his Demands on them. The Wiſeſt, when they find a *Great Stone*, Conceal it till they have an opportunity, and then with Wife and Children Run all away into the *Viſiapore* Country, where they are ſecure and Well uſed; by reaſon whereof Their *Mines* are much more Populous, and better Employed than thoſe of *Golconda*.

* *A* Pagoda *weight is* 9 Mangellins.

It is obſervable, that notwithſtanding of the Agreement with the Adventurers of the *Mines*, that all *Stones* above a certain Weight ſhall be for the *King*'s Uſe; yet in the *Metropolis* of either Kingdom, as the Cities of *Golconda* and *Viſiapore* are, there is no ſeizure, all *Stones* are free; and the late Deceaſed King, *Abdul Cutopſhaw* of the Former, and *Edelſhaw* of the Latter, would not

not only give very great Prizes for *large Stones*, but richly Veſt, and Preſent the Merchant that ſold them with Horſes, or ſomething elſe of Value, thereby encouraging others to bring the Like.

The Production of Amber; *by Mr.* Joh. Schefferus n. 19. p. 349.

LXIV. 1. Mr. *Joh. Schefferus* conceives Amber to be a kind of *Foſſil Pitch*, whoſe Veins lie at the bottom of the Sea; believing that it is Hardened in Tract of Time, and by the motion of the Sea caſt on Shore. He adds, that hitherto, it hath been believed, not to be found but in *Boruſſia*: But he aſſures that it is alſo found in *Sweeden*, on the Shores of the Iſle of *Biorkoo*, in the Lake *Melero*, whoſe Water is ſweet. Of this he ſaith, he hath a fine piece by him, two Inches large and Thick, preſented him by one that himſelf with his own Hands had gathered it and ſeveral other Pieces, on the Shore of the ſaid Iſland; affirming withal from the Mouth of a Shepherd of that place, that it is thrown out by a ſtrong Wind, bearing upon the Shore.

By Mr. Hevelius ib. p. 346.

2. I am almoſt of the ſame Mind with M. *Schefferus*, that *Amber* is a kind of *Foſſil Pitch*, or *Bitumen*, ſeeing it is not only found on the Shore of the *Boruſſian* Sea, but alſo digged up in Subterraneous places, ſome *German Miles* diſtant from the Sea; and that not only in Sandy, but alſo in other Hills of firmer Earth; of which *I* have ſeen my ſelf pretty big Pieces.

An Account of Amber; *by Mr.* Phil. Jac. Hartman. n. 248. p. 5.

3. *Succini* Antiquiſſimis Temporibus cognita Virtus celebre ipſi, pluribus *ante Chriſtum natum* Seculis, apud ſcriptores *Græcos* peperit Nomen. Poſtquam *Romanis* Admirationi eſſe cæpit, & his Auctoribus *Gemma* reddita eſt Memorabilis: Præſertim cum *Neronis* Mores in Luxum *Succino* abuti docerent. Quantacunque vero *Succinorum* Vetuſto Ævo fuerit Eſtimatio, Terræ Tamen, in quibus Generantur, incognitæ manſere; inde tot ſententiarum Divortia; his in *Africa*, iſtis in *Aſia*, aliis in *Europa*, Theſaurum reconditum memorantibus. Inter *Europæas* Ditiones, *Italiæ*, & in eadem *Eridani* vicinique Maris *Adriatici* ex *ſuccineis* Divitiis præcipua Laus fuit; quam tamen fida magis Hiſtoria, *Romanis* latè per *Germaniam* Victricia Arma circumferentibus, Maris *Germanici* ac *Baltici* Inſulis vendicat, *Hiſpania* & *Britannia* in partem aliquam Gloriæ admiſſis.

Verum ut Veteribus tot Regiones *Succiniferas* allegantibus ignoſci poſſet, neſcio an Proximo aut huic Noſtro Ævo Venia ſit danda, etiamnum ex *Africa* & *Aſia*, quin ex novè detecto Orbe, *nativum ſuccinum* afferenti, vulgato inſuper *Orientalium Succinorum* Nomine. Quod enim cum Pace tantorum Virorum dixero, plerique Auctorum ſunt inteſtabiles, Rumoribus plus juſto Tribuentes: Oculatos Teſtes, fallere & falli neſcios, vix produxeris. Per multos quidem qui in *Orientalibus* Partibus commemorati diutius, Rerumque Phyſicarum fuerint gnari, ipſemet atque Amici, coram & Literis, percontati ſumus, neque incidimus in quempiam, qui certi quidpiam cum Fiducia ediſſerere noſſet; majorque pars, quicquid de *Orientali Succino* Fama ſparſit, aut ſcriptis prodidit, Incertitudinis aut Falſitatis condemnavit. Quin Nomen *Ambari* ſive *Ambræ*, quod *Succino* cum Pretioſiſſimo & Fragantiſſimo *Orientali Bitumine* jam diu apud plurimas Nationes Commune eſſe cæpit, non paucos in Errorem induxit: *Succinum* enim crediderunt, quum *Ambram* in *Africæ*, *Aſiæ*, *Americæve* Partibus naſci acceperant. Si non alius Error *Succinum Orientale* progenuit, Reſi-

nâ *Copal*, *Succinum* mentiri aptiſſimâ, hoc Nomine ab Officinis *Pharmaceuticis* adoptatâ.

Nec in *Europæ* memoratis omnibus Provinciis, *ſuccinum* Generatur; Inanibus Auctorum de *Eridano*, *Mari Adriatico*, aliiſque *Italia* locis *Succiniferis*, Commentis. Nec de *Hiſpano*, *Britannico*, *Pannonico Succino* graviora aut certiora proſtant Documenta *Gagates Succini Nigri* Appellatione ſcriptoribus impoſuiſſe videtur. De *Polonicis*, *Sileſiacis*, *Bohemicis Succinis* effoſſis, quamvis Raros in Patriis Annalibus præcones nacta ſint, indubitatâ Experientiâ conſtat. *Germanici ſuccini* Crebrior & Evidentior eſt Memoria. In Litoribus Maris ad Inſulas *Belgicas*, ad *Holſatiam Jutiam*, in Ripis etiam Fluviorum, Lectum; quin ex Interioribus Terræ viſceribus erutum, graviſſimi Auctores conſignarunt. *Saxonia*, *Miſnia*, *Iſlebia*, *Suevia*, ex Gremio Matris Telluris ſe hunc Fætum ſuſcepiſſe, aliquoties atteſtantur: *Hallenſeſque* Carbonariæ Fodinæ, ſereniſſimi *Frederici III.* Auſpiciis non ita pridem detectæ, *ſuccineas* viliores Glebas plus via ſimplici oſtenderunt; Fidem faciente D. *Krug.* S. Electoris *Brandenb.* Archiatrorum Comite, & Conſiliario, Rerumque Metallicarum Directore Gnariſſimo atque Meritiſſimo. Nec Ignobiliora Teſtimonia inclyta *Marchia* perhibet: Superiori ſeculo *Jodochus Wilichius*, prope *Neomandram*, *novam Collam* dictam, *Francofurto ad Oderam* Tria *Milliaria*, circiter *Diſtantem*, in Lacus ingentis Ripa *ſuccinum Falernum* repertum; noſtra Ætate in Ripa *Viadri* prope *Cuſtrinum* juxta Pagum *Schaumberg* inventum, Cl. D. *Becmannus*; eque Foſſa Inſulæ *Pottamenſis* regnante Magno *Friderico Wilhelmo* eductum, Cl. D. *Elſholtius*, memorarunt. Major autem *Succinorum* eſt proventus in locis Mari *Baltico* vicinis *Suecia*, vel ex Lacus Dulcis *Meleri* Ripa Ejectum, ſæpius legit, aut Effoſſum ſuſtulit; *Dania* ex Foſſa *Hafnienſi* inſignia *Succina* vidit, & admirata eſt, atque ex Collibus *Selandiæ* ſuæ Mediterraneis non contemnandâ Magnitudine ac Multitudine prodiiſſe, uniuſque Colliculi Foſſionem quinquaginta Libras erogaſſe, Vomereque ex Agris extracta, meminit; Teſteſque Cl. *Borrichii* adſunt Literæ, Inſulas *Cimbriam Holſatiamque* allambentes [*Formöe Mandöe*, *Röm.*] ad Littora ſua in Oceano pariter Copioſum *Succinum* expiſcari. Liberalius tamen longè in *Samogitiæ*, *Curoniæ* & *Livoniæ* Contermina Maris *Baltici* Litora *Succineæ* Opes redundant; ut inter Algas Arenaſque abſconditæ à Ruſticis confertim deprehendantur. Inter Arandum quoque, & inter Fodiendum, in Maritimis Jugeribus ſeſe ultro, ſine gravioris Laboris impendio, offerunt, Vili Pretio ab *Electrotoreutis* ibi locorum quondam coempta.

Verum nulla Maritimarum Provinciarum, æque Opima ſpolia ex Mari *Baltico* legit, nulla ex ſinu Telluris æque numerosam Prolem *Succineam* ſuſcipit, ac *Pruſſia*; ut *Electrides* Antiquorum nullibi rectius collocaveris. Allata ſunt mihi ex *Sambia*, ex *Natangia*, ex *Hockerlandia*, ex *Pomeſania* fortuito inventa *ſuccina*; & prope Oppida *Hollandiam*, *Liebſtadium*, detecta; quæque ex *Electoralis Lithuaniæ* Agris effoſſa, *Varmienſia* quoque & *Elbingenſia* poſſideo. Olim Vir Conſularis, mihi Amiciſſimus, annotarat, in Sylva quadam *Kerbſwald Elbingenſis* Ditionis An. 1641. intra modicum Temporis ſpatium, *Septingentas Libras* fodiendo ex Terra erutas; fruſtumque Inſigne Amicus nuperrimè dono dedit, cujus idem Natale fuerat ſolum. Et in Ripis Lacus *Recentis* ac *Curonienſis* Fluviorumque *Pregelæ*, *Viſtulæ*, *Elmæ*, lecta adeptus ſum. Adeoque nullus

nullus dubito, totum *Pruſſiæ* Fundum *Succineum* affirmare, præſertim cum ſcaturigo de repente An. 1666. circa Oppidum *Bartenſtein* exundans, tantum vim *Succinorum* egeſſerit, ut Fiſci Reditus augeret; quæ a Terræ viſceribus avulſa, nec Mare vidiſſe unquam, certa eſt Fides.

Poſt *Pruſſiam*, *Pomerania Succinifera* nominari meretur, illo potiſſimum *Oræ* Maritimæ Tractu, qui per Litora *Electoralium* hinc & *Olivenſium* ac *Gedanenſium* Ditionum ad *Neriam* Recentem excurrit. Multum *Succini* cum Decumanis Fluctibus ad hanc Oram advolvitur, iiſdem ſignis proventum manifeſtantibus, *Electrotoreutarum Gedanenſium* Quæſtu non ſpernendo, quia ſenatu juſto prætio, quæcunque ad *Neriam* appellunt, redimerunt. Ad Inſulam *Rugiam* uſque Maris *Baltici* effuſa eſt Liberalitas, ſiquidem & hæc *Succineis* Glebis potitur; juxta *Hiddenſee* & Lectas & Hauſtas percepi. Nec Mediterranea *Pomeraniæ Succinorum* ſunt vacua, quippe quod pariter bona Fortuna in eadem Ruricolæ aliud agentes incidant ſæpius; *Curoniæque* & *Samogitiæ* inter *Succiniferas* Palmam *Pomerania* dubiam reddit.

Pruſſiam quaquaverſum *Succiniferam* prædicavi, ut tamen præcipue Litoris *Sudavici* amore *Succina* detineantur; Situm eſt Litus in iſta parte, quæ *Sambia* vocatur, a novo Tranſitu *(Neve Tiff)* ad Tabernam *(Vrantz Vrug.)* decem *Milliarium* ſpatio. Regia hæc *Succinorum* ſedes, *ſeptem Receſſibus* vulgato Angulorum vocabulo, Antiquitus diſtinguitur: *Krecke*, *Nodums vel Nodems*, *Laſsnicken*, *Kuckſe*, ſive *Kuyck*, *Palmenick*, *Nempe*, *Thierskeim*; Noſtra Ætate non *Nempe*, ſed *Kraydepellen*, ſive *Crapellen* inter *Palmenig* & *Subenig*, tum *Bruſter* magis quam *Dirſchkeim*, & præter hos alii accenſentur. Litus omne altis Montibus præcingitur, Mari Vadoſo; a Primo Ingreſſu Trium Quatuorve, mox Triginta aut Quadraginta Orygarum, poſtquam progreſſus fueris Profunditate minori, pergendo longius rurſus Altiſſima; ut Brevia ſive Syrtes intelligas, quæ Litus *ſudavicum*, hujuſque *Receſſum Bruſteram* adprimè Naufragiis infamant. Prærupta & ardua *Receſſum* Juga, quædam lentius attolluntur, verſus *Pillaviam* in Planitiem deſinunt. Solum minus firmum; alicubi latentium Aquarum Commeata fallax, in tantum ut quaſi Voragine Equi & Homines abſorpti memorentur; maximam partem ſabulo tegitur, aliquot Areolæ Herbis inveſtiuntur, *Petaſite*, *Eryngio*, *Lappa*; raris Arbuſtis aut ſenticetis, quæ tamen ad *Bruſteram* ſilveſcunt; eademque cum parte Montis aliquando ſubſidunt, Rupes nullæ, nec ſaxa, præterquam ad Radices Montium: Aquæ ex ſummis jugis paſſim dimanant, quæ inferius Alveis collectæ Rivulos imitantur. Iſta Exteriori facie Litoris *Sudavici*, Interranea Mineralibus abundant: *Vitrioli* non una comparet ſpecies: Alibi Niveis ſtriis, Terra Nigra interjecta, ſtratum ſuper ſtratum alicubi Fuſum Vitrum, Ligneis Fibris hinc inde interlucentibus, præſentat; alibi Terræ Micantium Pulviſculorum inſtar eſt admixtum. Præter *Vitriolum* Corticoſa Terra, qua integri Colles exſurgunt, & Lignum quod Litoreos Montes longo tractu medios dividit, ſunt conſpicua; tum terra flaveſcens, quæ *Ochram* æmulatur, & Lutum Cæruleum, certis Intervallis per Litus expanſum. Ex Lapidibus memorabiles *dactyli fidei (Alpenſchoſs)* inter ſaxa & Arenas diſperſi, ſed & ex Montibus effodiuntur: Saxa Mari vicina alia parte duriſſima, alia friabilia viſuntur: Petrefacta quoque Ligna Lapideſque *Alga Marina* Tenui Folia & veſiculari luxuriantes inveni: Mitto varios Luſus Naturæ in quos incidi. Præter vulgares Lapides, & *Adamantes*, & *Jaſpides* hoc Litus quandoque

profert. Camporum Vicinorum ſterilitas ſumma; ſilvæ Raræ, Pineæ nullæ. Illud adjiciendum, quod *Phocarum* Greges apricantes, in Scopulis & Collibus vadoſi Maris colludentes, ſæpius ſe conſpiciendos præbeant.

Litus hoc quidem inter Arenarum Lapidumve a cervos *Succina* monſtrat, ſed in his non Generari manifeſtum eſt: Multò minus ex Algâ Marinâ natales accerſendi, licet huic involuta ad Litus propellantur. Et quum intra Viſcera Montium Litoreorum ubique reperiuntur, in *Vitrioli* interſtratis *Cryſtallis*; in Terræ Flavæ, in Sabuli, in Luti Cærulei intertexto opere; non tamen in his omnibus prima eorum ſtatuenda Incunabula. In *Vitriolorum*, Terræ Flavæ & Sabuli partibus raro eventu *Succina*, eaque Minuta & ignobilia deprehenduntur. Cærulei Luti ductus nondum ita Experientia patuêre, quod in acceſſi; quamvis Egregia & Numeroſa *Succina* fovere à Colonis tradantur; mihique diffractâ Luti Glebâ, Nativus Fœtus *Succineus* animadverſus, quem Tenui Cortice obductum, Colore Fulvo dilucidum, inter Cara Naturæ *Succinea* munuſcula Muſæum aſſervat.

Quum autem Corticoſa Terra, & præter hanc Lignum Litus *Sudavicum* diſcriminent, Lignum quod Montes interſecat *Succiniferum* eſſe, ut quod maximè, multorum Annorum Experientia firmat. Hujuſque Ductum Foſſores indagant & obſervant, nunquam irrito Succeſſu, quouſque inſtabile ſolum ipſorum operas progredi permittit. Terra Corticoſa *Succina* exigua complectitur; minuſque ſolida, & ingrati Coloris. Lignum autem minimè ab Arboribus eſt Arceſſendum; ſiquidem tam vaſtos Truncos Arboreos, qui proſtrati plurimarum Orgyarum Longitudine & Latitudine Fibras ſuas extenderent, nuſquam Orbis vidit. Neque Arboreis Lignis ſimile eſt: quippe, quod nec Medullæ Intimæ, nec Corticis Extimi, ullum præbet indicium; Ramorum quoque Divaricationibus ac Nodis, Foliorumque Germinibus, prorſus deſtituitur; neque Fibras mutat, ſed eaſdem quavis ſui parte retinet: mitto quod Compagem Ligneam referens non tamen orbiculatim concreviſſe cernitur, ſed planiori ſpecie.

Atque Curioſi jam diu Ligna *Subterranea* mirari deſierunt, poſtquam plures *Europæ* Ditiones iſtiuſmodi, è Terra eruta, ipſorum Cenſuræ ſubmiſerunt. Ducatus *Spoletani* ſivæ *Umbriæ* fodinarum Lignum elegantiſſimum undularum, in quo & Artificium ingenia ſe exercere poterant, *Franciſcus Stellutus Lynceus* deſcripſit, inventore Duce & Principe *S. Angeli Friderico Ceſio*; ejuſdem & P. *Kircherus* meminit. Aliud *Germaniæ* Foſſile Lignum, Solertia D. *Pillingen* in *Miſnia* detexit, qui & Erudito Commentario Generationem illuſtravit. Tranſmiſſus mihi *Lunenbergenſis* Ditionis Subterraneus Fœtus Ligneus, *Pruſſico* Solidior & Ponderoſior. Lignum vero quale Litus *Sudavicum* profert, & alibi locorum, in *Pruſſia* Interiori, una cum *Succinis* erutum, ex complurium Amicorum literis fide Digniſſimis reſcivi: Graveſque mihi Actores *Bartholinus* & *Borrichius*, qui Cortices & Ligna ex Foſſis *Hafnienſibus* iiſdem, ex quibus *Succina*, non exigua Quantitate educta atteſtantur; felixque Capturæ indicium in Litore *Neringæ* ex adnatantibus Fragmentis capitur.

Matricis autem hujus, Experientiâ Duce, iſta indagavi Initia ac Rudimenta. Colliculi in Litore *Sudavico* hinc inde, imprimis an *Kraxtepellen*, procul Terra congeſta, ubi propius acceſſeris Cumuli Coacervatorum Corticum videntur: Superior pars, ſicubi a Sole ex ſiccata fuit Griſeis, his autem remotis, piceæ

Nigre-

Nigredinis, magnis & levibus nitidisque Crustis concretam offert Terram, quam si Cultro secueris, multorum molliſſimorum Corticum Compagem conſpicies: Ad Radicem istorum Colliculorum Uda Terra, Glutinoso ac Tenaci Liquore cohærens, Manuum Digitorumque impressorm Vestigia exacte refert, sed ut & Tangentes denigret. Talem Corticosam Pinguem Colliculorum Terram *Ligni Fossilis Prussici* judico Primordium: Neque Lignum nisi Siccitate, & qualicumque Soliditate, quâ magis compactum longiori Fibrarum Protensione, continuâ cohæret, a Corticibus istis differt. Corticosi enim Colliculi ab Uda Tenaci Terra nascendi Originem sortiuntur: Hanc postquam Maris Salsugo aliis *Subterraneis Salibus* admixta maceravit ac subegit, secedente Humore superfluo, Aer aut Calor Solis exsiccat; Siccitate verò à se invicem secedunt partes, quarum Pinguedo exhalavit, aut intus concessit; aliæ quæ Glutine hoc abundant, mutuo, licet in Crustas compactæ, cohærent, Speciemque Ligni referunt ubi justa Siccitas, qualicunque multarum Crustarum Cohæsioni Lignosam Formam conciliavit. Bituminosam verò Corticum & Ligni esse Naturam non solum Terrestris Pinguedo, sed & Examen ignis monstrat; accensa enim Fomitis instar Serpentem Ignem propagant, Sulphurque Naribus afflant; & Destillationi exposita, uti inferias traditurі sumus, aliquot Oleosas particulas, *Olei Petræ* simili Odore, dimittunt, præterquam quod Liquor Destillans *Succineum* Pingue quid exhalet. Post Bitumen Corticum & Ligni Generationem Salia Subterranea promovent; ab his enim Siccitas, & Crustarum Species deducenda intimè enim Lignis & Corticibus adhærent, *Vitriolum* superius disseruimus, quomodo Cortices undique ambiat, atque cum illis concrescat. Aliorum Salium non ita manifesta est Demonstratio: Deprehendi tamen in Siccissimorum Lignorum Corticosæ Compagis Interstitiis, scintillantes salinas Stellulas & Fila splendentia, quæ *Vitriolum* minimè referebant, insipidæ enim prorsus, aut subdulces, leniſſimè adstringentes: Aquâ affusâ eduxi illas stellulas, *Lixiviumque Aluminis* aut magis *Martis* subdulcem saporem prætulit, ut tamen *Vitriolica* Virtus extremum perciperetur, quæ inspissato *Lixivio* evidentior, aliquo tamen Subdulcis *Aluminosi* aut *Martialis* Saporis sensu. *Nitrum* quoque sub hoc Ligno latens olim detexi, Forti *Lixivio vitriolicis* particulis segregatis; quamvis ipsi *Vitriolo Prussico Nitrum* videatur admixtum: forte & stellulæ ac Fila salina per intimas Ligni Fibras diducta, *Nitrosæ* sunt Naturæ. *Alumen* quoque in Crystallis *Vitrioli* latet, si non prorsus *Alumini* vindicandi, quos *S S S* componere asserimus, quique *Amiantho* aut *Alumini Plumoso*, similes conspiciuntur; Acidulus enim horum sapor, ad illum Salis *Succini* volatilis proximè accedens.

Matrice cognita, quibus *Bituminis* & *Salis* Virtutibus sit impregnata, facile est conjicere quomodo *Succineus* Fœtus *Prussicus* intra illam concipiatur. *Prussiæ* Solum undiquaque *Bituminosum* cogita; insignes enim Glebæ *Bituminis* condensati in abditis Terræ aut Luti aliquoties a Colonis casu deprehensæ; ipsemet aliquot *Librarum* Frustum non procul a *Regiomonto* ex Limo eductum conspexi, quin *Olei* rivos ex Terra dimanasse, non vanâ Famâ accepi. Cespites vero *Bituminosi* ex pluribus Locis effodiuntur. *Bituminoso* itaque Litoris *Sudavici* Solo, Calor Subterraneus, quicunque iste fuerit, *Bituminis* exhalationes per interranea dispersas, undique consociat, & in Guttas cogit, præprimis ex Corticosa aut Lignosa Matrice easdem congregat; quod dum agit, simul vi-

cina

cina *Salia* pervadit, ipſorumque Effluvia ſecum abducens *Bituminoſis* Guttis immiſcet; *Salina* ſpicula intra Matricem adacta Fluorem *Bituminoſum* ſiſtunt, & ſi nullæ Suppetiæ *Bituminoſarum* Guttarum a Calore ſubmittuntur, Gleba pro Modulo incunabili, quod intra *Lignum* ipſi conceſſum, formam ſubit, omnique Exhalationum motu ſopito, Caloreque evaneſcente, *Salinæ* particulæ Rigorem recuperant, *Bituminoſis* ſuperfluum Humorem exhalantibus; Sociatæq; *Succineam* Gemmam producunt; Nitidiorem, Splendidiorem, Fragrantiorem, Firmiorem, ex Puritate & Proportione exhalationum *Bituminoſarum* ac *Salinarum*. Hæc vera *Succini* eſt Generatio, quam ante nos nemo Erudito Orbi Perſpicuam reddidit.

Aliquibus tamen is ſupereſt Scrupulus, an eadem *Succinorum* quæ Mare ejicit, Generatio ſtatuenda? Verum cum in Vulgus hic locorum jam Notum ſit, ex Collibus Marinis Tempeſtatum vi disjectis aut convulſis *Succina* prodire, quæ a Fluctibus ad Litus advolvuntur, Capturæ fructuoſæ, aut inanis, ex Collium iſtorum Divulſione, leviori aut profundiori, ſumpto Indicio; Qui, inquam, cum Hauſtilia *Succina* intra Colles Generari certum ſit, alius Modus intra hos Generandi reddetur vero ſimilis? Sane in Collibus *Submarinis* non minus quam in Littoris Naturæ Officina erit inſtructa: addo, quod inter Ejectamenta Maris & *Lignorum Foſſilium* copia in Littore *Sudavico*, æque ac in *Neringienſi*, reperiatur: quid ſi Colles Alluvionibus obtecti, qui quondam Terræ Pars fuerunt? Si quoq; in Collibus ſubmarinis reliquorum Mineralium eadem *Generatio*, cur non & *Succinorum*. Cæterum ſicubi extra Matricem Lignoſam, in Luto Cæruleo, in Terra Corticoſa, Flava, Sabuloſa, Vitriolica, *Succinum* naſci contigit, ne tunc quidem alia Ratio *Generationis* Suberit: pariter enim ex Bituminoſis Exhalationibus in Guttas condenſatis *Salium* juſtâ Miſcelâ, iſtæ Glebæ pronatæ fuerint. Neque tamen ubicunque reperitur ibidem & Nativa *Succina* ſedes illicò aſſerenda, per Maris enim vehementiam à Matrice avulſum in aliena loca ſæpè rejicitur. Quin & Animalium ventriculis recondita *Succina* novi; viſceribus patefactis exempta Amici Dono miſerunt: nec tamen in Animalibus *Succina* Generata dicemus. Ex Accolis Litoris *Sudavici* addidici, omnis Generis Animalia, Terreſtria, Aquatilia, Volatilia, avidè *Succineas* Glebas deglutire, adeoque intra Mactatorum Viſcera non raro obſervari. Corvi & Cornices tanta Copia ingerunt, ut egerere rurſus veſperi cogantur & Minutiæ complures ſub Arboribus, in quibus conſident, inter Excrementa reperiuntur. Ab Aſellis (*Pomucheln*) deglutitæ plures mihi obvenere, inſignior trium *Digitorum* Tranſverſorum Longitudine, duorum Latitudine ſpectatur. Eſt ex Ove Globus *Succineus* Mirabilis, quem Cruſta Gypſea Mucus Ventriculi obvelarat, quâ ab *Electrotoreuta*, imprudenter ab raſa, patuit ex pluribus Glebis, a Calore Animalis ſubactis, fuiſſe formatum.

Et Mare & Terra itaque in *Pruſſiam Succinea* Dona confert: ſed Maris Dona partim in Litore leguntur, partim ex Aqua hauriuntur: Vadoſo *Scil.* Mari, ſignis apparentibus, Coloni Reticulis Conto affixi Fundum verrunt, aut Fluctibus volventibus eadem adverſa opponunt; hæc quæ Hauſtilia: reliqua, inter Ejectamenta, quæ natantia prædæ Indicium faciebant, Algarum, Sarmentorum, Lignorum, aut Arenarum, ſedulò inveſtigantur & ſeliguntur, lactaque audiunt.

Ex

Ex Terra vero, quæ fodiendo acquiruntur, Foſſilia appellantur: Amam longiori Conto præfixam venæ in Montium Litoreorum jugis conſpiciæ, admovent, tentando ſicubi Glebam Ligno immerſam offendant, qua animadverſa Lignum leniter radunt, amaq; ſubjecta Glebas excipiunt, exceptaſque adducunt ſacculoque a Collo pendulo indunt. Foſſio vero ad Venarum ductum Priſcis ignota Magni *Frid. Wilhelmi* auſpiciis primum Montes Exercuit. Nec tamen ubique Foſſioni patet Litus, ſed certorum *Receſſuum* juga iſta opera fatigantur; *Eroſs*, *Gubnicken*, *Ekroſs*, *Dirſchkeim*, *Warnicken*, *Strobſchnec*, *Palmnig:* & ſicubi Matrix Lignea ſe conſpiciendam præbet, atque ad eandem facilis ac tutus eſt Aditus.

Succinum uti ex Matrice producitur, quod in Foſſorum operas intentus ipſemet expertus ſum, Rigidum & durum tactu dignoſcitur: Contingit aliquando Frangi dum protrahitur, ſed vitio Glebæ; *ſuccinum* enim *ſuccino* Duritie præſtat. Non pauci tamen & Priſco & Noſtro ævo *Mollia* ac Liquida, quidem ab altera parte Dura ab altera Mollia *Succina* ſibi viſa jactitarunt: Quæ mihi iſto nomine Oblata, nec Fragrantia nec Sapore, nec Deflagratione, ſe *Succina* probarunt; caſui itaque inter Hauſtilia reperta *Bitumina* iſtis Auctoribus in *Succineum* Cenſum referre placuit. Verum & Picea Gleba, & Carbo Foſſilis, & Segmentum Picæ navali abductum, aliaque plura una à Fluctibus Maris in Litus projecta, iſta ratione *Succinei* Cenſus habenda forent. Opinio, quæ in Fundo Maris ſcaturiginem *Liquidi Bituminis* commenta eſt, ut a ſalſugine Maris Coagulatum *Succinum* haberet, *Mollia* iſtiusmodi *Succina peperit*: Neque Hauriendo, neque Fodiendo, neque Legendo, ſibi *Mollia* cognita, illi qui Rerum *Succinearum* aſſiduam Curam gerunt, aſſeverarunt omnes. Ipſe, Magnos *Succinorum* Rudium acervos perſcrutatus ſedulo, nullum *Molle* adverti, quod Virtutis Experimento *Succinei* Generis agnoviſſem. Vulgo perſuaſum eſt, Diſcrimen Foſſilia & Hauſtilia intercedere Duritiei potiſſimum, & Puritatis, ac Cruſtæ diverſis Notis. Verum falluntur, qui iſtud in Animum inducunt ut Credunt: Evenit ut extra Matricem alienis in locis ſepultorum Robur aut Calor aliquid vitii contrahat, craſſiori etiam Cruſta ſuperinducta; hi tamen Caſus Nativorum differentiam minime inferent: Æque intra Colles ſubmarinos, ac intra Litoreos, pro varia *Bituminis* & *ſalium* Copia ac Virtute Nobiliora & Ignobiliora *Succina* Generari certus ſum.

In Glebis *Succineis* Formandis mirum Naturæ elucet Ingenium: ut in lucem eduntur, Pira, Amygdalas, Cepas, Piſa, aliaſque Fructuum ſpecies, aut peregrinorum Corporum ſimulachra, vario Luſu referunt; Guttarum his apud *Electrotoreutas* Nomen, quum Globoſam Figuram maxima ſui parte exprimant. Major Pigmentorum in Cruſta denudatis admiratio. Literata Naturæ *Succina* plura vidi: Teneo in quo Albeſcens Linea Flexu ſuo concinne Literam S. *Latinorum* formavit, reliqua fruſti facie flava: *Arabum* ac *Hebræorum* Characteres quædam ruditer exhibent. Præterea Arbuſcularum, Frondium, Nubium, Ruderum aliarumque quarumcunque rerum Delineamento in *Succino* Variegato curioſus Oculus advertet. Eſt mihi Pectore tenus efficta ſenilis Imago, in ulna infantem reclivem monſtrans;

monſtrans ; *Jeſus* parvulus in *Simeonis* amplexu hærens animo obverſabatur, quando primam hanc Naturæ Picturam intuebar.

Cæterum & quæ *ſuccinis* Concreta adhærent, memoratu non indigna puto: Inter hæc Algæ viſicularis & tenuis Foliæ Rami, radicibus firmiter infixis, ex *ſuccineis* Glebis propullulantes inveniunt locum; tum ſilex parvulus, eminentiori libera, latiori parte *ſuccino* obvoluta: Alii Glebæ Lumina ferrea agglutinata eſt: Et Segmenta Lignorum, Conchylia, variaque alia adnaſci contingit.

Animalculorum *ſuccinea* Funera, jam *Plinio* & *Martiali* celebrata, intentiorem Curam expoſcunt; ultra Triginta ſpecies Inſectorum in meis *Succinis* numero; Muſcas, Araneas, Culices, Formicas, Papiliones, Apes, Millepedes, Teredines, Curculiones, Erucas, Scarabæos, & ex Cornutis & Deauratis aliquot; & quorum nomina memoriam ſubterfugiunt. Sunt qui & perfectiora Animalia *Succino* condita memorant, Ranas, Lacertas, Piſciculos; Quibus ut fidem habeam ægre a me impetro. *Hermano* decantata Ranæ & Lacertæ ſepulchra non uno modo mihi ſuſpecta redduntur. Piſciculos fraude Artis *ſuccino* incluſos, jam aliis animadverſum eſt. Nativa Animalculorum *ſuccinea* faretra ab Arte elaboratis, illo maxime diſtinguis, quod in iſtis non procul a ſuperficie, inſecta implicita reperiuntur, in his vero meditullium occupant; *ſcil.* Artem non ita feliciter occultarent *Electrotoreutæ*, ſi extimas partes excavarant, illiſque Animalcula crederent, Tranſlucida enim *ſuccinea* Lamina fraudem proderet. Si quoque ſolidum, Purum, nullis Fiſſuris hians, nec Cruſtarem Compage diſtinctum eſt *Succinum* in quo ſepulta ſunt, illud non a Natura fabrefactum ſcias monumentum; Pleræque enim Glebæ *Succineæ*, quibus Animalculorum Exuviæ ſunt repoſitæ, id quod Millies contuitus ſum, corticatim cohærent, aut Fiſſuris hinc inde ſunt interſectæ, ex quibus & pars Exuviarum aliquando exterius conſpicienda prominet. Neque omnium intra *ſuccinum* reconditorum Animalculorum par eſt Conditio: Alia ſitu obducta, alia nitida, quædam *ſuccineo* fulgore ſplendentia intueor: Duas Apes & Erucam Nidumque Curculionis ſitus obtexit; ſcarabæus fulget; ex Muſeis quædam nitent. Porro alia Vivacitatem, alia Languorem præ ſe ferre; nonnulla quaſi Evigilantia, cum Conatu vinculo iſto ſe extricandi, conſpicies. Quædam *Succina* Integrum Examen Inſectorum, & ejuſdem & diverſi Generis, involutum, commonſtrant.

Vexata hinc Curioſorum quæſtio, quomodo *ſuccinum* Animalcula oppreſſerit? Non pauci Difficultate Quæſtionis permoti Fœtum Arborei ſuccI *Electrum* contendunt, quaſi Reſinis aut Gummi Arborum adrepentia Animalcula irretirentur facilius: Verum abſque Experientiæ ſuffragio; neque in Reſinoſis aut Gummoſis Stillis hunc in modum, ſi recte memini, incluſa Inſecta magno numero; ſi modo ullo, Curioſitas hactenus detexit; extrinſecus adhærentia conſpeximus, non ita Fuſo Liquore obtecta. Alios Gravitas Argumenti eo adegit ut negarent eſſe quæ in *Succinis* videntur Animalcula; Phaſmata Ludos iſtos dare. Sed Fractorum aut ſectorum inſpectio hos refellit, manifeſta enim Infectorum ſuperſunt Indicia; licet enim Corpulcula Animalculorum vis *Bituminoſa* ita ſubigat, ut Fibris *Succineis*,

cinis, intercurrentibus viſcera condenſata in Lapidem Indureſcunt, quando facilis per Rariorum Texturam Inſectorum Effluviis *ſuccineis* eſt Commeatus, tamen Corporis alieni haxitum luculenter diſcernere datur ; Apumque noſtrarum Exuviæ, interaneis conſumptis, iſtud ob Oculis egregie ſiſtunt.

Funeſtos itaque Caſus, quibus Inſecta a *Succinis* ſunt oppreſſa, ut rectius percipiamus, repetendum memoria, quod Inſectis uſu veniat, ſi quando Tempeſtatum aut Hiemis Injuria compelluntur, Cavernas & Latebras ubique quærere, inibique ſomno ſepulta deliteſcere. Quare cum & Litorea Latibula non unum Genus Inſectorum ſubintret, in illiſque aliquando hæreat invitum, aut obdormiſcat, Exhalationibus *Bituminoſis* a Calore Subterraneo in laticem collectis, ubi in Matricem *Succini*, quæ Latibulum ac Dormitorium interea præbuit, Liquor deſtillat, eadem implicat & obtegit, Gremioque ſuo ſuſcepta, quando *Succinum* evaſit, commonſtrat. Contingit Beſtiolas in Dormitoriis iſtis a Calore Subterraneo excitari ; aut in vivas Fluor *Bituminoſus* impingitur ; ſed cum nullum vigilantibus patet Effugium, eandem cum Dormientibus ſortem ſubire coguntur, ut tamen ſortis tunc ſuæ in Sepulchris *Succineis* relinquant memoriam, Vivaciori, atque Animoſiori corpuſculorum Simulachro. Firmat Noſtram Sententiam iſtud, quod *Succino* ſepulta inſecta pleraque ſint ex illorum Genere, quæ Cavernas in Dormitorio eligunt: Majorem partem etiam languida ac ſomnolenta, aut mucoſa tranſparent. Vivacia, quæ cum Niſu obluctantur, aut Alas expandunt, abitumque parant, rariora puta ſed tantam Vivacitatem, quæ Amoris Æſtu in Coitum Animalcula concitarit, ut iſto nexu cohærentia *Succineus* Latex involviſſet, Hoſpitio huic Subterraneo minime convenire autumo; Quare quæ Culicum Muſcarumve iſtos Hymenæos oſtendunt faretra ſuſpectis ad numero.

Specioſiora alia nunc depromam quæ Plantarum Germina ſinu ſuo obvelant. Eſt mihi in quo explicata Algæ Veſicularis Folia Alas Aquilæ expanſas & Pedes cum corpore utcunque adumbrant. Aliud Semen Tiliæ, ſtipitiſque partem ; aliud Folliculum, diductis Foliis hiantem, quatuorque Semina complexum, ex quibus Apex medius exſurgit, Caulículo ad Superficiem protenſo & prominente ; eſt quod Muſcum, in Pergule. S. Porticus Hortenſis ſpeciem, Fornicatis Operibus compoſitum obtutui ſiſtit. In alio Floſculus minimus marceſcens, in altero Roſmarini Sylveſtris, *Pruſſis Korbl* dicti Ramulus tribus Foliis diviſus Tranſparent; Rude aliud Algæ memoratæ Veſicularis Ramum majorem per Corticem non politum oſtentat. Plura ex Muſco villos disjectos obtinuere: Nobile autem illud, in quo pars Albeſcens Convallem & Colliculum Muſco inveſtitum exhibet, ſed per Speculum quaſi, quando ex Flavo Ignei Coloris *Succino*, huic ameniſſimo Spectaculo mirabili Naturæ Artificio quaſi Vitrum eſt Objectum, per quod Muſcoſi apparatus delicatior eſſet aſpectus: Nec vile alterum Aqueo Lacteſcentis Coloris, quod Villorum Muſcoſorum criſpata Congeries nobilitat. Spectabiliora hæc Herbarum *Succinea* Monumenta quam illa Animalculorum cenſeo. Major Copia Corticibus, Lignis, & Feſtucis intertextorum ; Feſtucæ Pineæ videntur, ſpecie iſta-

rum quibus Formicæ acervos extruunt; Verum accuratiori Examini Fossi Ligni ac Corticis monumenta patuerunt.

Ex Minerali Regno quoque adducenda, quæ *Succinis* inclusa: *Vitriolum* sæpius sapori promptè dijudicandum; *Pyrites* quandoque, crebrius *Ferrum* de quo *Electrotoreutæ* conqueruntur, quod non nisi cum Detrimento Instrumentorum educatur: Armatura quoque *Aurea* & *Argentea*, divulsis coagmentatis partibus, in impuro conspicitur. Sed & *Aquæ* Guttas intro receptas diversis Alveis stagnantes *Succina* detinent: qui effluit Liquor Salsus aut Subsalsus, aliquando & insipidus, Non Exsiccari, ab aliis cum Luna Crescere & Decrescere Liquor traditur; habeo in quo Exsiccatus est; habeo in quo Perennat semper idem. Quæcunque autem ex *Plantis*, *Mineralibusve Succinum* complectitur, casu haud absimili, dum in Matricem illapsa sunt, a Fluore *Bituminoso* obsessa atque occupata intelligo. *Aquearum* Guttarum intra *Succinum* occlusarum singularis Ratio cogitanda: Udam Matricem calida *Bituminosa* Exhalatio obsepsit, intro compulsa *Aqua* à Calore Subterraneo consumi nequiit, & ob Copiam Circumstantis *Bituminosi* Laticis nullam Rimam quâ diffluëret invenit; præcluso itaque Exitu, captiva se includi passa est; Conatum elabendi, quando in Arctum coacta fuit Gutta, manifestis Indiciis quædam Glebæ produnt.

Fossile Succinum Declaravimus; *Metallis* tamen non esse accensendum, vel illud arguit, quod nec Ductile sit, nec Liquabile; sicubi enim in Fluorem deductitur soliditati ejus multum decedit, contra quam *Metallis* evenit. Fuerunt qui *Succinum* Fundendi, & parva frusta in unam Molem salva Firmitate uniendi Artem se tenere asseverarunt. Ego variis Experimentis, dum Fusioni *Succini* operam dedi, frustra istud tentare didici, siquidem salinum vis, à qua maximum *Succinorum* Robur, inter solvendum avolat; nec a Fuga retinetur, nisi addito aliquo; eo ipso tamen Soliditas corrumpitur. Quod si Calor tam Blandus admoveri posset, qualem Natura in Animalibus Humente Vapore miscet, non desperandum Arti putarem; Globus enim *Succineus* in Ovis Ventriculo repertus ex pluribus minutis coagmentatus est, relictis junctur æ ubique Vestigiis; quæ ipsa nec Fusorium, sed Tepidum Glutinandis commodum, ignem a Natura adhibitum fuisse indicant. Fusa *Succina*, quibus Sceleta obducta atque *Succinea* Funera venditata, Vernix sunt, uti Amicissimus D. *Vogeding* optime monuit. Solvi olim *Succinum* & Liquefeci, solo Ignis adminiculo, nulla alia re admixta, sed fragilius justo comperi, imminuta Coloris Gratia, Salinis Minutiis quæ Lateribus Vasis adhærebant causam reddentibus. Multô minus ad *Terrarum* aut *Salium* Classem *Succinum* referendum erit; quum *Terris* Arctius coalæreat, & *Salibus* sit Pinguius, utriusque etiam humidius. Ad *Bitumina* & *Sulphura* propius accedit; Ut tamen Durities ipsum ab his discriminet, tam Dura enim ac Solida pura *Bitumina* aut *Sulphura* nemo indicabit.

Durities vero *Succinum* inter *Lapides*, Splendor inter *Gemmas* collocat; neque Fragilitas objiciatur; Fragilis & *Gagates*; *Gemmæq*; *Gemmis* Solidiores, nec tamen propterea Loco moventur; *Electrotoreutæ* satis Dura *Succina* experiuntur, *Alba* in primis, ut Ferri aciem hebetent; Tormentaque

taque & Mortaria Ludicra, à Pulveris Pyrii Explosione illæsa, Soliditatem docent. Summa etiam *Succini* ex Duritie & Soliditate Gloria: facessant itaque Friabilia ac Fragilia, quæ Ignobilitate contempta ab Arte rejiciuntur. Sed Virtutum, quæ *Succinum* à reliquis *Gemmis* discernunt, præcipua Antiquis visa *Attractiva*, ut *Electrica* ipsis vocarentur Corpora, quæ facultate Trahendi quidpiam ad se pollerent; & celebre hujus Virtutis Nomen *Platonis* etiam ingenium in explicando exercuit. Recentior ætas, quæ res Naturales intentiori *Experimentorum* Curâ explorat, aliis Gemmis, Lapidibus, Vitris, Bituminosis, Resinosisque, Sulphuri, Asphalto, Laccæ, communem vim *Attrahendi* advertit. Reliquis tamen *Gemmis* fortius *Succinum* attrahet, ut quod attritum pinguia Effluvia eaque Tenacia copiosius emittit: Virtutem enim hanc Oleosis Particulis adscribendam persuasit *Experimentum*, quod de Colophonia gemina cepi; altera enim post Olei destillationem excepta pariter se *Electricam* adducendo levia probat; altera verò, quam post Balsami Nigri Liquorem exemi, licet Nitida & quasi Vitrea esset, nullam Vim *Attrahendi* exserebat: Nimirum illa, aliquid *Pinguedinis* retinuit, hæc vero *Capitis Mortui* instar omni *Bituminosâ Pinguedine* prorsus exuta fuit. Veteres quædam exceperunt, quæ non adduceret; *Sympathiæ* & *Antipathiæ* Miraculo: perperam admodum, siquidem & Ocymum & Oleosa & Humida, ipsasque Aqueas Guttas à *Succino* Attrahi pro lubitu demonstro, insigni & polita Gleba admota; eleganti spectaculo, quando Effluviis ingredientibus Gutta, in Bullam adsurgit, aut quando Pendula transilit. Sed & in Corpus Humanum hâc Virtute *Succinum* agit: Frusto Cervici alligato partem, quam leviter attingit, leni Sudore Humectam Tactu percipies. Il. *Boyle*, *Angliæ* imò *Europæ* Eruditæ maximum quondam Decus, enarrabat & incredulo mihi asseverabat, Illustris Prosapiæ Virginem Globulorum Grandiorum lactei Albescentis Corollâ ita affectam, ut Os in Tremorem & quasi Spasmum ageretur, quoties Collo suspensam gestaret, remotâ verò Corollâ Tremorem cessasse & Convulsionem. Efficaciam autem *Attrahendi* Humores in *Fonticulis* quidam Globulis *Succineis* persensere.

Propria *Succino* est *Fragrantia*, qualem nulla *Gemmarum* exhalat; neque ex reliquis Naturæ Fætibus, Aromaticæ sortis quidquam parem Odorem spargit; non *Thus* non *Myrrha*, non *Camphora*, nec *Mastiche*; in resinarum intra Formicarum acervos abditarum Glebulis imitamentum habes Odoraminis, sed ut in Attritis & Accensis Discrimen se prodat illicò. Diversus est Flavorum sive Igneorum ab Albescentibus Odor; illorum Pinguia, adeoque Blandiora, horum salsa & Acriora sunt Effluvia, quæ haud similiter Nares afficiunt. Peculiaris quoque inter Gemmas *Succinis* est Sapor; sed & hic variat, uti Oleosarum & Salinarum particularum variat Miscela; Alba Fibras Linguæ pungunt, Flava non item. A plerisque Gemmis & Colorum varietate differunt: Nigrorem refugiunt; Opaca rara sunt reperta; superant inter Pura Pellucida. Denique levitate Parem vix nominabas Gemmam.

Princeps Virtus Corporibus Animalium mederi, ad quam Gloriam nulla Gemma æque accidit: Crudum citra Artis operam est Salutare, sive intus sive extus applicetur, *Indis* & *Chinensibus* suffitus in Delitiis habetur, ut in Luxum degeneret: Sed *Catarrhis* ex Pituita Suffimentum prodesse vulgus notavit; Exhalationibusque *Succineis Alexipharmacis* acceptum quondam tulerunt *Electroto-*

reutæ Regiomontani, quod ipſe à Peſte manſerunt intacti: Certe non efficacior adverſus *Contagiæ* Suffitus, quam ex *Succino*; Neque ulli ex Fodinis Litoris *Sudavici* Graves aut *Peſtilentes* erupere unquam Vapores. Fluxionibus Capitis Alba perpolita *Succina* ſunt proficua, Cervici alligata Humores avellunt; Blanda quoque Oculis Flavorum affrictio; & Fonticulis *Succinei* Globi lenius induntur. In Pulverem contuſum ad Urinam Ciendam, ad Calculum propellendum, ad Muliebris Sexus Menſtruum Profluvium movendum, multum valere, ſi cætera ſunt paria, quotidiana loquitur Experientia. Dono à Generoſa Domina acceperam Calculum plurium *Unciarum*, duos Articulos Digitorum & ſupra Latum, tres longum, quem carnificem Ruſtico in Sinu Pudoris tres Menſes paſſa erat; dato *Succini* Albi Pulvere, Cochlearis Menſurâ, feliciter carnificinâ liberata eſt; ipſam Aniculum ad me adduci curavi, ut omnia exquirerem accuratius. Pariter *Succini* Pulvis, Vino infuſus, hinc ſub operculo incoctus, calido Vino epoto, & Urinæ & Calculo, & Menſibus trahendis inſervit, quamvis minus efficaciter. In memoratos *Uſus Medicos* præſtat Album ſumere; Salis enim maxima in his enitet Virtus.

Magiſterium Reſinoſum ſalubriter Pilularum Formâ uſurpatur, nec *Balſamo Copaitæ* cedet; ſive Urina cienda, ſive Pituita digerenda, ſive Gonorrhæa temperanda: Idem Cephalicis Emplaſtris convenit. Colophonia Diaphoreticis quibuſque & Stomachicis Emplaſtris Congruit; Commodo maximo ſi adverſus *Paralyſin*, *Apoplexiam*, aut *Epilepſiam*, aut etiam *Gangrænam* muniendæ ſunt Partes; Sumptu minori: Debilitatos ab *Arthritide* Artus benignè fovet. Oleum *Succini Europæ* & *Aſiæ* præclarum præbet Medicamen, ſed imprudentiâ Medicaſtrorum infamiam incurrit; ſiquidem in Gonorrhæa, Calculo & Menſibus Suppreſſis ſæpe in exitium ægrotis ceſſit: Parca ejus ſit Doſis Gutta una & altera aliquot *Drachmis* Sacchari vires impertit; Frigido Pituitoſo Cerebro una Guttula Vertici aut Suturis illita medetur; Goſſypio excepta Auribuſque admota Flatus & Tinnitus diſcutit; ambuſtas Frigore partes reſtituit; Partui difficili fert Opem, quod vel Veterinariis in *Pruſſia* innotuit, quamvis his Pulvis magis in uſu. Oleum autem eligendum quod Aërium, nullâ ab Igne notâ Empyreumatis impreſsâ, Albeſcens, Subtiliſſimum & Fragrantiſſimum. Salis Volatilis *Succinei* contra *Epilepſiam* alioſque Affectus Cephalicos à Pituita oriundos decantata eſt Medicina: Sed & Dieureticum inſigne præſtat. Eſſentia *Succini* eſt Olei ſubtilior portio, adeoque eadem de hâc tibi promittis Commoda, ſed quæ *Spiritus Vini* Mixturâ diluta eſt largius in uſum aſſumi poteſt: valet quoque ad arcendam Gangrenam extus. Sunt qui Phlegma Medicamentis adnumerant: Sed quodcunque ipſi in eſt Virium, Olei atque Salis reliquiis debetur, quibus ſi privatur Fatuum ac Fumoſis Exhalationibus imbutum reſtat. Quod poſtremum Deſtillat craſſum Oleum non niſi vulgo in Frigidorum Artum Medelam conveniet, Empyreuma enim graveolus reddit, ut ſatius eſtimem iſto abſtinere, & Colophoniam integris Viribus ſervare.

Illud unicum adjicio, me juſta Analyſi Ductu Naturæ Pura ab Impuris ſeperando, blando in ſubſidium advocato Igne, vires *Succini* omnes ita coadunare, ut ſalvâ Fragrantiâ Nativâ, Pinguium & Salinarum particularum ſalvâ quoque Efficaciâ, Externo Internoque uſui idoneum Remedium evadat: ***Balſamum Succineum*** voco, in quo remotis Terreſtribus Graveolentibus partibus Volatiliores

liores atque Delicatiores amiciſſimo Fluoris Nexu arctæ cohærent, nullo alieno in Societatem admiſſo. Quicquid à *Succino* Crudo aut Arte quomodocunque Præparato expectari poteſt, citius, tutius et jucundius à noſtre *Balſamo* præſtabitur. Internè formâ Pilularum commodiſſime aſſumitur, aut Boli; Externè Apoplectici, cujus & Colorem præ ſe fert, Balſami in modum applicatur; Gingivis, Linguæ, Palato, in *Deliquiis*, in *Paſſionibus Hyſtericis*, *Epilepticis*, *Paralyticis*, cum fructu affricatur: Prophylaxeos ergò quavis Septimana bis terve *Grana* 5, 7, 10, imo 15, tuto uſurpantur; ſimiliter in Renum, Veſicæ, Genitalium certis Morbis, admixtis Anodynis; contra Tinnitum Aurium quam Oleum affert Medelam, at certiorem. Non malè apud *Hofmannum* & *Ettmullerum Balſami Peruviani* gratia Oleo *Succini* jungitur; Aſt felicior *Peruviani* & noſtri *Balſami Succinei*, adverſus Gonorrhæam & Fluorem Album imprimis, ſocietas erit.

Succini notior eſt Diſtillatio, quam ut deſcribi opus habeat: Et XX & Retorta huic Negotio inſervire valent; verum per Rimas multum Olei & Salis elabitur ſi XX adhibes, Vehementiſſimam enim Olei & Salis vim nullum *Lutum Philoſophicum* coercebit; præſtat igitur Retortæ operâ uti Attendum autem ut Alba ſi ſalis, ſi Olei copiam elicere Satagis, ut Flava eligas: ex ℔j. Albi recepi Salis volatilis ʒſs. quum ex Flavi ℔j. *viz.* ʒj. elicias. Felicius quoque & ſuavius Oleum proveniet, ſi polita Fragmenta, aut nitida, tenui Cortici lucida fuſtra, quam ſi impura, Craſsâ Cruſtâ inveſtita, aut vulgarem Raſuram adhibueris; nihil autem *Succino* eſt admiſcendum, quamvis ſilices & Arenas addere olim fuit in uſu. Abſit Ignis Vehementia; ex Arena Calor leviter intenditur; atque juſto Regimine mox cum Phlegmate ætherea Olei portio aſcendit, quam Limpidam peculiari vaſe excipies; ubi Flaveſcens Oleum prodiit cum ſale Volatili, ceſſet Deſtillatio.

Urgeri quidem poteſt *Succinum*, ut craſſum Liquorem Nigrum fundat; parumque *Capitis Mortui* Nigri & Splendentis inſtar Colophoniæ erit reſiduum, ſed hoc omni Virtute Olei & Salis eſt ſpoliatum; ex ℔ſs. Albi reſtabat ʒj. hujus *Capitis Mortui*. Sed præſtat aliquas Colophoniæ vires relinquere, quando gratior hujus præ Fætido Nigro Balſamo eſt uſus. Sal Volatile, quod ad Roſtrum Vaſis evolavit, aut Lateribus adhæſit, calidâ Aquâ abluitur, atque ut ab admixtis Oleoſis particulis ſeparetur, Charta humefactata ſolutio percolatur, Tranſeunte ſale, reſtitat Oleum: à Solutione percolatâ poſtea Superfluus Humor abſtrahitur, ut tertia pars relinquatur, quæ Frigori exponitur, atque ſingulare ſalis concreſcunt Cryſtalli, Miliares quaſi ſive Grandinoſi. Alius eſt modus Sal Depurandi, ſi feculentum Vitro longioris Colli inditum Cinerum aut Arenarum Calori exponitur; Nives enim Floccis, ſive Spiculis ad ſublimiora Loca evolantibus, in Fundo impurior pars hæret: verum hæc Operatio cum jactura Vitri & Salis eſt conjuncta. Quidem & Phlegmati ſeperando ſtudent, verum rectius hoc cum Aquâ, quæ ſal volatile imbibit, jungitur, ut pariter ſale ſuo exuatur; neque reiterata Deſtillatio illi conciliabit Virtutem, niſi à ſale Volatili illam acceperit; nec Gratus Phlegmatis Odor, ut in Salis Volatilis Conſervationem commendari poſſet.

Accepi

Accepi ex ℔ ß. Albi Phlegmatis ℥ ß. quod Salis *Succinei* ſapore erat imbutum, repetita autem Deſtillatione Fumum ſolum ſapiebat, cætera Fatuum & ingrati Odoris. In Colophonia, ſi non prorſus fuerit exuſto, aliquid Salis latitat, quod ope Aquæ calidæ, morâ quâdam Macerationis educes: nonnullis hoc Sal Fixum *Succini* audit; non rectè, quia Parilis Volaticæ eſt Virtutis, Sapore & Odore eodem: Colophoniæ autem Virtutem hoc quodcunque eſt Salis intendit. Oleum omne, ut alia opera Depuretur non opus eſt, modo *Recipiens* vas juſto tempore mutetur, atque ritè inſtituatur Deſtillatio, puriſſimum ſtatim accipies. Qualitates Olei *Succinei* ex Bitumine ſive *Oleo Terræ* ſunt derivandæ, qua in re Cl. *Borrichio* minimè refragor; ſed quod idem omnes Virtutes *Succinei Petræ Oleo* vult communes, in hoc diſſentio: alteratum enim *Succineum* Odor & ſapor ab illo *Olei Petræ* aut *Terræ* diverſus demonſtrat; at Olei ex *Ligni Foſſilis* Deſtillatione, Odor *Olei Petræ*, non autem *Succinei* Odori congruit: Credo autem alterationem *Olei Terræ* in *Succino* Salium intimæ deberi Combinationi. Quænam vero iſta ſint ſalia determinare non licet, illa ipſa tamen erunt quæ *Succini* ſal Volatile ſuâ miſturâ progenerant. Nullum enim eſt *Succinum*, cujuſcunque ſit Coloris, quod ſale Volatili deſtituatur; atque à Sale volatili omnis iſta Peculiaris *Fragrantia*; quantoque Sale abundant, tanto in attritu Fragrantiora experieris. Ut autem temerarium Naturæ Arcana deſinire, ex *Vitrioli* tamen *Martialis* Corpore ſal iſtud *Succineum* majori ex parte componi citra Crimen Audaciæ aſſero; & enim in Albis Sale Volatili inſigniter pollentibus, & Odore & Sapore Chalcanthum tale manifeſtò deprehenditur. Sed minime communi *Vitriolo* Sal *Succini* adſcribimus; *Vitriolum* Alteratum ſit oportet, quod tale Virtutis ſingularis Sal Volatile producit. Eſſe autem *Vitriolum Pruſſicum* ab aliarum Regionum *Chalcantho* diverſæ Naturæ, Analyſis inferius declarabit.

Certe ab Acido Originem trahere Sal Volatile, Acidus, iſque non ingratus ferme Vinoſus Sapor arguit; ad *Spiritum Vitrioli Philoſophicum* proxime hæc gratia Acoris in Sale Volatili *Succini* accedit; pungit, minimè corrodens; affuſoque *Spiritu Vitrioli* non Efferveſcit, neque Ebullit, nec Conſumitur, cum *Sp. Salis Armon*, commiſſum Bullulis excitatis cum ſtridore abſorbetur. Subtiliſſimum hunc & gratiſſimum volaticum Salis *Succini* acorem moderationi Bituminoſarum Exhalationum vindico; quemadmodum *Sp. Vini* cum *Spiritibus Nitri* aut *Salis* Combinatus, hos mitiores reddit, ut Dulces audiant. Siquidem dum *Bituminis* Particulas diſperſas Calor ſubterraneus in unum cogit, fit ut hæ per Ditiones *Vitrioli* Tranſitum faciant, quas dum permeant, ſubtiliſſima *Vitrioli* Effluvia eodem Calore excitata ſecum rapiunt, minori, majorive Copiâ, atque in *Matricem Ligneam* auferunt, ut junctis ſeminiis *Succinea* pronaſcatur Proles.

Succini, quâ in Pollinem terendo redigitur, levior eſt Præparatio; equidem parùm intereſt, Pulverem contendendo an terendo minutum exhibeas; ſcilicet utroque modo prodeſt, vel Brutorum Exemplo, quæ avidè *Succinorum* Minutias devorare annotavimus. Verum tamen quod Diviſio in Minima ad faciliorem Commiſtionem cum Succo nativo Animalis diſponit, non inutilis in Medicina iſta erit opera. Infuſionem *Succini* aut Coctionem præterirem, niſi inter

Euporiſta

Euporiſta Domeſtica meritò hæ Præparationes locum ſibi dari poſcerent: certum eſt, quod Virtus *Succini* Coquendo in Vinum tranſeat; ſed Infundendo atque Digerendo Vinum *Succino* Medicatum impetrabis. Eſſentiam ſive Tincturam affuſus *Succino Sp. Vini* parat, qui tamen à Puris Albis Flavedine non tingitur; an *Sp. Vini* Igneus præſtet, an Dilutus, in dubium vocaveris; illum enim Oleoſæ hunc Salinæ partes depoſcunt; verum cedit *Succinum* utrique & per Digeſtionis quamcunque moram neceſſe eſt ut *Sp. Vini* tandem reddatur Dilutior, præferendus itaque generoſior. Felicius autem Tinctura proveniet, ſi Ramenta tenuiſſima cum *Sp. Vini* ſociaveris: quidam *Ol. Tartari per* delo aut *Salis Fixati* addunt, aut his *Sp. Vini* acuunt, ut major Virtus & Ocyus in Spiritum tranſeat; non malè; niſi quod Alieni particeps hæc evadat Tinctura. Sed & Ebullitione in Vitro oblongi Colli *Succinum* Felicius diſſolvitur, ut Virtus prompiè ſuſcipiatur, & Spiritus illâ Saturetur penitus; id quod ſola Digeſtio longiſſimâ Morâ demum aſſequetur.

Majores Magiſterium ex *Succini* Extracto per Acidum redigere ſategerunt, nullo operæ pretio; ſi Acidum *Succini* Pulveri aſſociare cupis, Terendo idem aſſequeris rectius. Præſtantius Magiſterium dabit Tinctura abſtracto *Sp. Vini* Reſinoſum iſtud eſt, imò ipſa Reſina ſive Oleoſa pars *Succini* qualemcunque mutationem paſſa; ſiquidem *Sp. Vini* quem Deſtillando recipis *Sucineis* Viribus impregnatus intimam ſui cum *Succino* unionem indicat.

Ligni Foſſilis Fragmenta contuſa Aquâ Calidâ maceravi, Lixivium ſubdulcis *Aluminoſi* aut *Martialis* potius erat Saporis, ut ægre tandem aliquid *Vitriolici* perſentiſceres; ſed ad *Chryſtallos Salinos* congregandos inſpiſſatum, magis atque magis *Vitriolicum* ſaporem prodebat, ipſique *Cryſtalli* eundem referebant, niſi quod primum *Martialis* Dulcedo Linguam afficeret; id quod repetendo Solutionem & Corporationem in *Cryſtallos* denuò expertus ſum. Exutum Sale *Lignum* Retortæ indidi; & Calore Arenæ intenſiſſimo, ut intra Vitrum Fragmenta canderent, omnem Humorem elicui: Lacteus prorſus erat Liquor qui prodibat, ſpecie Emulſionis Amygdalarum; quadam poſtea in Superficie Cuticula, & ſubſidentibus in fundo Particulis Calciformibus. Odor Graviſſimus *Sulphureus*, qui totum Hypocauſtum illicò pervadebat; ſed propius admoto Liquore Nares *Succineum* quid percipiebant, non quidem Fragrantis Glebæ aut Olei, ſed Phlegmatis ut poſt Deſtillationem in Retorta Reſidui: Sapor quoque qualis Phlegmatis, Fumoſus ab Empyreumate, Salſo aciduli quidpiam Guſtui intermiſcens. Lacteus Color in Liquore poſtea diſparuit, Pinguiori relicta Cuticula. Denuo partem Igni feci exponi, ſi qua ſal Volatile & Puriores Olei Guttas reiterata Deſtillatione exciperem: Verum Salis Volatilis nihil aſcendit, Oleoſæ autem Particulæ ſubtiliores innatabant, non amplius in modum Cuticulæ cohærentes; quædam etiam forma Globulorum Pellucidorum Fundum petierant, Igneo *Succini* Colore conſpicuæ. Exigua portio Olei, aliquot Guttarum ex ℔j. Liquoris; Sapore & Odore *Oleum Petræ* prorſus imitabatur; Globuli vero, ut in Fundo Reſinoſi apparerent,

levi

levi concuſſione Liquori commiſcebantur. Calciformes Particulæ tenuiori Terreſtri Portioni adſcribendæ erunt, Ignis viſurſum elatæ.

Lignum ex Retorta exemptum Brunno ferruginei erat Coloris; multum *Sulphuris* exhalabat; Accenſum inſtar Fomitis Ignem alebat; Superficies ejus leviter Rubro Pulviſculo conſperſa fuerit.

Crucibulo impoſitum per tres Horas ignis exercuit; refrigeratum pariter *Cinnabarino* quaſi Pulviſculo obtectum fuit: Flammæ admotum minus prompte Ignem ſuſcepit, neque diu detinuit, nedùm ut Fomitis inſtar propagaſſet: ſpirabat autem *Sulphur* Auratum, hujuſque ſaporem Commanſum præbuit; accenſum vero minus *Sulphuris* exhalabat quam quod in Retorta erat relictum: Colore etiam lucidiori. Denuo in Crucibulo ultra novem Horas detinuimus, neque Accendi amplius potuit, ſed inſtar *Amianthi* Album poſt ignitionem comparebat, nullo *Sulphuris* Odore. Color poſt tam longam in Crucibulo moram ex *Griſeo* partim Nigricans, partim Splendens: *Microſcopii* ope aliæ partes inſtar Scoriarum, aliæ inſtar Chryſocollæ, aliæ inſtar Calcis efformatæ Dignoſcebantur. Toſtum atque Exuſtum ſatis *Lignum* Felle Vitri admixto, Igni Fuſorio expoſuimus; & facile coierunt in Maſſam, quæ Granulæ diſperſa *Reguli Martialis* exhibuit poſtea. Dum vero in unum Corpus iſta Granula fortiori igne cogere intendimus, Colliquata cum *Regulo* Maſſa, ex Nigro Splendens, Vitrea producta eſt.

Nativum Vitriolum, ſive illud *Amianthi-Forme* ſive *Fuſum* alterum, attritu Chalybis prodit ſibi non cum *Venere*, ſed cum *Marte* Societatem initam; nullam enim Cupri indicem Rubedinem relinquit. *Nativum Amiantha-Forme* ſolutum & in *Cryſtallos* redactum idem confirmat; ſubdulcis enim ac plane *Martialis* primo ſenſu percipitur ſapor, qualis Salis ſive Solutionis *Martis Cryſtalli* non iſta Specie qua *Goſlarienſe* concreſcunt; Solutionum autem prius depurgavimus affuſa Urina, atque ſemotis Fecibus concrevit Terra Foliacea; reliquus Liquor *Cryſtallos Sappharini* ferme Coloris inæqualibus Angulis exhibuit. Cæterum ex Solutione Inſpiſſata hincque Filtrata, ſuccedente Evaporatione, Album *Olum* prodiit, quod Furno Piſtoris leviter Calcinatum Loricatæ Retortæ inditum *Sp. Vitrioli* intra 24 Horas fudit egregium, qualem ex *Olo Martis* alias Officinæ parare ſolent. In *Colchotare* multum Salis *Oli* adhuc latere, ope *Microſcopii* exploravimus; ut pateat quomodo *Olum* in *Colchotare* Aeri expoſito regenerari intelligendum.

Terram Corticoſam ejuſdem cum *Ligno Foſſili* eſſe Naturæ Ignis Examen confirmavit; Leviori Toſtione opus erat ut ex hac aliquid Metallici eliceremus, licet quod obtinuimus Exiguum eſſet. Ex *Luto Cæruleo* olim per Deſtillationem Spiritum Nactus ſum Volatilem *Sulphurei* Odoris, & *Bituminoſi* quid in Superficie comparebat. *Terram* vero *Flavum* ad *Martem* inclinare adverti; & *Vitriolici* aliquid traxiſſe ex Confinio Sapor arguit & Odor.

Inter *Regias Opes* antiquiſſimis Temporibus Theſaurus hic *Succinorum* repoſitus fuit *Regibus*, qui Terras *Succiniferas* tenuêre jam olim *Succina* colligentibus,

colligentibus; ut Magnificentia Munerum aliis pares eſſent. Apud *Solinum*, *Rex Germaniæ*, (*Pruſſiæ* intelligendus, quam *Germania* tantis Opibus *Succineis* nunquam gaviſa ſit) tredecim millia Librarum *Neroni* Donum miſit; Non unius ſed plurimorum Annorum congeſtus Acervus. *Pruſſia* inter Regalia *Crucigerorum* Ordini *Succina* vindicavit, aliquo in eadem Epiſcopi *Sambienſis* jure. Atque publicâ Autoritate Collectio eſt inſtituta, ſeveris in Depeculatores Legibus. Seceſſione Civitatum *Ordinis* Ærarium acciſis *Succini* Reditibus non leve Detrimentum paſſum eſt, quam vis obnixè omnia ageret ut integro Theſauro ſolidè potiretur. Poſt *Crucigeros* Ducum *Pruſſiæ* quæ fuerit in ſeverandis Fiſco *Succinis* Cura, Annales parcius eloquuntur: Deſtinati tamen operi memorantur Litoris *Sudavici* Coloni, quibus ex Capitaneatibus *Schakenſi* & *Fiſchuſiano* additi ſunt alii: Servituti non ſtati Dies, ſed ſi quod Capturæ Tempus commodum, diu noctuque, Hieme æque ac Æſtate. Stipendum his, Domus inſtructa & Agellus, atque à Tributis Immunitas; Hauſtique vel Lecti *Succini* Modius Modio Salis redhoſtitur. *Foſſili* præſens Pecunia adjicit Auctarium. *Crucigeri* Dominum *Succinorum* vocabant qui *Succineis* Rebus præerat; alicubi &Commendatoribus iſtaCura incumbebat.Sub Divo*Alberto* Magiſtrorum atque poſtea Camerariorum nomen frequentius fuit, Equeſtris Dignitatis Viris hoc Munere defungentibus: Noſtrâ Ætate partem Muneris capit Capitaneatus *Fiſchuſani* Præfectus, partem *Feloniorum* Director, Adminiſtratore Litoris peculiari. Adminiſtratori Cuſtodes Litoris Equites (*Dimond Keuten*) præſto ſunt; Equitibus autem adjuncti ſunt ſervi Cameræ (*Hunmer Muſta*) qui Pedeſtres cum Equitibus Munus Cuſtodiendi alternant, quandoque ſi opus eſt, & horum vices obeunt.

Adminiſtratoris Officium eſt ad Operas ordinandas juſſa edere, *Succina* undique recipere, congeſta *Regiomontum* tranſmittere, Furta præcavere, de Inventis diſceptare, & Regale Sereniſſimi ubique Inviolabile præſtare: Hujus etiam eſt Sal Colonis diſtribuere. *Equites* & *ſervi Cameræ* Litus de Die obequitant aut circumeunt, ne quis *Succina* tollat; iidem Tempeſtates obſervant, & Colonos ſi Hauriendum Fodiendumque convocant, Foſſumque & Hauſtum recipiunt. Nulli Colonorum *Succina* detinere Domi licet, ſed ad *Equitem* aut alium, cui iſtud Delegatum, deferunt; quæ in *Pillaviæ* & *Neringiæ Recentioris* Litore leguntur, ſcriba *Felonii* ab his ſuſcipit. Si quando Anguſtia Temporis, inſigniori Copia, in Litore ſeligere non permittet, Domum aſportandi Facultas concedetur: vi juramenti autem proximo Luce eadem reddunt: Inter Hauriendum & Fodiendum Operariis Sacculus à Collo pendet, & Furti Reus habetur qui VeſtimentoGlebam abdidit.Recepta à Colonis*Adminiſtratori* exhibentur, à quo *Regiomonti* in *Succinorum Camera* Reconduntur, atque præſente *Directore Feloniorum* Diſcernuntur & Divenduntur. Olim plures *Succinorum Cameræ* erant, *Lochſteti*, *Dirſchkeimi*, *Memelæ*, *Germoviæ*, ſinguliſque ſui præerant *Magiſtri*.

Extra Litora, *Succina* in prædiis Fiſci reperta Præfectis ſunt reſtituenda; quæ in privatorum Fundis, ſi non Privilegio Domino vendicari poterunt, Fiſco neceſſe eſt pariter cedant; quamvis hactenus privatis invidendas ex *Succino* Opes obtigiſſe non memini.

Quondam Privatis *Succinorum* Captura erat elocata, ut certa Annuâ Summa præſentis Pecuniæ 10000 aut 12000 Talerorum redimeretur, preterquam

quod in Colonos impenſæ erant faciendæ. Verum plus Queſtus ad Fiſcum rediit, poſtquam publicâ Autoritate non ſolum Curata, ſed & Divendita ſunt *Succina*, certo pretio cuilibet Generi *Succinorum* ad Menſuram ſtatuto.

Succineæ Rudes Glebæ in auctarium prætii diſcernuntur, Capitales (*Haubt Stuck*) aliquot *Unciarum* pondere, carius veneunt; Tornatiles (*Dubly*) *Pulmæ* Longitudine ac Latitudine, minoris conſtant; minimæ (*Krauſs*) his cedunt. Illis autem, quæ aliquot *Librarum* pondera æquant, nulla certa eſt æſtimatio. Puritas, Dignitas Coloris, Pretium adanger; Viliſſima habentur Impura (*Dibluck*), Pretioſiſſima *Alba Lactea*.

Cruſigeris Dominis, *Lubecenſes* & *Stolpenſes Succinorum* Commerciis inclaruere: Poſtea & *Gedanenſes* atque *Regiomontani*. Noſtra Ætate *Gedanenſium* maximus ex *Succinis* eſt Quæſtus, poſtquam Mercatores *Pruſſica* ad ſe traxere, *Electrotoreutarumque* Collegium quæ *Neringiæ Recentis* Litus offert, ſolide poſſidet. Cruda *Orientalibus* Populis magno Pretio venduntur; *Armeniique* & *Perſæ* olim *Regiomonto* aſportari curarunt, Lucro Civium non contemnendo. Cæterum As *Electrotoreutarum* majorem Quæſtum facit, Sculptura ac Celatura aut Torno varias Figuras inducendo, ut inter Pretioſiſſima habeantur ex *Succinis* fabrefacta opera. Operibus pretium intendit ſi ex Eadem Maſſa integra confecta, ſi Nobilioribus Coloribus ſunt conſpicua, ſi Rariora Naturæ Pigmenta monſtrant.

Primus Ego Perſuaſi, ut *Italos* & *Gallos* invitentur, qui Effigiem rerum & Animalium ſegmentis aut Teſſellis *Gemmarum* ingenioſe componunt: Et ſuccederet Opus, ſi ſupremi Domini juſſa accederent, Facultaſque daretur ſeligendi, quæ ad *Vermiculata* ſive *Muſiva* iſtiuſmodi Opera requiruntur; etenim Opaci Colores, quibus Ars maximè indiget, in *Succinis* occurrunt Rariſſimi. Neque ſolum Arte *Toreutica*, ſed & *Pharmaceutica* ex *Succinis* Lucrum redigi poteſt; quum Agyrtæ Circumforanei Adulteratis Oleis & Balſamis *Succinorum* tantum Argenti lucrentur. Præterea *Vernicis* & *Succino* magnus eſt Uſus; atque *Laccæ* non cedit *Succinum*, ſi recte preparatur. Infectores quoque Helium, *Ruſſi* imprimis ac *Judæi*, *Succinum* Opere adhibent; ut & Horum ratione ex *Succino* Quæſtus promitti queat.

An Odd ſort of Amber; by M. Hevelius. n. 64. p. 2061.

LXV. I lately received from one, that liveth on the ſide of the *Baltick Sea*, a piece of *Amber*, which is ſo *Soft*, that I Printed my Seal on it. It's *Yellowiſh* as moſt *Amber* is; Tranſparent, and Burning as other *Amber*; but its Scent ſtronger, as if it were a kind of Glutinous *Bitumen*; and yet it hath been caſt up from the *Sea* this Year, and was found among other pieces. A very Credible Perſon, related at the ſame time, that he had been Maſter of a ſmall piece of *Amber*, *Soft* on One ſide, and very *Hard* on the other, where in day Buried a Fly.

n. 66. p. 2028.

Succinum quod *Sigillo cedit* inter omnium Rariſſima quæ apud nos reperiuntur, merito habetur; quippe dum vixi, ſi bina illa Fruſta, quæ penes me habeo, excipias, ne unquam quidem vel Minimum fruſtulum vidi, ut ut tale à multis Annis ſollicite quæſiverim. An unquam fruſtulum, altera parte *Molle* altera *duriſſimum*, poſſim impetrare, valde dubito.

LXVI. The

LXVI. The chief Fiſher upon the *Inland Poyſonous Sea* near *Dantzick*, informed me, that 2 or 3 Years ago Fiſhing in this Sea, his Net brought up a conſiderable large piece of *White Amber*, which was a Rarity he preſented to one of the chief Fathers of the *Olives* Abby, to which this *Sea* belongs. Now ſince this Sea lyes High, and about 3 *German Miles* diſtant from the *Ocean*; and ſince alſo the Neighbouring Woods, that bear none but highly Reſinous Trees, cannot be reaſonably ſaid to furniſh ſuch *Amber*, that Conjecture, which imports that *Amber* is a *Bituminous Fluid Subſtance*, hardned by the *Æqua aerial* Particles upon it, may receive ſome Confirmation from this account.

White Amber; *by M.* Kirkby. n. 83. p. 4069. *Vid. Sup. Cap.* II. §. XXIII.

LXVII. Having occaſion in *July* 1674 to view certain *Foſſils*, which I had diſpoſed into divers Drawers in a Cabinet made of *Barbadoes Cedar*, I obſerved many of the *Stones* in Every Drawer (and ſome were lapped up in Papers) to be thick Covered over with a *Liquid Roſin* like *Venice Turpentine*; though after diligent Search there appeared no manner of Exudation in any part of the Cabinet.

The Electrical-Power *of Stones in relation to a Vegetable Roſin, by Dr.* Liſter. n. 110. p. 224.

Of the many ſorts of Stones I there had, divers eſcaped, but not any of the *Hæmatites* kind; having therein *Manganes*, *Sciſtos*, *Botryades*, *&c.* which were all deeply concerned: and amongſt perhaps 500 pieces of the *Aſtroites* here and there one or two in an appartment, and ſometimes more were ſeiſed, and the reſt Dry; as it fares with People in the time of the Plague in one and the ſame Houſe. I further obſerved, that Stones of a Soft and Open Grain, as well as thoſe of a Hard and Poliſh'd Superficies, were concerned in a manner alike.

'Tis certain, that the whole Body of the *Turpentine* of the *Cedar-Wood* was carried forth into the Air, and floating therein was again Condenſed into its own proper form upon theſe *Stones*. This makes it more than probable, that *Odoriferous* bodies Emit and Spend their very Subſtance. Thus *Camphir* is ſaid if not well Secured, totally to Fly away. Again it is hence Evident, that there is great Difference betwixt the *Diſtillation* of *Vegetable Juices*, and the Emiſſion of Effluviums or this *Natural Diſtillation*: That really Separating and Dividing the Subſtance into different parts; but this carrying out the Whole entirely and Unaltered in its Nature.

LXVIII. Non ſolum *Succinum & Gagates* Allectant Corpuſcula, ſed & *Adamas*, *Sapphirus*, *Carbunculus*, *Iris* Gemma, *Opalus*, *Amethiſtus*, *Pſeudo-adaneas Briſtolienſis*, *Berillus* & *Chriſtallus*: Item *Hyacinthus*, *Granatus Bohemicus*, *Vitrum*, & ex *Vitro* ſive *Chryſtallo Gemmæ Adulteratæ*, *Vitrum Antimonii* & *Saturni*, Omnes *Fluores* ex *Fodinis*, *Belemnites*, *Sulphur*, *Maſtix*, *Cera Sigillaris* ex *Lacca*, *Reſina Durior*, *Arſenicum* ſed imbecillius, & Cælo Sicco *Sal Gemmæ*, *Lapis Specularis*, & *Alumen Rupeum*.

A Catalogue of Electrical Bodies; *by Dr.* Rob. Plot. n. 245. p. 384.

Ambergreece, a Vegetable Production; by .... Communicated by Mr. R. Boyle. n. 97. p. 6113.

LXIX. 1. The ſeveral Trials and Obſervations of my own about *Ambergreece* having long kept me from acquieſcing either in the Vulgar Opinions, or thoſe of ſome Learned Men concerning it; yet I confeſs, my Experiments did much leſs diſcover what it is, than the following Paper has done, in caſe we may ſafely and intirely give Credit to its Information, and that it reach to all kinds of *Ambergreece*. And probably you will be invited to look upon this Account, though not as Compleat, yet as very Sincere, and on that ſcore Credible, if you conſider, that this was not written by a *Philoſopher* to broach a Paradox, or ſerve an Hypotheſis, but by a *Merchant* or Factor for his Superiours, to give them an Account of a Matter of Fact; and that this Paſſage is Extant in an *Authentick Journal*, wherein the Affairs of the *Dutch* and *India Company* were by Publick Order from time to time Regiſter'd at their chief Colony *Batavia*, which was lately taken in a *Dutch Eaſt-Indian Prize*. And it appears by the Paper it ſelf, that the Relation was not looked upon as a Doubtful thing, but as a thing from which a Practical way may be deduced to make this Diſcovery eaſily *Lucriferous* to the *Dutch Company*.

"*Ambergreece* (*ſays the Journaliſt Mar.* 1. 1672.) is not the Scum or Ex-
"crement of the *Whale*, *&c.* but it iſſues out of the *Root* of a *Tree*, which *Tree*
"how far ſoever it ſtands on the Land, always ſhoots forth its *Roots* towards
"the *Sea*, ſeeking the Warmth of it, thereby to Deliver the *Fatteſt Gum* that
"comes out of it: Which *Tree* otherwiſe by its Copious *Fatneſs* might be Burnt
"and Deſtroyed. Wherever that *Fat Gum* is ſhot into the *Sea*, it is ſo Tough,
"that it is not eaſily broken from the *Root*, unleſs its own Weight and the
"Working of the *Warm Sea* doth it, and ſo it *Floats* on the *Sea*.

"There was found by a Souldier $\frac{7}{8}$ of a *pound*, and by the Chief, Two
"pieces weighing 5 *Pounds*. If you plant the *Trees* where the ſtream Sets to
"the Shoar, then the ſtream will caſt it up to a great Advantage.

An Animal Production; by Mr. Rob. Tredway. n. 232. 711.

2. An Ignorant Fellow in *Jamaica*, about 2 years ago, found 150 *pound* Weight of *Ambergreece* Daſh'd on the Shoar at a Place in theſe Parts call'd *Ambergreece Point*, where the *Spaniards* come uſually once a Year to look for it. This vaſt Quantity was Divided into two Parts; ſuppoſed by Rolling and Tumbling in the Sea. This Man tells me that 'tis Produced from a *Creature*, as *Honey* or *Silk*: And I ſaw in ſundry Places of this Body, the *Beaks*, *Wings*, and part of the *Body* of the *Creature*, which I preſerved ſome time by me. He adds, that he has ſeen the *Creatures* alive, and believes they Swarm as *Bees*, on the *Sea-ſhore* or in the *Sea*.

The Production of Coral; *by* S. Paulo Boccone. n. 99. p. 6158.

LXX. 1. *S. Boccone* having been preſent at the *Coral Fiſhing* in the Channel of *Meſſina*, which ſeparates *Calabria* from *Sicily*, relates in a Letter of his, written on that Subject to Signor *Marchetti* at *Piſa*, that before the *Coral Fiſhers* drew their Nets out of the Water, he immerſed his Hand and Arm into the Sea to Feel, whether the *Coral* was *Soft* under the Water, before it was drawn up in the Air, and found it altogether *Hard*, except the

Round

Round End, which having been Bruiſed with his Nails, he found it made up of 5. or 6. little Cells, full of a White and ſomewhat Mucilaginous Liquor, reſembling that Milky Juice, found in Summer in the long Cods of the Herb, call'd *Fluvialis Piſtana foliis Denticulatis*, ſpoken of by *Joh. Bauhinus*.

This *Corallin Juice* he calls *Leven*, becauſe having Taſted it himſelf, as well as the Mariners did, they always found it of a *Sharp* and *Adſtringent* Taſte, in ſuch pieces as came Recently out of the Sea; thoſe that are Dried loſing that part of the Taſte which is *Acrimonious*, and retaining only that which is *Adſtringent*: Which Change of Taſte he affirms to be made in about 6 *Hours* after the *Coral* hath been drawn up; in which time alſo the ſaid *Leven*, that is incloſed in the Pores, is Dried, and hath changed its *Colour*. He inclines ſtrongly to the Opinion of thoſe who Conceive, that the Long Concoction of the *Ferment* Fixes the parts, and produces the *Red-Colour*, eſpecially being near to the *Hard Coral*, and the *Red Vermillion*, which Surrounds it.

2. M. *Guiſony* is of Opinion, that *Coral* is ſo far from being a *Plant*, that 'tis a meer *Mineral*, compoſed of Much *Salt* and a little *Earth*; and that 'tis Formed into that Subſtance by a *Precipitation* of divers *Salts*, that enſues upon the encounter of the *Earth* with thoſe *Salts*; after the manner of the known *Metalick Tree*, which in a very little time is form'd and Increas'd by the Settling and Combination of *Mercury* and *Silver*, Diſſolv'd in *Aqua-Fortis*, and afterwards caſt into common Water; the parts of this *Mineral* and *Metal* joyning themſelves one to another. Which thing alſo happens in ſome *Subterraneous Grotto's*, where by a continual and long Fall of Water-Drops many ſorts of *Figures*, and, amongſt them Shapes of little *Trees* are Form'd. This Sentiment he confirms by alledging, that he can ſhew a *Salt* of *Coral*, which, being Caſt into Water, and there Diſſolv'd, upon the Evaporation of that Water by a gentle Heat, is preſently *Coagulated*, and Converted into ſtore of ſmall Sticks, reſembling a little *Forreſt*.

By *M.* Guiſony. *ib. p.* 6159.

LXXI. 1. The *Stones* Figured like *Plants*, which *Agricola* calls *Trochitæ*, and the Compound ones *Entrochi*; we in *Engliſh*, St. *Cutberd's Beads* are (like the *Lapides Judaici*) of an *Opaque* and *Dark Coloured Sparr*; though I have of them from ſome parts of *England* of a *White Sparr* or *Cawke*, as our Miners call it. They all break like *Flint*, Poliſhed and Shining.

Trochitæ *and* Entrochi *deſcribed; by Dr.* Liſter. n. 100. p. 6181.

Vinegar as a Menſtruum will corrode and diſſolve them (as well as all *Foſſiles* of what *Figure* ſoever) provided they be Broken into indifferent ſmall grains, and if the bottom of the Veſſel hinder not, they will be moved from place to place by it.

The Figure of the *Trochitæ* is *Cylindrical*; the utmoſt round or Circle (we ſpeak of one Single Joynt, which *Agricola* calls *Trochites*) is in general Smooth both the Flat ſides are Thick drawn with fine and ſmall Rays, from a certain hole in the Middle to the Circumference. Two, Three, or more of theſe *Trochitæ*

Joyned

Fig. 93. together make up that other *Stone*, which is called *Entrochos*. The *Trochitæ* or ſingle Joints are ſo ſet together, that the Rays of the one enter into the others Furrows, as in the *Sutures* of the *Skull*.

They are found very plentifully in the *Scarrs* at *Braughton* and *Stock*, little Villages in *Craven*. I never met with any much above two *Inches* about; others there are as ſmall as the ſmalleſt *Pin*, and of all *Magnitudes* betwixt thoſe proportions. They are all *Broken Bodies*; ſome ſhorter pieces, ſome Longer, and ſome of them indeed *Trochitæ*, that is, but ſingle Joints. I never found one Intire piece much above 2 *Inches* long, and that very rarely too; in ſome of which long pieces, I have reckoned above 30 Joints. And as they are all broken Bodies, ſo are they found Dejected and Lying confuſedly in the Rock, which in ſome places, where they are to be had, is as hard as Marble, in other places ſoft and Shelly (as they call it) that is, Rotten and Periſhed with the Wet and Air. And though in ſome places they are but ſprinkled here and there in the Rock, yet there are Whole Beds of Rock of vaſt extent, which are made up for the moſt part of Theſe, and other *figured Stones*, as *Bivalve*, *Serpentine*, *Turbinate*, &c. as at *Braughton*.

As to the *Injuries* they have received in their Removal from the Natural Poſture, if not Place of their Growth and Formation, they are manifeſt; for, beſides their being all *Broken Bodies*, we find many of them *depreſſed* and *Cruſhed*, as if the Joint of a Hollow Cane ſhould be trod under Foot: Theſe *Cruſhes* being alſo real Cracks as of a Stone or Glaſs. Again, theſe *Stones* conſiſting of many *Vertebræ* or Joints, they are many of them ſtrangely *Diſlocated*; ſometimes two, three, or more of the Joints in a piece are ſlipped out of Order, or Rank, and ſometimes a whole Series of Joints, as when a pack of Crown pieces leans obliquely upon a Table. Further, others I have that are twiſted like a Cord; if this poſſibly may be reckoned among the *Injuries*. Laſtly, ſome have their Joints, indeed, Even and in File, but are yet ſtuffed with a Foreign matter, as when Bricks are laid in Morter.

Fig. 92.

There is great *Variety* as to the Thickneſs of the *Trochitæ* or ſingle joints: Some are ſo Thin, that they are ſcarce the full of the 24*th* part of an *Inch*; others are a full *quarter* of an *Inch* Thick; of theſe latter I only found at *Stock*: Betwixt theſe Extreams there are Joints of all Meaſures in Diverſe pieces, but in one and the ſame piece they are moſtly of an equal Thickneſs. And there are ſlender and ſmall *Entrochi*, or pieces, which have as Thick Joints, as the Biggeſt and Faireſt Pieces.

There is alſo ſome Difference in the *Seams*, or cloſing of the Joints. Some are but ſeemingly Jointed; which appears by this, that if they be eaten down a while in *Diſtill'd Vinegar*, the ſeeming *Sutures* will Vaniſh, as in ſome I had out of *Staffordſhire*, from about *Beresford* upon the *Dove*: Others, and all here at *Braughton* and *Stock* are really Jointed, and the Sutures Indented; which Indentures being from the Terminating of the Rayes, they are more fair or Large, according to the Difference of the Rayes, but Even, Equal and Regular.

We

We have ſaid that the Utmoſt Circle is generally Flat and Smooth, yet are there many other Differences to be Noted; very probably becauſe they are parts of *Different Species*.

1. Their Joints are of different Thickneſſes.

2. On ſome *Entrochi*, betwixt Suture and Suture, in the middle of each Joint, are certain Knots in a Circle; the Joints thus diſtinguiſhed are very Deep and Large, and are very frequent of *Stock*

3. There are likewiſe of theſe with a Circle of Knots, which have many Knots beſides on each Joint and look Rugged.

4. Some with much Thinner Joints, which yet have a Circle of Knotts in the middle of each Joint; and this alſo looks as though it were all over Knotted; and theſe are found at *Braughton* only, as far as I know.

5. As ſome have but one Circle of Knots, others are Knotted all over the Joint and Rough; ſo are there ſome others, which have a Circle of Larger Knots in the middle of each Joint, and a Circle of Leſſer on each ſide cloſe adjoining to the Border or Verge of the Suture. This is huge Pretty, and they are found at *Stock*

6. Others betwixt Suture and Suture in the middle of each Joint, riſe with a Circular Edge

7. A ſmooth *Entrochos* with a large or much riſen Edge on the middle of one of the joints, and a much ſmaller on the middle of another joint, and that Alternatively.

8. The ſame Alternate Difference, the Joints only much Rounder and Blunt, and here the Joints are viſibly one Thicker than the other.

9. The ſame with Alternate Edges Knotted.

10. A Double Edge in the Middle of every Joint; this makes the Joints look as though they were exceeding Thin, and Numerous, but indeed they are not ſo.

11. A Double Edge in the middle of every *Joint* Knotted by intervals, or as it were, Serrate Edges.

Some of the Pieces of moſt, if not all, of the Differences of theſe *Entrochi*, are Ramous, having leſs Branches Deduced from the Greater, and that without Order. Theſe Branches are deep inſerted within the Stemm, and by being ſeperated, leave great Holes in the ſides of it. The Rayes in the Joints of the Branches, run croſs to the Rayes of the Stemm. On thick Stemms are ſometimes very ſmall Branches, but moſtly the Bigger the Stem the Thicker the Branches. Some of theſe Branches are branched again: Yet I find not any of them above one *Inch* intire, and yet adhering and inſerted into its Stock or Bole, and for the moſt part not above a Joint or Two. The Branches are known from the Stemm, by being a little Crooked and ſomething Tapering or Conic. *Fig. 99.* *Fig. 93.*

We meet but with few Pieces (beſides the Branches) that are not exactly Cylindrical, ſetting aſide the *Injuries* above mentioned. And amongſt thoſe Few, ſome Tapering at both ends, and much ſwelled in the middle; others figured like a kind of Fruit, or *Lapis Judaicus*; yet truly *Entrochi*, and jointed, notwithſtanding this ſhape: Upon a ſmall Stalk of two or three Joints is ſuddainly *Fig. 94.*

ſuddainly Raiſed an Oval Bottom, Broken off alſo at both Ends.

Fig. 95. To theſe we ſhall add, what ſeems to have been *Summitates* or *Faſtigia*; Long and Slender pieces with a little Button, Hollow on the very Top; which Top ſeems not to have been divided or broken off from any thing elſe.

Theſe Hollows are ſometimes filled with Earth, and ſometimes another *Entrochos* is incloſed, like a pair of Screws, and which is, (as it were) Pith to the other.

Of theſe Inward *Entrochi*, ſome I have which are Tranſparent. Theſe Hol-
Fig. 91. lows or Piths are of different Bores, but moſt are Round. And yet there are of them in great plenty at *Stock*, whoſe Hollow in the middle is in the Elegant Faſhion of a *Cinque-foil*; and the Rayes of the Joints of theſe *Entrochi*, are much deeper and Fewer in number, than of any other yet obſerved by me. Theſe alſo are Smooth jointed. This is moſt ſurprizing, and I know not any *Vegetable* whoſe Pith is *Perforated* in ſuch a manner.

Fig. 96, 97, 98. *Laſtly*, We, in theſe Rocks, find certain *Rude Stones*, of the bigneſs of *Walnuts*, which have many Impreſſions of *Trochitæ* upon them, as though they had been the *Roots* of them. And when theſe have been a little Cleanſed in *Vinegar*, theſe Impreſſions appear more than Caſual; for, the Subſtance that Covers them (if not the Stones themſelves) is *Sparr*, and the *Impreſſions* are Round Holes with Rays, like thoſe Holes which we ſaid above the Branches, made in the ſides of the Stock, when Broken out from them. I have found ſome of them moſt Elegantly *figured*, Intire and Compleat at *Stock*, amongſt very many others ſtrangely Shattered and Defaced. One is in the faſhion of a *Pine Apple* or *Cone*, with a Hollow Bottom, about the half of an *Inch* deep, and as much over at the Bottom: On the very top is the round figure of an *Entrochos* broken off; round about the Bottom or Baſis are five ſingle Feet at equal diſtances, in the Figure of Creſcents. This Stone is Incruſtate or made up of Angular Plates; *viz.* the bottom is compoſed of 5 Plates, which we call Feet; the middle of the Stone of 5 other Plates, all of a *Sexangular* figure; and the Top Stone. All other Plates are ſmooth on the outſide.

Another is much after the ſame *Pyramidal* faſhion; the Bottom Convex, about one *Inch* and a quarter over; on the Top is the lively Impreſſion of an *Entrochos* Broken off; or rather a *Trochites* yet remaining; Round the Baſis are 5 double points or Feet at equal diſtances, all Broken off and ſomewhat in the Figure of Creſcents. This Stone is alſo Incruſtate or Covered with *Sexangular Plates*, which are Rough.

Of theſe *Figured Plates* I find great variety in the Rocks, Broken off, and Heaped together in great Confuſion, which yet manifeſtly belong to the above deſcrib'd *Stones*. Some of the faireſt of them at *Braughton* and *Stock*, are *Pentagonous* and as broad as my Thumb Nail, Hollow on the one ſide like a Diſh; Convex on the other ſide, where are certain Eminent Knots, about the bigneſs of a ſmall Pin's Head, ſet in a kind of ſquare Order: This Plate is ſomewhat Thin at the Edges and yet Blunt. Others are *Pentagonous* and ſome-

what

what Convex Above, but not Hollow Underneath, and without these eminent Knots; the Edges as Thin as of a Knife and Sharp. Others of these *Pentagonous* Plates are Convex on one side, and somewhat Hollow on the other; Thick Edged; one of the 5 sides only is Indented; the Indented side is ever the Thinnest, and the Stone is most sloped towards that side. *Note*, That there are many amongst these last Indented sorts of Plates, which are Channelled on the Concave side and otherwise Notched. One of these *Pentagonous Plates* from *Wansford-Bridge* in *Northamptonshire*, has one of the 5 sides Thick Indented; the Convex part has in the middle a Raised *Umbo*, like some Antient Shields, and round about the sides a List of smaller *Studds*; and some from *Bugthorp*, under the *Woolds* in *Yorkshire* are much like this.

The *Sexangular Plates* are small, save here and there one. Some of them are a little Hollow on the one side, and Convex on the other, having the Convex side most elegantly wrought with Raised or Embossed Work; that is, with an Equilateral Triangle bestriding each Corner, and a single Right Line in the Midst; or, if you will, Two Triangles one within another. These we found at *Braughton Scar* only. Others (which are most common in these Rocks) are a little Hollow on the one side, and Convex on the other: They are for the most part smooth on the Convex side or Scabrous only; some are much Thicker than others; some being as Thick as Broad, but most are Plate like; the Sides are very Unequal, as in *Crystals*; sometimes 5 Broader sides and one very small; again Two sides Broad and 4 much Narrower; and infinite other Differences as to the inequality of sides.

2. 'Tis strange that these Main *Stemms* should be of Equal bigness from the Top to the Bottom, and not at all Tapering, if they be indeed the Bodies of *Rock-Plants*. There are found in *Maltha* certain Stones called St. *Paul's Batoons*, which I suppose were originally a sort of *Rock Plants*, like small snagged Sticks, but without any Joints; the Trunks whereof Diminish according to the proportion of other Plants, after the putting forth of their Branches. Those *Roots* which you have observed, are a good Argument, that these Stones were Originally pieces of *Vegetables*. Who knows but there may be such Bodies growing on the *Submarine Rocks* at this Day, and that the *Fishers* for *Coral* may find of them; though being of no use, they Neglect and Cast them away. Certain it is, there is a sort of *Coral jointed*. *By Mr.* Ray. ib. p. 6190.

3. All the *Trochitæ* and *Entrochi* describ'd by Dr. *Lister* are found in *Mendip Hills*; except that Figured like a *Fruit*, and my Observations generally agree with His. But I may add that I find even the Joints of some of those *Entrochi* which *Swell in the Middle*, to be of that Make: So that such an *Entrochos* Shews like a parcel of little Barrels, set one on the other. *By Mr.* J. Beaumont. n. 129. p. 724.

Their *Hollows* are of all bignesses, from a Central point to the taking up of more than a Third part of the Stone. Some of these *Entrochi* are so *Hollow*, that there is only a Thin Shell left, smooth within and without: Others have only a Thin Shell left, but with Screws within and without; and sometimes Both these are one entire piece, with seeming Sutures. Those *Hollows* like a *Cinquefoil* seem most natural to the *Radix*, having 5 Hollow Stirts or Feet issuing side-ways from it: And I find in some pieces of *Radix*'s that a little furrow passes inwardly from each Foot to the Top of the Stone with a Ridge on the

outside of it. Besides these, I have a new species of *Trochites* and *Entrochi*, which has 6 Inlets in the *Hollow*, as the latter has but 5; but with this Difference, that these Inlets terminate in Angles, so that it is a *Sexangular* Hollow, whereas the *Cinquefoil* Inlets are Round as the Leaf is, and not pointed, though I have seen even of these with sharp Angles.

The *Rays* shooting from a Center, must of necessity leave considerable Widenesses betwixt them, as they pass towards the circumference, according to the bigness thereof; to fill up those Widenesses, I find that in some, betwixt two *Rays*, issuing from the Center, a Third Ray rises about half way on the Stone from the Center, and shoots to the Circumference; some have their *Rays* gently widening from the Center to the Circumference; some have a Trunk rising from the Center, which grows Forked towards the Circumference; sometimes betwixt those Forks, there rises a little Ray near the Trunk where the Forks join, which shoots to the Circumference; (but note that these Differences are scarce discernable where the *Rays* are fine, but with the help of a Glass.) Some again are *Ramous*, having a Trunk rising from the Center, with 3, 4, or 5 Branches shooting to the Circumference; some are Smooth Half way on the Stone from the Center, and have a Circle of small Rays near the Circumference; some are smooth without any *Rays*; these are commonly pretty Thick, and are joined in an *Entrochos* after this manner: One *Trochite* a little within the Outward Circle, in the upper and lower parts, where the *Rays* use to be, has Round Inlets or Sockets, pretty deep, so that only a thin *Tympanum* hinders, but the *Trochite* would be Hollow at this wideness all through; and in the Middle of this *Tympanum* there is a Hole, as in other *Trochites*, which is sometimes Round, sometimes like a *Cinquefoil:* The *Trochites* that answer this on both sides, have smooth joynts, (I cannot properly call them *Screws*, having no Ridges) which enter into these Sockets; those Joints being Hollow also, and so other *Trochites* with Sockets come on upon those again to make up the *Entrochos*. Some of these have both Sockets and Rays, some have a Socket on the one side, and Rays on the other without a Socket; some are all smooth, only a small Ridge runs round them a little within the outward Circle, which enters into a small furrow answering to it; some are all smooth and Joined only *per harmoniam*, as Mr. *Lister* calls it; some *Trochites* hold of an equal Thickness of Substance from the Center to the Circumference; some are pretty Thick in the Circumference, and grow Thinner towards the Center; so that they have Concavities on both sides, to which Convexities in other *Trochites* answer. Some hold of an equal Thickness half way on the Stone from the outward Circle, and then grow Concave toward the Center. I have also found some *Entrochi*, as well as *Trochites* of an *Oval* Figure, and their Bore is also *Oval*. Some *Trochites* of this kind have no *Rays*, but are joined together only by one Ridge which passes directly along the middle of the Stone the long way, there being a Furrow in the other answering to it; these have also a small Speck in the middle, making but a very little Impression in the Stone, and seldome passing through it, though I have of this sort with indifferent Holes as the other *Trochites*, but such are commonly Pointed at the Ends, and not carried out with an Oval Round as the others. There are some Single Joints which are shaped with a *Double Oval*; that is, the *Oval* in the

Upper

Upper part of them ſtands clean contrary to the *Oval* in their lower part. In ſome again the *Ovals* do not ſtand ſo extremely oppoſite to each other, but only the *Oval* in the Upper part of the *Trochite* ſeems a little Wreſted from the Direct line of the *Oval* in the Lower part, ſo that they ſtand Bend-ways to each other, like a St. *Andrew's Croſs*; there are *Entrochi* too made up after this manner; and I find moſt of the *Oval Entrochi* grow Crooked and Twiſted.

I have One Perfect *Radix* without any Impreſſion of a *Trochite* on it; the Top of it, indeed is a little Flat with a Hole in it, but it is withal very ſmooth, without the leaſt ſign of a *Ray*; yet I find another with the Rays there; At the Middle of the Broad End there is another Hole, juſt Oppoſite to this. At the Ends of the 5. Stirts or Feet, where the *Hollows* ſhould ſhew themſelves, there grows after a very Artificial manner a pretty large Seam of the ſame Stone juſt over the middle of the Hollow, from the upper part of the ſtirt to the lower part of it, parting the Hollow in the middle, and covering about a 3d part of it; not that this ſeam enters farther into the Hollow than the mouth of it; ſo that the Hollow of each ſtirt preſents it ſelf with two Eyes: Hence it appears, that thoſe ſtirts or feet were never longer than they are, and that no ſtone ever Grew to them. Theſe Fore ſeams, being very obnoxious to the Leaſt Injury, were broken off from Dr. *Liſter's*. The ſtone is compoſed of *Trigonal*, *Tetragonal*, *Pentagonal* and *Hexagonal Plates*. *Fig.* 96. The upper part of the Conical End is wrought round with ſix large *Hexagonal Plates*, and theſe reach half way the ſtone; then follows a ſecond Round, made up of *Pentagonal Plates*, pretty large, and theſe reach almoſt to the Broad Bottom, which is a little Convex; the Bottom it ſelf and Feet contain *Plates* of all Makes, but moſt of them are very ſmall. *Fig.* 97. This ſtone is in ſubſtance a Whitiſh Opaque *Fluor*, of the ſame nature with the *Trochites*; it has outwardly a Ruſty coat, and is Blewiſh within like ſome *Sea-Shells*. When 'twas firſt found, 'twas full of a ſort of Aſh coloured griſty-Clay, which is the evident Material Cauſe of it, it being found in a bed of the ſame

I eaſily pick'd out the Clay with a Needle, ſo that 'tis now all Hollow; the Shell-like and *Sparry* ſubſtance being ſcarce as thick as half a Crown. I have one *Sexangular Plate*, whoſe Convex part has on it a ſtar conſiſting of 6 Emboſt Rays, which ſhoot from the Center directly to the middle part of the ſides betwixt the Angles, and betwixt every Two Rays there grows a little ſtud after a very Elegant manner.

I find the *Trochites* ſticking to Rake-Mold ſtones, and in the Crannies of Rocks, at all Depths from the Graſs to 20 Fathom; and doubtleſs there are of them Deeper: But I find them moſt plenteouſly in certain beds of an Aſh coloured griſty-Clay, and particularly at one place within a Yard or two of the Graſs. I found here a *Fruit* with them like a *Lapis Judaicus* (though ſomewhat defac'd) if not a *Species* thereof; *Fig.* 94. its about the bigneſs of an Acorn, with Ridges and Furrows running the long way; it differs from thoſe deſcrib'd by Dr. *Liſter*, being rather leſs in the middle than at the Ends, and the Ridges not knotted or Purl'd. It is in Subſtance a Whitiſh Opaque *Spar* like the *Trochites*, though (as Mr. *Liſter* ſays) ſome *Trochites* are of a Dark-Coloured Spar;

and I find ſome of a White Cawky ſubſtance, and ſome have a Tincture of Red; but theſe differences proceed from the Clay of which they are made; for though an Aſh colour be the chief in it, yet there are ſome Veins of Red in it, ſome of White, ſome of a Light Blew, ſome of a Dark Blew, *&c*; which cauſe theſe Varieties in the *Stones*. I find ſome *Trochites* and *Entrochi* Shaped in a *Raw Clay*, before they have attained the Conſiſtency of a *Stone*; and theſe, if laid in the Sun, become Light and Spungy like a *Pumex*. I took up there a piece of another ſtrange *Stone*, of the like *Sparry* ſubſtance; it is about the bigneſs of a Walnut, Hollow, and Fill'd with the ſaid *Clay*; it ſomewhat reſembles a Helmet; the fore part of it is Smooth, the Upper part, which has a large Ridge in the middle, is all wrought with little Rings, Three at a place, encircled within each other. The ſtone call'd *Cornu Ammonis*, ſhap'd like a Ram's-Horn, is very frequent in this *Clay*; the largeſt I have is 7 *inches* in length, 4 *inches* in compaſs at the Broad end, and 2½ at the ſmall end; the Top being broken off. Tracing its Original, I find ſome of the firſt Buddings out of it about the bigneſs of a young Cocks-ſpur, and very much like it. I have ſome in *Raw-Clay*, and one growing of a white *Cawky Stone*. They generally become at laſt a Whitiſh *Spar*, and ſome Milk White as ſome of the *Trochites* are:

There are of all intermediate proportions betwixt theſe two, though very few of any bigneſs are to be found Entire, but all Broken and imperfect pieces: And I take the ſeeming *Summitates* of Mr. *Liſter* to be only little Eſſays of Nature towards the production of this *Stone*, the Alliance being evidently nearer than betwixt them and the *Trochites*. The texture of theſe ſtones is thus: Some have Maſſy *Spar* in their inſides, which takes up three parts of the *Stone* then from the ſharp Top there grow thin flat Cells, or ſmall pipes of *Spar*, ſet Edgeways one cloſe to the other, all round the ſtone, which ſhoot towards the Broad end, and appear outwardly like ſmall Ridges or Seams; and many of theſe Pipes running down thus after the *Stone*, ſhew their Hollows, ſome at one place of it, ſome at another, and ſome not till they come to the Broad End: And this is the Texture of the Great ſtone, which has Rings alſo, though ſomewhat Defaced, running round it, tending likewiſe in their growth towards the Broad end as in a *Ram's Horn*. Moſt of the leſſer *Stones* have very little Maſſy *Spar* within them, and ſome have none, but appear ſomewhat Hollow at the Broad End, with Cells coming down inwardly from the Top of the ſtone, reſembling thoſe in the *Flowers* of *Coral*, which Terminate its Branches; and doubtleſs, if taken from their Beds in a ſeaſonable time, would yield the like *Milky-juice*; for I find in the Cells of ſome Broken pieces of theſe *Stones* an evident Concretion of ſuch a *Milky-juice*. And I may here acquaint you, that I have a Piece of *Branchy Spar*, which I found at a Mine on theſe Hills, growing like *Coral*, and Terminated with Buttons or *Flowers* like it. I find very few of the leſſer *Cornua Ammonis*, whoſe Cells do any way appear or ſhew their Hollows Outwardly, as in the Great ſtone, whoſe outward ſurface is wholly made up (as I ſaid) of thoſe Cells, or thin Flat Pipes, ſet cloſe the one to the other, many of which ſhew their Hollows at ſeveral places in the ſtone, whereas the Cells in the ſmaller ones appear only Inwardly, having

one

one Coat Outwardly which covers them all, and this Coat in ſome is Smooth, in others it is all wrought with little Rings like the *Helmet ſtone* before mentioned; and ſome Out ſides have Ridges or Rings round them as a *Ram's-horn.*

Theſe ſtones generally *Move* in *Vinegar, Juice of Lemons, &c,* ſending forth Bubbles, as I find *Cawk* will very freely, and moſt of our *Mineral Stones.* This Motion ſeems to proceed from the Conteſt betwixt the *Acid Spirit* of the *Vinegar* and the *Mineral Salt*; ſo that the *Spirits* by Fermentation breaking forth Under the ſtone produce that Effect.

4. After Diligent ſearch I have at laſt found a Mine, where well near all the *Entrochi,* (ſo called hitherto) or bodies of *Rock-Plants,* grew Tapering and Ramous, ſome of them having Branches iſſuing from them near 2 *inches* in Length, and other ſmall Branches iſſuing from thoſe, and upon a nearer ſearch I diſcovered an entire Plant, though ſmall, growing up after the ſide of a Stone I found alſo, that all the clifts in ſome Mines are made up of theſe *Stone Plants*; whereof ſome as appears, were converted into the nature of thoſe Limeſtone Rocks, whilſt they were in their firſt Tender Growth; others being become *Spar* compoſe Rocks of that ſubſtance. Ib. p. 732. *Fig.* 100.

Conſidering that all the Clifts for a very large circumference in ſome places are made up of theſe Plants, we may truly ſay, that there have been, and are whole Fields or Forreſts of theſe in the Earth, as there are of *Coral* in the *Red-Sea.* In the *Courſes,* (or *Loads* as ſome call them) betwixt the Clifts I find of theſe *Plants* growing up in the Griſty Clay, mentioned above, being Rooted on the *Rake mold Stones*; many of them being above a foot in Height, and about the bigneſs of the Stem of a Tobacco Pipe: All I have yet ſeen of this Length, are either Raw Clay; or of the Conſiſtency of a *Lime-ſtone,* and ſome of them have outwardly evident Beginnings of *Circles* and *Sutures.* The ſmall *Plant* which is Entire, and the *Branched bodies* of many others, have attained their full Term of Growth; being become Perfect *Spar.* If theſe had ever a Height anſwerable to their Bigneſs, (ſome of them being near 3 *inches* about,) they muſt have been much Higher than thoſe before mentioned. The *Branches* are all joynted, and have the ſame *Bore* with the Trunks, and are terminated with Round and Blunt joynts, but very ſmall. I find the *Bores* or *Hollows* of ſuch as are found to be commonly fill d with a *Milky* Crudled ſubſtance, which probably in their time of Growth was Fluid, like that in *Coral.* As it cannot be Doubted but many of theſe *Plants* Grow on thoſe admirable *Radixes* of which we have given an account, and whereof I have at preſent ſome pieces which have a *Cinquefoil Bore* on the *Top,* others with the Impreſſions of *Oval* Joynts there; and many other Differences; ſo I am now fully ſatisfied that many of them Grow from *Plain Roots,* that is from *Plain Spar,* or *Lime-ſtone,* without any ſuch Figure, as the *Entire Plant* does, and many other Trunks which I have noted.

Theſe *Plants* do not always Grow up with One Trunk or Body: but ſometimes 5 or 6 Sprouts, near of an equal bigneſs, ſhoot up together from the ſame Root; as it uſually happens with *Coral.* I have met with ſome of them which have only 4 *Inlets* in their *Hollows,* and others with *Seven.* Some

have

have a *Circular Edge* on every other Joynt, the Intermittent Joynt being *Smooth* without Edge or Knot. Some Trunks have Circular Edges on the middle of every Joynt, but ſo that the *Firſt* and *Fifth* Edges are the Higheſt; the *Second* and *Fourth* the loweſt; the *Third* is Higher than the Latter, and Lower than the Former; the Joynts themſelves being Great and Small accordingly; and this Order holds all along the *Plant*. Some Trunks have Edges according to the ſame Order, only the Edges on the 2*d* and 4*th* Joynts are Round and Blunt, the other 3 being ſharp; ſome have Edges after the ſame Order, which are all Round and Blunt. There are ſome Trunks wrought after the ſame manner, only the *Firſt* and *Fifth* Joynts have a Circle of Knots round them, the other *Three* have Edges: Some Trunks have no Circles, nor Knots, but are only a little Scabrous like the *Plates* which compoſe ſome *Roots*. But notwithſtanding theſe Diverſities of *Figures*, the Texture of their ſubſtance appears to be wholly the ſame: And therefore ſince we find no Qualities either by the ſmell or taſte which manifeſt any Specifical Diſtinction, it may perhaps, be as hard to make them out to be Diſtinct *Species*, as to ſhew a Specifical Difference betwixt ſeveral *Snow Bloſſoms*.

Fig. 101. The Reaſon of that ſtrange *Diſorder* which theſe *Plants* uſually lye in, and of thoſe *Injuries* they have received, perhaps may be this; whilſt they were Growing, the *Clay* wherein they Grew was ſoft as a Quagmire, theſe probably requiring ſuch a ſubſtance to ſupport their Growth, as *Coral* does *Sea Water*: Afterwards as they began to ſettle to a ſtony Conſiſtency, and as part of the *Clay* became of a Rocky Nature, the whole Maſs Sunk from its Poſition, and the Moiſture paſſing away made ſome Concavities, waſhing down ſome Broken pieces of thoſe *Stones* with it; and Lumps of *Clay* and other ſtones, falling down through thoſe Crannies, added to their *Confuſion*, being very apt to be Diſordered by the leaſt Concuſſion, either whilſt they were in their Firſt Growth, or after they were become *Spar*, their Joynts being very Tenderly ſet together; and Hence theſe ſtones are generally found in *Leirey* places (as they call it) that is, *Cavernous*.

Theſe *Rock Plants* begin their Growth from the Fineſt Parts of *Clay*, being commonly White, Soft, and ſmooth at firſt, and by Degrees come to have Ridges, Knots, and Sutures, as they grow towards a *Stony*, and ſo to a *Sparry* Nature.

The *Pith* continues ſtill ſoft and White, as the whole is at firſt, and it is continually Refreſh'd by the Mineral ſteams and Moiſture, which have free Acceſs to it through the 5 Hollow *Stirts* or Feet, in the *Figured Roots*, or through the Maſs of *Clay* which commonly lies under the *Plain Roots*. Nor can it be ſaid but thoſe *Stone Plants* have True *Life* and *Growth*; for ſince in the Curioſity of their Make they may Contend with the greateſt part of the *Vegetable* Kingdom, and are ſhap'd like them, having inward Pith or Sap, and likewiſe Joints and Runnings in their Grit, and ſometimes Cells, which may very well ſupply the Place of Veins and Fibres, I know not why they may not be allowed as proper a *Vegetation* as any Plant whatſoever.

Vid. Sup. §. LXX. 2. And though a *Salt* of *Coral* after Diſſolution, will upon Coagulation ſhoot into a little Grove of *Plants*, as it were, Reſembling the *Growth* of *Coral*, yet

yet this cannot Disprove its *Vegetation*; for its well known, that all *Plants* may be so Prepared, that from their Ashes they will Rise again in their Proper *Species* after such a manner.

But I am enclined to the Opinion, that these *Rock Plants* are *Lapides sui generis*, and not *Parts* of *Plants* or *Animals Petrified.* Indeed the *Figured Roots* on which these *Rock Plants* sometimes Grow (as appears by the Impression of *Rays* on the Tops of some answering to those in the *Joynts* of the Plants, and by the impression of *Oval Joynts* there) may give us some Suspicion that they once belonged to an *Animal*, whether it were a species of the *Stella Arborescens*, or some other: But the Trunks of these *Stone Plants* cannot be looked upon as Parts of *Animals*, with the least shew of Probability. And I think them almost as hardly Reducible to any known Species of *Vegetables*; considering that, besides the *Bores* of some of these with 4, 5, 6, and 7, inlets in them, and besides their admirably Diversified *Joyntings*, scarce either of them to be match'd in any *Vegetable*, I have by me above 20, if not 30, Species of these *Rock Plants*, Differing Outwardly from each other in their *Joynts*, *Knots*, and *Sutures*, all observing a wonderful Regularity, and not one of them to be parallel'd by any *Vegetable* that I know of in Nature. And we cannot well imagine, how so many *Species*, Diffused through many parts of the whole Earth, should all happen to be *Lost* together. So that upon the whole, this seems to me a considerable objection, against those who maintain that all *Figured Stones* in the Earth, are *Petrefactions* of *Plants* or *Animals*, to which Opinion *Steno*, in his Dissertation concerning *Solids naturally contained within Solids*, adheres. n. 150. p. 276.

LXXII. 1. I have procured a good quantity of the *Astroites* from *Bugthorp* and *Leppington* at the Foot of the *Yorkshire Woolds*: At the former place I have seen them Dug out of a certain Blew Clay on the Banks of a small Rivulet, betwixt the Town and the foot of the *Woolds*. There are plenty of them washed into the Brook; but the most Fair and solid are those we get out of the Clay. *The* Astroites; *by Dr.* Lister. n. 112. p. 274. *Fig.* 103.

The Matter and substance of these *Stones*, if Broken, is *Flint-like*, of a Dark Shining Polituře; but much softer, and easily Corroded by an *Acid Menstruum*. *Vinegar* indeed makes them Creep; but a stronger Spirit, as of *Nitre* Tosses them. I doubt not, but they will readily Calcine, as the *Belemnites* to a very strong and white Lime.

These *Stones* (as we now find them) are all *Fragments*; either one *Single Joynt*, or 2, 3, or more *Joynts* set together, making a *Pentagonous* or Five sided, Column. I have not yet had any Piece much above one *inch* long, which consisted of 18 *Joynts*; but I have seen one Piece, somewhat shorter than the former, which had 25 *Joynts*. These last *Thin Joynted* pieces are quite of a Different Make, as to all Circumstances, from the Other.

Every *Joynt* consists of 5 Angles, which are either Drawn out and sharp, and consequently the sides of Pieces made up of such Joynts are Deep Channell'd; (and this is the condition of some of the *Thick Joynted* pieces, as well as of all the *Thin Joynted* ones; or the Angles are Blunt and Round, and the sides

Plain

Plain or very little hollowed. There are as Big, and as ſmall pieces of this ſort, as of any other more Sharp-angled.

Where the *Joints* are *Thin* or Deep, they are ſo equally throughout the Whole piece; yet are there ſome, but very few pieces, which conſiſt of *Joints* of Unequal Thickneſs. Many of the *Thick-jointed* pieces have certain *Joints* a thought Broader, or a very little ſtanding out at the Angles, and thereby the *Joints* are diſtinguiſht into certain Conjugations of 2, 3, or more Joints: And theſe Conjugations are very obſervable in the Thin-*jointed Stones*, and are marked out with a ſet of *Wyers*.

The Thickeſt piece, which hath yet come to my Hands, is not above *one Inch* and a *half* about, and thoſe very rare too: From which ſize to that of a ſmall Pin, I have all the Intermediate proportions; and theſe ſo exceeding ſmall pieces are as Exactly Shaped as the Greateſt. Moſt pieces, if not all, of any conſiderable Length, are not Streight, but viſibly Bent and Inclining.

All the pieces, of any ſort, are much of an Equal Thickneſs or but little Tapering; yet one of the ends, by reaſon of a *Top Joint*, is viſibly the Thickeſt.

This *Top-Joint* hath 5 Blunt Angles, and is not *Hatched* or *Engraven*, or but very faintly, on the Outſide. Every Joint elſe of a piece (ſave the *Top-Joint*) is an *Intaglia*, and Deeply Engraven on both ſides alike; and will accordingly ſerve for a Seal. The Middle of each Angle is Hollow, and the Edges of the Angles are Thick Furrowed: The Terminations of theſe *Hatchings* are the Indented Sutures by which the *Joints* are ſet together; the Ridges of one Joint being alternately let into the Furrows of the other next it. The Hatchings of the Flat-ſided pieces are in Circular Lines; but of the other two *Species*, they are ſtraight Lines or near the matter.

Fig. 104. In the very Center of the 5 Angles, is a ſmall *Hole*, conſpicuous for moſt *Joints*. Note alſo, that in the Middle of each *Joint*, betwixt Angle and Angle, in the very Suture, is another ſuch like ſmall Pin Hole very Apparent, if the Stones be firſt well ſcoured.

105. In the *Deep jointed* pieces, juſt under the *Top-joint* above deſcribed, the Veſtigia of certain *Wyers* rather than Branches; and ſometimes 2, 3, or more of the Joints of the *Wyers* yet adhereing. Theſe *Wyers* are ever 5 in number, *viz.* One in the Middle or Hollow part betwixt Angle and Angle. Again in *Thin Jointed* pieces there are 5 of theſe *Wyers*, or a *Set* of them Inſerted into every Conjugation of *Joints*; ſo that it were ſome Repreſentation of the thing, to Imagine the Stalk of *Aſperula* or *Equiſetum*: Alſo I have ſeen, but that very rarely, (not in one piece among 500) a *Set* of *Wyers* in the Middle of a *Deep-jointed* piece. One *Thin-jointed* piece *I* have by me, where a *Wyer* of 20 *Joints* and upwards (and how much longer they may be *I* know not) lies Double within the Hollow ſide, and by that accident was preſerved in its natural place. Further, ſome Lumps of Quarry *I* have from the Place abovenamed, where the *Wiers*, as well as the *Stones* themſelves, are ſeen in Long pieces. It is no wonder, that theſe *Wyers* are knock'd off, and but very rarely found adhering to the Stones they belong to, being very ſmall and Slender, of a Round

Fig. 106.

Figure

figure and *Smooth-Joynted*, being ſet together *per Harmoniam* and not Indented Sutures. Nothing that I can think of, is ſo like theſe *Wiers*, as the *Antennæ* of *Lobſters*. Laſtly ſome of theſe *Wiers* are Knotted, and others of them fairly ſubdivided or Branched.

2. If you can allow the *Trochites* and *Entrochi* to have been Fragments of *Rock-plants*, I ſee not why you ſhould make any Difficulty of admitting theſe to have been ſo too; the ſeveral *Internodia* being alike Thin in both, and the *Commiſſures* not much Different; only the external Figure doth not Correſpond. The *Wiers* ſpringing out of the Furrows or Concave Angles of ſome of the *Internodia*, and Encircling the Stalk like the leaves of *Aſperula* or *Equiſetum* ſeems to me to Argue theſe bodies to belong to the *Genus* of *Vegetables*; no leſs than *Coral*, *Coralline*, and the ſeveral ſorts of *Pori*; ſome of which are alſo *Joynted*: But no *Vegetable* either of Land or Sea, that I know of, hath ſuch frequent *Joynts* and ſhort or Thin *Internodia*; and ſo they are things of their *Own kind*, whoſe *Species* is, for ought we know, *Loſt*. If they were *Vegetables*, I gueſs they were never *Soft*; but grew upon the Rocks like *Coral*, and the other *Stone Plants*, juſt as they are. *By Mr. Ray. ib. p. 278.*

The *Leaves* of ſome ſort of *Equiſetum* are *Joynted*, as well as the *Stalk*: Elſe I know no *Plant* that hath *Joynted Leaves*; except ſome ſorts of *Ruſh-graſs*.

I have found on the Banks of the River *Tanar* in *Piedmont*, plenty of the *Fragments* of the ſtalks of *Equiſetum* perfectly *Petrified*, with little or no Increaſe of *Bulk*, ſo exactly like the Plant, that all the *Striæ*, did all along clearly Appear. The colour of theſe *Petrified Stalks* was White.

LXXIII. We have plenty of Stones called *Dactili Idæi* and *Lapides Judaici* (for *kind*) in the Stone Quarries at *Newton* near *Hemeſley*, and at *Hellingley* by *Malton*. There is ſome Variety in the *Figure* of them; but the moſt common one in theſe Rocks is after the faſhion of *Date ſtone*, Round and Long about an *Inch*, and ſometimes Longer. They are a little ſwell'd in the Middle, and Narrower towards each end: They are Channelled the length way, and upon the Ridge Knotted or Purled all over with ſmall Knots, ſet in a a *Quincunx order*. The inward ſubſtance is a White Opaque *Sparr* and breaks Smooth like a *Flint*; not at all Hollow in the Middle, as are the *Belemnites*. Lapides Judaici; *by Dr.* Liſter. n. 110. p. 224. *Fig.* 107.

LXXIV. 1. Dr. *Home* of *Berwick* tells me that he never uſed the *Oſtracites* to any that he knew to be troubled with a *Confirmed Stone* (being perſuaded that no Medicine can *Break* a *Large Stone*) but only to ſuch as were afflicted with *Gravel* or *ſmall Stones*; that ſome of his Patients were Cured without Evacuating any *Gravel* or *Stones* at all; that others Evacuated both: That it never does its work ſuddenly, (being not remarkably *Diuretick*) but that it rather *Diſſolved* the *little Stones* than Forced them. That none that he ever gave this Medicine to, however Grievouſly and Frequently Afflicted before, have ever been troubled with *Nephritick Pains* ſince; that his Manner of giving it, is in Fine Powder mixed with about a third part of *Flores Chamomeli*. *Vertues of the* Oſtracites; *by Dr.* Cay. n. 250. p. 81.

Doſe from *Half a Dram* to *One Dram* in White Wine; That the greateſt Doſe is often apt to offend and Nauſeate the Stomack; that he once gave it alone, with a weak Infuſion of *Chamomil Flowers* in White Wine after it, but this did not ſo well.

I can ſay little of my Own Knowledge of this Medicine, having had it but a ſhort while, and not Uſed it yet to any but one Gentlewoman, whoſe Frequent and Violent Fits of the *Gravel*, made her lead a Life uneaſy enough. I gave her this Medicine mixt with poudred *Semina Saxifrag.* I cannot ſay, that ſince ſhe Uſed this Medicine ſhe never had any Returns of her *Pains*, but ſhe neither has them ſo Violent, nor ſo Frequently; and whenever ſhe is Threatned with them, ſhe moſt certainly finds Eaſe by that time ſhe has taken 3 Doſes of her Powder. And ſhe has, ſince the uſe of this Medicine, *Voided* a great many *ſmall Stones*. But the Reaſon perhaps why ſhe is ſtill Threatned with the Return of her *Nephritick Pains*, is, that ſhe has never Follow'd her Medicine throughly, but upon the third Doſe, finding ſuch certain Eaſe, ſhe gives it over, till a New Fit forces her to Uſe it again.

I take this *Shell* to be what Dr. *Liſter* calls *Oſtracites Maximus Rugoſus & Aſper*. It burns to a *Lime* as other *Shells* do, and as the *Selenites* (tho' weakly) does. It yields no *Volatile Salt*, tho' I tryed it in a Naked Fire; nor does Common *Oyſter Shells*, Freſh taken and uſed, afford above *Half a Scruple* of a Liquor ſomewhat moderately *Urinous*, from 4 *Ounces* of *Shells*. And it may be, if they were long Dryed and Expoſed to the Weather, they would loſe even that, and yield no more *Volatile Salt* than the *Oſtracites*. I confeſs I was ſomewhat ſurpriz'd at this matter; ſince there are who ſay, that even the other *Shells*, that are commonly call'd *Petrify'd*, yield a *Volatile Salt*: and *I* had my ſelf from the *Shells* of *Cruſtaceous Fiſhes*, (particularly of *Lobſters*) had a *Volatile Salt* and *Fætid Oyl* in no inconſiderable Quantity, even in a *Sand-Furnace*. But theſe ſort of *Shells* differ from other *Shells* (as Dr. *Liſter* has exactly obſerv'd) in this too, *Quod in his Umbo ad Cardinem leviter Roſtratus eſt, qui tamen in* Oſtreis *paulum aliter eſt*. They Differ too in their *Specifick Gravity*, theſe being more Ponderous than Common *Oyſter Shells*, and ſomewhat near the *Specifick Gravity* of the *Selenites*. But indeed they Differ one from another in *Gravity*, as well as from other *Shells*, as they partake more or leſs of a *Taphaceous* ſubſtance that Coats many of them on the inſide, and which perhaps may be ſomewhat a kin to the *Selenites*. I have obſerv'd ſome ſuch Differences among the *Cornua Ammonis*, having had one or two ſmall ones from our Coal-Pits here, that had a conſiderable Mixture of the *Pyrites*; whereas theſe that are found about *Whitby*, approach, I think, more to the Nature of the *Alum ſtone*; and perhaps the *Cornua Ammonis* of the Antients were found in Beds of ſomewhat yet more Valuable, ſince *Pliny* ſays they were of a *Golden* colour, and were reckoned *inter Sacratiſſimas Æthiopiæ Gemmas*. I know *Agricola De Ortu & Cauſis Subterran, Lib.* 4., accounts for this *Golden Colour* after another Manner: *Cornua Ammonis, inquit, Succo* Aluminis *infecta* Aurei Coloris *fiunt*. And I am ready enough to think, that there is ſome Truth not only in this Obſervation, but in what he immediately adds; *Idem inquit, & aliis quibuſdam Lapidibus accidit*: For I cannot but attribute the extraordinary

traordinary Appearance of *Colours* in the *Peacock Tail Coal*, to its being infected with the *Succus Aluminis*, having ſeen ſome Pieces of this pretty ſort of coal ſhoot into True and Genuine *Alum*.

I ſhall only add concerning theſe *Shells* that if they be *Real Shells*, their being found in ſuch Different Parts of the World, and at ſuch great Diſtance from any Sea, may ſerve for a Fair and Convincing Argument of the Univerſality of the *Deluge*. And if they be not *Shells*, but only *Stones* Form'd by (what ſome People call) Fanciful and Sporting Nature, we may at leaſt conclude thus much from it, That ſince even theſe *Luſus Naturæ*, theſe Freaks, and Random Strokes of Nature, have not only a Beauty, but a Real Uſe, nothing in Nature is made in Vain: And that many other *Foſſils* that we now contemn as Toyes and Trifles, fit only for furniſhing out a *Muſæum*, may have other Remarkable Virtues, that may in Time bring even them to be taken Notice of, and Valu'd, as well as the long Neglected and Deſpiſed *Oſtracites*.

2. The *Golden Colour* is from its being a *Pyrites*, that is *Iron Stone*. Again, all the *Conchitæ* Kind, but more particularly the *Belemnitæ* and *Lapides Judaici*, were known to the Antients for *Specificks* in *Gravel*. *By Dr. Liſter. ib. p. 85.*

LXXV. *Siliquaſtrum* (quantum nobis innotuit) toto genere Novus eſt idemque Rariſſimus, nec Inelegans Lapis. *Siliquaſtrum*, autem appellare placuit, quod Siliquæ Lupini vel alterius cujuſdam Leguminis, Valvulum alterum (Cavitate tamen Repletâ) non parum referat. *Siliquaſtri* Notæ Genericæ ſunt, quod ſit *Lapis figura plereque ad* Siliquæ Valvulum (*Sublato Concavo*) *accedenti*; *ex parte altera ſemper* Convexior; *&* (*ſi* Marmoris *inſtar fortu to expolitos excipias*) *minute admodum Rigoſus*, *ſeu*, ut explicatius loquar, *Crebro & Eleganter Malleolatus*: *Facie quaſi Oleo Obductus*, *Reſplendenti*: *Textura ſi comminuitur* Belemnitis *fere ad inſtar Striata*. Hujus *Lapidis* plures dantur Varietates quarum præcipuas ſolum modo nunc vacat recenſere. *Several Regularly* Figur'd Stones; *by Mr.* Edw. Lhwyd. n. 206. p. 746.

1. *Siliquaſtrum* ad *Phaſeoli* Valvulum quodammodo accedens; ſeu *Siliquaſtrum Phaſeolatum*. Figuram Titulus indicat; Magnitudinem quod attinet, *Seſcunciali* eſt Longitudine, *Dimidium Unciæ* Latum, vix *Quadrantem* craſſum. Quoad Periferiam, aliud Latus quodammodo Falcatum eſt, aliud (quod etiam magis acclive eſt) Rectum: Extremum alterum linea Obliqua cum Duobus Angulis clauſum; alterum non item. Ex parte pronâ ſuperficies rectilineis Striata eſt, cæterum leviter Rugoſa; & color *Anthracinus*, niſi quod ad utrumque Extremum, paululum vireſcat. Ex parte ſupina, Accretione quanam lapidea fædatur, Coloris *Rubiginoſi*. Inveni in Lapicidina *Witneienſi*, ſeptimo ab urbe *Oxon.* Lapide; ſed Rariſſime occurrit. Triplo aut Quadruplo minores aliquot, in quibuſdam à jam deſcripto differentes, habeo, è fodina *Stunsfeldenſi*, in hac Provincia. *Fig.* 108.

2. *Siliquaſtrum Lupini*, Siliquam nonnihil referens: Seu veniam dabis ſic loqui, *Siliquaſtrum lupinatum*. *Phaſeolato* ſubinde Brevior eſt, at Semper Latior: Colore incerto, ſed ut plurimum à Prona parte *Nigro*, vel ad *Nigredinem* accedenti; à Supina *Rubiginoſo*. Sed & utrinque variat quoad Colorem & Superficiem. A parte Gibboſa Lineolis Albis & Maculis neſcio quibus diſtinctum vidimus; quod & *Buſoniis* Lapidibus, & *Gloſſopetris* quibuſcunque a- *Fig.* 109.

liquando accidit. Sed & inveni unum aut alterum cui à parte averſa neſcio quid Appendicis adnaſceretur; in qua Virgulæ aliquot Tranſverſæ conſpiciatur, quaſi amiſſi cujuſdam ignoti Veſtigia. Differt hic Lapis à præcedente præcipue, quod ſit Latior, magiſque Rectus, à neutro latere Falcatus. In *Anglia* Mediterranea non admodum Rarus eſt hic Lapis. Vidimus in *Latomia Garvordienſi* in *Bercheria*, *Witneiæ* & *Charltoniæ* apud *Oxonienſes*, ad Pagum *Rance* in Comitatu *Northamptoniæ*, *Honey-comb Laſh* apud *Waltonienſes*, *&c.*

Dantur etiam in hoc Genere Lapides, quos *Piſi vulgaris* & *Viciæ Siliquas* æmulari dixeris.

Fig. 110. 3. *Siliquaſtrum Minus*, *Triangulum*; ſeu *Minus*, *Conchæ ad inſtar Roſtellatum.* Colore & Superficie cum reliquis convenit: at *Tellinam* aliquam, vel (mavis) *Concham parvam Anglicanam Liſteri*, magis refert quam *Siliquam.* Verum ex Facie, cum Externa tum Interiori, *Siliquaſtrum* ſe prodit. *Stunfeldiæ* habuimus in Agro *Oxonienſi.*

Fig. 111. 4. *Siliquaſtrum*, Officulum è capite *Aſſelli Minoris* referens.

Fig. 112. 5. *Siliquaſtro congener Punctularia Gibboſa*, quandoque *Tortilis*, ſuperficie *Marmorea:* ſeu *Siliquaſtrum Gibboſum*, *Marmoreum*, argute admodum plereque *Punctulatum.* Superioribus magis Terſum & Expolitum eſt hoc *Siliquaſtrum:* ex Prona parte nunc magis, nunc minus *Gibboſum*; & Colore ut plurimum *Nigricanti*, alias *Subviridi*, *Exalbido*, *&c.* Ex parte Averſa ſeu Interiori, neſcio qua Oſſea Appendice munitur, Coloris *Nigri* vel *Rubeſcentis* ſed hoc in pleriſque deſideratur. Utrinque in Mucronem magis Obtuſum deſinit quam priora. In multis quæ videre contigit Exemplaribus, pars *Gibboſa* Soli obverſa, minutula admodum & creberrima oſtendit *Punctula.* Paſſim Occurrit in Comitatu *Bercheriano* & *Oxonienſi.* Inveni in Lapicidinis ad pagos *Marcham Garvord* & *Stunsfield.*

Fig. 113. 6. Ejuſdem Lapidis major Varietas.

Fig. 114. 7. *Siliquaſtro accedens Ricinus*; ſeu *Siliquaſtrum Minimum inſtar Seminis Phaſeoli*, *Ricinus Lapis Siliquaſtrum* eſt omnium, quotquot hactenus videre contigit, Minimum; quod *Ricini* Herbæ, vel etiam *Phaſeoli* cujuſdam Minoris Semen quadantenus exprimat. Superne ſcaber eſt, plane ut *Siliquaſtra* proprie ſic dicta; Colore aut *Fuſco* aut *Atro nitenti.* Infra vero Decolor eſt, & informis. *Witneiæ* inveni, inſtar *Scarabæi Atro nitentes*; *Stunsfeldiæ* autem, & ex *Atro-nitentes*, & *Fuſcos.*

Conjicio quod hos *Lapides* quos nos *Siliquaſtra* diximus, Poſteri ad minimum (ſi non hujus ſeculi) Philoſophi *Piſcium Dentes* & *Officula*, tuto appellaverint. Certe quod ad *Siliquaſtrum Minus Triangulum* attinet, vidimus aliquot ſpecimina, *Officulis* iſtis vulgo notis ex *Aſellorum* Capitibus non parum conſimilia.

Fig. 115. 8. *Bufonites Majuſculus Atro rubens inſtar Capſulæ Glandis Quercinæ.* Colore eſt undiquaque ex *Atro Subrubente*; quoad cætera omnino convenit cum Figura *Boetii.* Inveni in Lapicidina *Faringdonenſi* apud *Bercherianos*; ſed rarius occurrit.

Fig. 116. 9. *Bufonites Medius Rotularis* Alveolo utrinque donatus. Color in ambitu

bitu *Subpallidus* eſt; Alveolus ab utraque parte *Rubiginoſus*. Cum priore habuimus.

10. *Bufonites Medius Orbiculatus*, ſeu *Bufonites Vulgatior Anglicus*. *Majuſculo* Atro rubenti triplo aut quadruplo Minor eſt. Colore inſigniter Variat; alias *Anthracino*, alias *Fuſco* ſive *Hepatico*, alias alio: Sed & nonnunquam *Cæruleis* maculis, & lineolis notatum vidimus. Unicum habeo Craſſiuſculum, & cæteris minus Depreſſum, Colore *Pallido* aut *Exalbido*; *Atro* limbo aut Faſciola fimbriatum. *Fig.* 117.

In Latomiis & ſabuletis *Angliæ Mediterranea*, paſſim obviam habuimus: at Specimen noviſſime dictum, in Lapicidina *Farringdonenſi*. Paſſim inveniuntur & Minores & Minimi Orbiculati, & forma quaſi in plano Ovata.

11. *Bufonites Minimus a convexiori parte Rugoſus*. In Agro *Gloceſtrenſi* & *Oxonienſi* cum reliquis, ſed Rarius. *Fig.* 118.

12. *Bufonites Minor, Trochili ad inſtar Faſtigiatus*, ſeu *Bufonites Trochilus* dictus. Coloris eſt ex *Antracino Subcærulei*, & fimbria *Nigra* donatus. E ſabuleto *Faringdonenſi*. *Fig.* 119.

13. *Bufonites Minimus Trochilo affinis Calyculo Striato longiuſculo donatus*. Caliculus Striatus *Caſtanei* Coloris eſt: Umbonis idem fere Color ac præcedentis. In Sabuleto *Faringdonenſi* aliquoties obſervavimus. *Fig.* 120.

14. *Bufonites Scaphoides extremo altero latiore*. In Lapicidinis *Marchamiæ* & *Gravordiæ*, & ad *Faringdoniam* non admodum rarus. *Fig.* 121.

Omnes *Bufonites* ut id ſemel dicam, variant Colore; at *Anglicani* ut plurimum ad *Nigrum Fuſcum*, & *Hepatiem* accedunt. Hos Lapides *Angliâ*, antehac inveniri non conſtat: nam *Bufonites* D. *Plot in hiſtoria Oxonienſi*, hujus loci non eſt. *Bufonites* D. *Chriſtopheri Meret* (ſi locum memini) Lapides non erant, ſed ipſiſſimi *Lupi Piſcis Dentes*, *&c.* Quod quidem ſatis feliciter, ſive ab ipſo ſive a quovis alio, excogitatum: Quippe hi Lapides aliud non ſunt, me Judice, quam *Luporum* aliorumque *Piſcium Dentes*, Habitu & Veſtitu *Lapidum* perſonati. In fodina *Garvordienſi* ſeptimo ab *Academia* milliari, (ob Rariores quos habet Lapides, diutius a me frequentata) tandem incidi in *Maxillæ Piſcis* ut videtur fragmentum, cui Tres *Bufonites*, Triangulato quodam ordine, arcte inhærebant; Bini ſilicet *Orbiculati Minores*, & *Minimus* Tertius. Sed de *Bufonitibus* hæc dicta ſufficiant; quos, ſi id magis placeat, *Ichthyodontes Scutellatos* in poſterum jure merito appellare poteris. *Fig.* 122.

15. *Plectronites lævis Mucrone paulo acutiore*. *Plectronites* non aliud eſt quam *Ichthyodos* quidam tereti formis, Plectrum Gallinaceum referens, radice *Bufonitis* inſtar, excavata. Colore, Superficie & Magnitudine, ut reliqui, *Ichthyodontes* variant. Paſſim in Lapicidinis *Bercherianis*, cum *Bufonitibus* & *Gloſſopetris* inveniuntur. Striato Perioſteo denudatos ſuſpicor quotquot Marmoris ad inſtar Politos cernimus. *Fig.* 123.

16. *Plectronites Major altiuſculè Striatus*, *Mucrone magis obtuſo*. Hujus Lapidis non niſi Duo Exemplaria hactenus videre contigit. E Fodina *Stunsfeldienſi*. *Fig.* 124.

17. *Rhombus Minor* ſive *Medius*, quem *Rhombum* appellare placuit; Compreſſior eſt quidam Lapis; præter-propter *Cucumerini Seminis* magnitudine, forma *Fig.* 125.

forma ad *Rhomboidem* accedenti. Ab uno latere Convexior eſt, & Colore ut plurimum *Nigro:* ex altero Planior, & Teſtacea quadam lamella obductus; quæ mirè ſplendet, Colore *Anthracino* vel ex *Atro Rubenti*, Hæc Teſtula, ſive Teſtacea Lamella, Figuram *Rhomboidalem* conſtituit, Margine quandoque leviter inclinato; & quod materiæ elegantiam, elimatum *Teſtudinis* Exuvium quam proxime ſimilat. Invenimus in Lapicidinis *Marchamenſibus* & *Charletoniæ*. Dantur etiam & *Majores* & *Minimi*, & quidam figura à *Rhomboidali* multum diſcrepantes. *Rhombum* quoad Materiæ & Coloris elegantiam excipit.

Fig. 126. 18. *Scalpellus*. Eſt autem *Scalpellus*, Lapis figura ab omnibus hucuſque notis prorſus aliena. Quod ad Magnitudinem ſpectat & Colorem, cum *Rhombo* aliquatenus convenit. At Figura eſt omnino ſibi propria. *Scalpellum* nominare volui, quoniam *Cultelli* Mucronem quodammodo mentitur. Nam Lamellatus eſt Lapillus; Figura tamen Trigonali, cum alio quodam Angulo minus eminenti. Facies altera omnino Plana eſt et Seſſilis; ſed altera ob demiſſum Marginem, ſeu mavis Tranſverſas quaſdam Lineas eminentes, undiquaque leviter Acclivis. *Charletoniæ* habui cum priore.

Fig. 127. 19. *Bufoniti Congener Gibbus Lapis*: ſeu *Bufonites Gibbus* cognominatus. *Gibbus* autem lapis ex Re Nomen habet; nam *Bufonites* eſt non ut reliqui plane ſeſſilis, ſed omnino Arcuatus: adeo ut ſi in Plano poſueris, lucem ſubtus recipiat. Atque hinc a Dorſo Elatiori, apud nos *Gibbi* nomen ſortitus eſt. In parte *Gibboſa*, foramen obtinet ad Baſin latiorem; ei prorſus ſimile quo cæteri donantur Bufonites minores. In Arenoſis *Marchamiæ* Lapicidinis invenit optimæ ſpei Juvenis D. *Joannes Archer* è *Collegio Reginenſi*: qui inter alios Lapides aliquam multos, ejuſdem Duo vel Tria habet Specimina. Nos poſtea in Sabuleto *Faringdonenſi* obſervavimus.

Hactenus dictos *Lapides* ut et alios aliquam multos, quos in *Anglia Mediterranea* inveni, pro *Piſcium Dentibus* aliiſque *Capitum Oſſiculis* aut habeo, aut vehementer ſuſpicor. Cæterum & eorundem *Vertebras* non paucas undiquaque in Agris *Gloceſtriæ Bercheriæ* & *Oxonii* ſparſas, obſervare licuit; quos omnes generali nomine.

Fig. 128. 20. *Ichthyoſpondylos* appellare conſuevimus. Sunt autem ii vario pro conditione loci, Tincti; alii *Nigri*, *Fuſci* alii; quidam *Subletei* aut *Cinerei*. Magnitudine etiam & Forma non minus Varia ſunt quam *Ichthyoſtea*, ſuperius dicta. Invenimus qui Latrunculos Luſorios Magnitudine exſuperent; atque etiam *Viciæ Semine* Minores. In Arenoſis Fodinis *Marchamenſibus*, ſine ulla fere (ut mihi viſum eſt) materiæ *Oſſeæ* jactura conſervatos vidimus. Porro *Ichthyoſpondyli* aut raro aut nunquam inveniuntur pluribus ſimul junctis, ut Piſcium *Vertebræ*: Magno quidem Indicio, me Judice, has non eſſe *Lapides* Spontaneos, ad imaginem (cognatæ quantumvis materiæ) *Oſſium* formatos. Nam ſi Natura Subterranea, quod Marina perficit, preſtare conatur quidni eodem opere ac labore, quo Singularem *Piſcis Vertebrarum*, integrum ſaltem *Sceleton*, ut cætera nequeat, conficeret?

Fig. 122. 21. *Maxillæ Piſcis* fragmentum *Lapideum*, cum adnati *Bufonitibus*. *Garwordiæ* inventum.

2. *Gloſſopetra*

Plate 5. Vol. 2. Pag. 510.

Fig. 64.

Fig. 65.

Fig. 66.

Fig. 67.

Fig. 68.

Fig. 69.

Fig. 70.

Fig. 71.

Fig. 72.

Fig. 73.

Fig. 74.

Fig. 75.

Fig. 76.

Fig. 77.

Fig. 78.

Fig. 79.

Fig. 80.

Fig. 81.

Fig. 82.

Fig. 83.

Fig. 84.

Fig. 85.

Fig. 86.

Fig. 87.

Fig. 88.

Fig. 89.

Water

63

90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 149 150

22 *Gloſſopetra* Exigua cum *Mandibulæ* fragmento *Lapideo* adnato. *Faringdon.* *Fig.* 129.

23, 24, 25, We found near *Lhan Deilo* in *Caermardhinſhire*; 26, 27, 28, 29. on the *Severn* Shore in *Gloceſterſhire*; 30 at *Gold Cliff* in *Monmouthſhire*; and all the reſt in the Iſle of Caldey, in *Pembrokeſhire*. The 25*th*. *Fig*, 132. whereof we found great Plenty, muſt Doubtleſs be referr'd to the *Sceleton* of ſome *Flat-Fiſh*; the 23*d*. and 24*th* I know not at all what to make of: The reſt are *Modioli*, or *Vertebræ* of *Sea-Stars*; for *I* have been long ſince fully ſatisfied that all ſorts of *Entrochi* and *Aſteriæ* muſt be referr'd thither; not that I conclude that either theſe, or any other *Marine Terreſtrial* Bodies, were ever really, either Parts or *Exuviæ* of *Animals*; but that they bear the ſame Relation to the *Sea-Stars*, that *Gloſſopetræ* do to the *Teeth* of *Sharks*; the *Foſſil Shells* to the *Marine* Ones; *&c.* n. 243. p. 279. *Fig.* 130, 131, 132. *Fig.* 133, 134, 135, 136. *Fig.* 137. *Fig.* 138, 139, 140, 141, 142, 143, 144, 145. 146, 147, 148.

Fig. 149, 150. Repreſent a *Limeſtone Marble*, we have lately diſcover'd in *Wales* when Poliſh'd. We have Plenty of it; but few pieces exceed 6, 9, or 12 *Inches* Diameter; for 'tis only a ſort of *Alcyonium*, incorporated in ſeveral ſmall Blocks of the *Limeſtone*; whereof *Fig.* 149. Repreſents a piece Poliſhed Perpendicularly, and *Fig.* 150. Horizontally. 'Tis to me more Beautiful than the *Florentine Marble*, but much more Hard and Subſtantial. n. 252. p. 187. *Fig.* 149, 150.

N. B. This ſtone is a ſort of *Coral*, and the *Lapidis Aſtroitidis* ſive *Stellaris Primum Genus. Boet. de Bodt*; or *Aſtroites*, *Worm. Mus.* It grows in the Seas adjoyning to *Jamaica*. It is frequently found Foſſile in *England*. *I* have ſome of it that will Poliſh as well as *Agat*, which was many years ſince found out by Mr. *Beaumont*. *By Dr.* Sloan. *ib. p.* 188.

LXXVI. 1. This Deſcription of the *Giants Cauſway I* received from a Scholar and a Traveller, who went on purpoſe the laſt ſummer 1692 with the 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 *Derry*. The Coaſt there is a very great Height from the Sea: And from the Foot of the Precipice, there runs out Northward, into the Main Ocean, a Raiſed *Cauſway* of about 80. *Foot* Broad, and about 20 *foot* High above the reſt of the Strand; its ſides are Perpendicular; it was about 200 *Foot* in View to the Sea-Water. *The* Giants Cauſway *in* Ireland; *by Sir* Rich. Buckley. n. 199. p. 708.

This whole *Cauſway* 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*. When one Walks upon the Sand below it, the ſide of this *Cauſway* has its Face all in *Angles*, the ſeveral *Cylinders* (pardon the *Impropriety* of the *word*) having ſome *Two*, ſome *Three* of their ſides open to View. The very vaſt High Precipice does alſo conſiſt all of *Cylinders*; tho' ſome Shorter and ſome Longer: 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.

2. The

By Dr. Sam. Foley. n. 212. p. 170.

2. The *Giants Cauſway* is ſomewhat more than 8 *Engliſh Miles* North East from the Town of *Colerain*, and about 3 from the *Buſh Mills*, almoſt directly North. It runs from the bottom of an high Hill into the Sea, no Man can tell how Far, but at Low Water the Length of it is about 600 *Foot*, and the Breadth of it, in the Broadeſt place 240 *Foot*, in the Narroweſt, 120 *Foot*. It is very unequal likewiſe in the Height, in ſome places it is about 36 *Foot* High from the Level of the Strand, and in other places about 15 *Foot*.

It conſiſts of many thouſand Pillars, which ſtand moſt of them perpendicular to the plain of the Horizon cloſe to one another, but we could not diſcern whether they do run down under Ground like a Quarry or no Some of them are very Long, and Higher than the reſt; Others Short and Broke; ſome for a pretty large ſpace of an Equal Height, ſo that their Tops make an Even Plain Surface; many of them imperfect, Crack'd and Irregular, others Entire Uniform, and Handſome, and theſe of Different ſhapes and Sizes. We found them almoſt all *Pentagonal*, or *Hexagonal*, only we obſerved that a few had 7 *Sides*; and many more *Pentagons* than *Hexagons*, but they were all Irregular: For none that we could obſerve had their ſides of Equal Breadth; the Pillars are ſome of them 15 ſome 18 *inches*, ſome 2 *Foot* in Diameter, none of them are one Entire ſtone, but every Pillar conſiſts of ſeveral *Joynts*, or Pieces, as we may call them, of which ſome are 6, ſome 12, ſome 18 *inches*, ſome 2 *Foot* Deep.

Theſe Pieces lye asCloſe upon one another as 'tis poſſible for one ſtone to lye upon another; not *Joynting* with Flat ſurfaces, for when you force one off the other, one of them is always *Concave* in the Middle, the other *Convex* There are many of this kind of *Joynts*, which lye looſe upon ſome part of the *Cauſway*, and on the Strand, which were blown or waſhed off the Pillars. Theſe *Joynts* are not always Placed alike, for in ſome Pillars the *Convexity* is always Upwards, and in others it ſtands always Downwards. When you force them aſunder, both the *Concave* and *Convex* Superficies are very *Smooth*, as are alſo the *Sides* of the Pillars which touch one another, being of a *Whitiſh Free ſtone* Colour, but a Finer Cloſer grit; whereas when we broke ſome pieces off them, the inſide appear'd like *Dark Marble*.

The *Pillars* ſtand very *Cloſe* to one another: And though ſome have 5 Sides and others of them 6 yet the Contextures of them are ſo adapted, that there is no Vacuity between them; the Inequality of the Numbers of the ſides of the Pillars being often in a very ſurpriſing and Wonderful manner, throughout the whole *Cauſway*, compenſated by the inequality of the Breadths and Angles of thoſe ſides. So that the Whole at a little diſtance looks very Regular: And every ſingle Pillar does retain its own Thickneſs, and Angles, and ſides, from Top to Bottom.

Thoſe *Pillars* which ſeem to be Entire as they were Originally, are at the Top *Flat* and *Rough*, without any Graving or *Striate* Lines; thoſe which lye Low to the Sea are waſhed *Smooth*; and others that ſeem to have their Natural Tops blown or Waſhed off, are ſome *Concave*; and others *Convex*.

The High Bank hanging over the *Cauſway* on that ſide which lyes next it, and towards the Sea, ſeems to be for the moſt part compoſed of the common

ſort

Fig. 138.

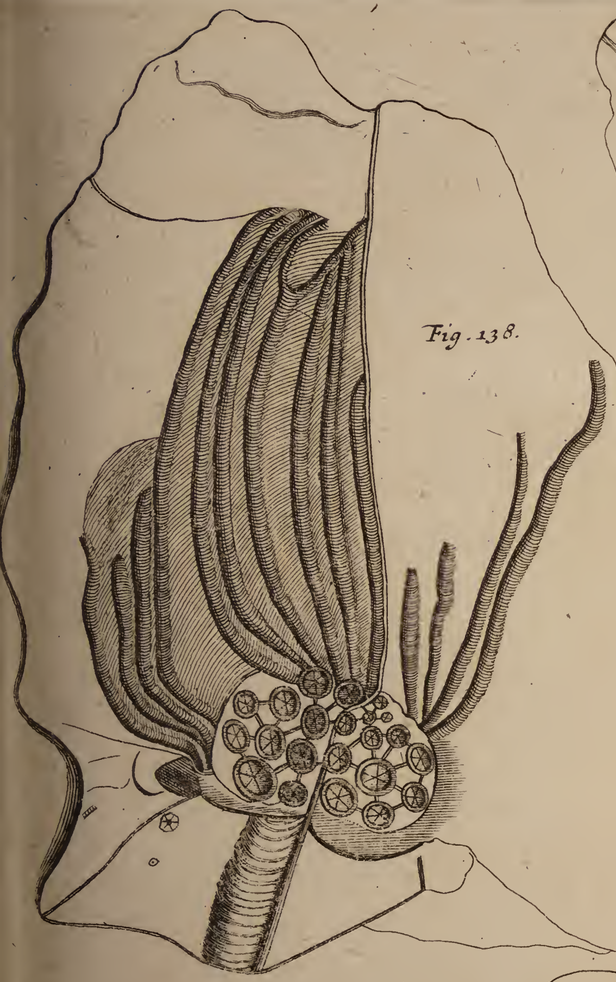


Fig. 139.

Fig. 140.

Fig. 130.

Fig. 133.

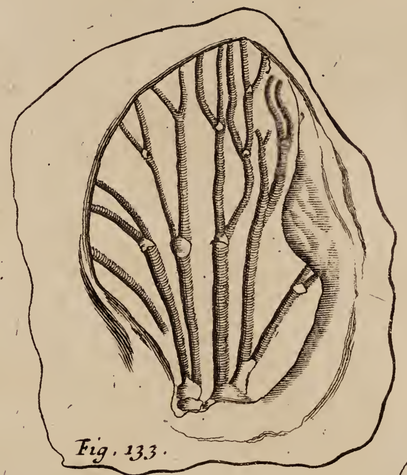


Fig. 131.

Fig. 145.

Fig. 136.

Fig. 146.

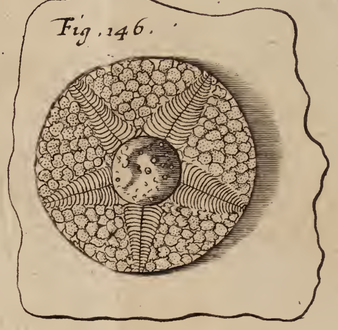


Fig. 134.

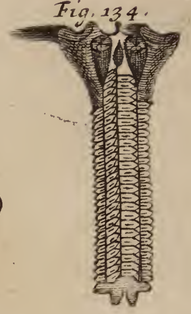


Fig. 148.

Fig. 132.

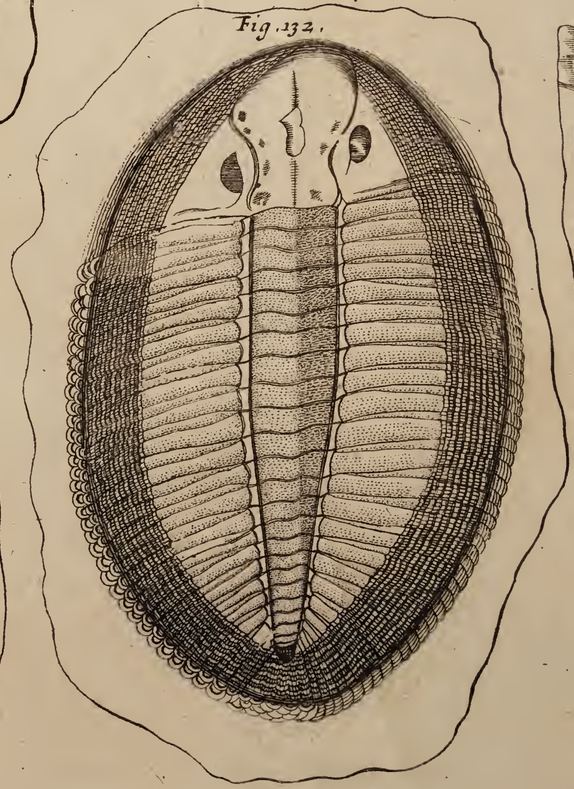


Fig. 147.

Fig. 135.

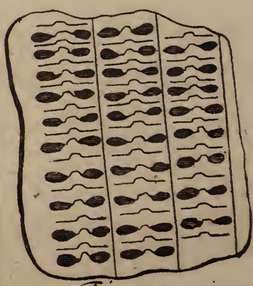


Fig. 137.

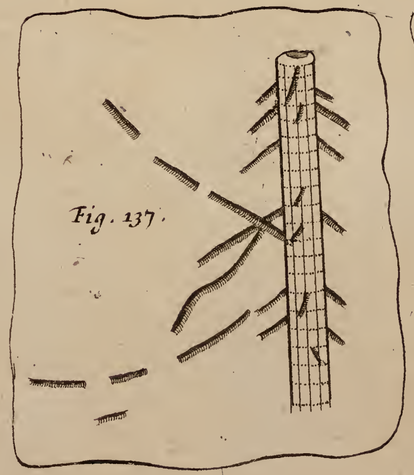


Fig. 141.

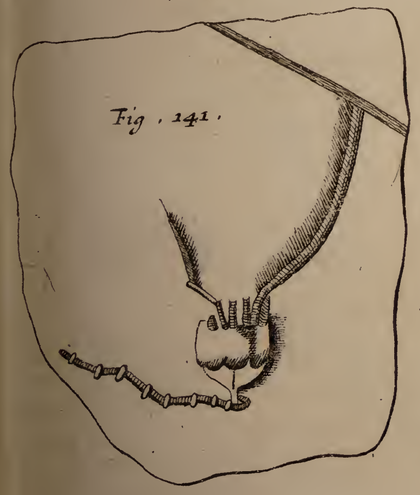


Fig. 142.

Fig. 142.

Fig. 143.

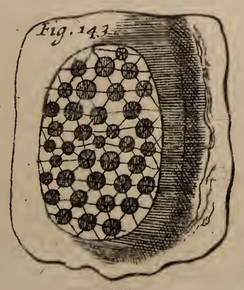
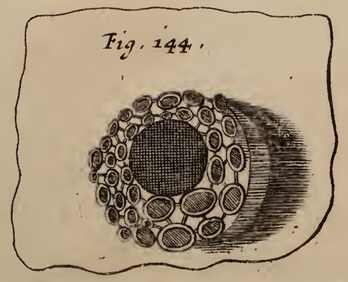


Fig. 144.



ſort of Craggy Rock: Only we ſaw a few Irregular Pillars on the Eaſt ſide, and ſome farther on the North, which they call the *Looms*, or *Organs*, ſtanding in the ſide of a Hill; the *Pillars* in the Middle being the Longeſt and thoſe on each ſide of them ſtill ſhorter and ſhorter: But juſt over the *Cauſway*, we ſaw as it were the Tops of ſome *Pillars* appearing out of the ſides of the Hill, not ſtanding, nor lying Flat, but Sloping.

We ſuppoſe each *Pillar*, throughout the *Cauſway*, to Continue the ſame to the very Bottom, becauſe all that we ſaw on the ſides were ſo.

N. The ſeveral ſides of One and the ſame Pillar are as in the Planes of *Cryſtals*, of very Unequal Breadths or Lengths, call it either, when you Meaſure them Horizontally; and that in ſuch as are *Hexagonal* a broader ſide always ſubtends, or is oppoſite to, a narrower, which ſort of *Geometry* Nature likewiſe obſerves in the *Formation* of *Cryſtals*. *ib. p.* 174.

3. Among the ſeveral *Figur'd Stones* already Deſcribed by Authors, *I* find none that has more Agreement with thoſe which compoſe our *Giants Cauſway* than the *Entrochos*, the *Aſtroites*, or *Lapis Stellaris*, and the *Lapis Baſanus* or *Baſaltes*: And yet for all the great Reſemblance they have in ſome particulars, they Differ very much in Others. *By Dr.* Tho. Molyneux. *ib. p.* 175.

The *Entrochos* Agrees with the *Pillars* of our *Cauſway* in that it is a ſtony ſubſtance, formed by Nature *Column wiſe*, and conſiſting of 20 or 30 ſeveral *Internodia*, or *Joynts*, ſet one a top of another; but then it Differs in that its Outward ſhape is Round and *Cylindr'cal*; in its having a *Hole*, or *Pith*, run from Top to Bottom through all the *Joynts*; in the ſetting on, or Way of Fitting one *Joynt* to another; and in its ſize and Magnitude.

The *Aſtroites* or *Lapis Stellaris* is not only ſhap'd *Column-wiſe*, as the *Entrochos*, and *Joynted* with ſeveral *Internodia* cloſely adjuſted to one another, but its ſides are *Angular*. But then it muſt be obſerv'd that the ſides of the *Aſtroites* are always *Sulcated*, or a little Furrowed, and are conſtantly *Pentagons*; whereas the *Iriſh Stone* has its ſides perfectly ſmooth, and *Plane*, and ſometimes in *Hexagons* and *Heptagons*, as well as *Pentagons*. Moreover the *Aſtroites* has Furrow'd and Protuberant *Rays* ſtriking from its Center, ſomewhat as they draw a Star. Whence it has its Name, that adapting the *Concavities* and *Convexities* together, cauſe the Cohæſion of the *Joynts* to one another; whereas the Internal Superficies of the *Internodia* in our *Iriſh Stone* ſends forth no ſort of *Rays* from its Center, and unite to one another by a quite different *Articulation* For beſides what Dr. *Foley* remarks of the Bottom or Top of each *Joynt*, having a large round *Concavity* or *Convexity* that extends it ſelf from the Center of the Stone within an inch or two of the Angular Circumference; Examining two *Joynts* that were ſent up from the place hither to *Dublin*, I obſerv'd likewiſe, that the Bottom or Top of each *Joynt* round this *Concavity* or *Convexity* either Riſes with an eminent *Verge*, or *Ridge*, if it be *Concave* in the Middle or if it be *Convex*, is Hollowed with ſuch a ſort of Groove, as to receive cloſely into it all the Eminent Ridge of the next *Joynt* either above or below it; ſo that each Superficies in the *Articulations* adapt themſelves on all ſides ſo exactly one to

t'other, as 'tis poſſible for two Bodies, that are only Contiguous, and not Cohæring.

The *Aſtroites* alſo as well as the *Entrochos*, Differs extremely from our ſtone in its *Size*, or *Magnitude*; for the Largeſt that is found of either of thoſe kinds, do not much exceed the Thickneſs of a Man's Thumb, whereas our *Columns* are ſome of them 2 *Foot* in Diameter. Yet this Diſproportion of bulk is not ſo conſiderable a Difference, ſince we obſerve that Nature Affects the like Diſparity in other of her Works, and thoſe too neerly allied, and evidently of the ſame Tribe, or Family. Our ſmall *Joynted Ruſhes* or *Reeds*, and the Largeſt *Eaſt Indian Bambon*, one of which I remember to have ſeen in *Holland* above 26 *foot* high and as thick as a Man's Middle, are yet *Plants* of the ſame Species and Claſs.

But nothing among all the *Foſſil* Tribe that *I* have ſeen ot read of; comes ſo nigh in all reſpects, in its Formation, Subſtance, Size, Way of Growth, or manner of ſtanding, *&c.* to the *Columns* whereof this *Cauſway* is Compoſed, as the *Lapis Baſaltes Miſenus*, deſcribed by *Kentmannus* in *Geſner* de *Figuris Lapidum*, whereof he ſays there is a great large Bed within 3 *Miles* of *Dreſden* in *Saxony*. He gives the following account of it thus in his own words. —— *Lapides Anguloſi plures coagmentati* Baſalten *repræſentat*, *qui creſcit formâ & magnitudine Figni mediocris*, *Singularis quidem ſed Copioſus atque ita Junctus Coaptatuſque*, *veluti ab* Arcularioarte *commiſſus eſſet*; ſeptem, ſex, quinque, *nonnunquam ſed rarius* quatuor Angulorum: *Omnino Figura Trabis erectæ*, *foris Lævis*, *& Tactu minime Aſper*, *Ferrugineus Ponderoſus*, *Duritie velut Adamantis*; *H. Lapides ſic Coagmentati è terra Ulnas decem & ſeptem extant*; *Quanto ſpatio intra Terram condantur*, *nemini adhuc exploratum eſt*. But, I find this Difference between theſe and the *Miſnean Baſaltes*, that its *Columns* were one Entire piece from top to bottom, whereas our *Iriſh Baſaltes* is compoſed of *Columns* Divided into many *Joynts*. So that I think it may not Improperly be called, to Diſtinguiſh it from this and all other *Foſſils*.

Lapis Baſaltes *vel* Baſanos Maximus Hibernicus *Angulis minimum Tribus plurimum Octo conſtans*; *crebris Articulis ſibi invicem affabre conjunctis*, *ſed facile ſeparabilibus*, *Geniculatus*.

Whether our *Iriſh Baſaltes* can pretend to the Name *Baſanos*, on the ſame account the *Miſnean* does, from the *Greek* word Βασανίζω, *Exploro*, becauſe it has the property of the *Touch Stone*, that ſhews by Lines drawn with Metals on its Smooth Surface, which are Genuine, and which Adulterate, *I* cannot poſitively ſay; becauſe thoſe *Pieces I* have, are ſo Rough, that unleſs ſome part of the Superficies were Artificially Poliſhed, the Experiment cannot be made: Yet *I* have reaſon to believe it would Succeed, were the Stone Poliſhed; becauſe *I* find *Black Marble* in general, ſo it be of a Cloſe Texture and Hard, as this is, always partakes of that Property.

A further Account of the Giants-Cauſway; *by Dr.* Tho. Molineux, n. 235. *and* n. 241. p. 209.

4. To have a Juſt Idea of this *Wonderful Production*, *I* propoſed the laſt Summer 1697. to ſome Philoſophical Gentlemen here in *Dublin*, that we ſhould

ſhould Imploy, at our common Charge, one Mr. *Sandys*, a good Maſter in Deſigning and Drawing of *Proſpects*, to go into the North of *Ireland*, and upon the Place take the Genuine and Accurate *Figure* of the Whole Rock, with the Natural Poſture of the Hills and Country about it for ſome diſtance; accordingly we ſent him away with ſuch Inſtructions as I drew up for him, and he Returned ſoon after with a Fair and Beautiful Draught, very expreſſive of each Particular we deſired.

A. The *Great Cauſway*; which is from *B.* to *C.* 135. *Yards*; from *D.* to *E.* 120 *Yards*; and from *F.* to *G.* 64 *Yards.* *Fig.* 151.

H. The *Imperfect Cauſway*, which is 120 *Yards* Long.

I. Stones, the ſame as thoſe of the *Cauſway*, which lye on their ſides in the *Hill.*

K. Rocks in the Sea, which appear to be the ſame ſort of Stone.

L. The *Organs*, which are *Pillars*, the ſame with the *Cauſway.*

M. The *Chimneys*, which are ſtone and make that Figure.

The *Prick'd Line* in the *Cauſway*, ſhews how far the Sea *Flows* at *High-Water.*

Fig. 152. The *Proſpect* of the *Eaſt ſide* of the *Cauſway.* *Fig.* 152.

There are alſo ſeveral of theſe *Kind* of *Stones* ſeen in the *ſides* of the *Rocks.*

But the moſt inſtructive part of the *Scheme* is that which expreſſes all the *Various Figures* of the ſeveral *Joynts* and *Columns* that have been found by careful Obſervation to make up the *Cauſway*,

N. A *Joynt* but of *Three Sides.* *Fig.* 153.

O. A *Joynt* of 4 *Sides.*

P. A *Joynt* of 5 *Sides.*

Q. A *Joynt* of 6 *Sides.*

R. A *Joynt* of 7 *Sides.*

S. A *Joynt* of 8 *Sides.*

Fig. 154. A Piece of a *Column* of 6 *Sides*, Tranſverſly divided in the Middle, the Uppermoſt part *a.* laid cloſe by the Lower part *b.* that the Manner may the better and more plainy appear, how the *Convexity* or *Riſing* of the *Joynt* below, mark'd *c.* was let into the *Hollow* of the *Joynt* above, mark'd *d.* when that was in it's Native Poſture, ſtanding a top and Covering it. By this ſort of *Articulation* the ſeveral *Joynts* of the *Columns*, whether they conſiſt of 3, 4, 5, 6, 7, or 8, *Sides*, Adapt and Unite themſelves to one another: and obſerve, in all the reſt of the *Figures*, *c.* denotes a *Convexity* or *Riſing*; *d.* a *Cavity* or *Hollowneſs*, in the Stone. *Fig.* 154.

Fig. 155. Is a Collection of 7. *Columns* as they ſtand together in the *Cauſway*; and ſhew that though the *Pillars* Differ from one another in their *Shape* and *Angles*, yet they Adjuſt their *Sides* in ſuch a Manner to the next immediate adjoyning *Columns*, that there remains no *Vacuity* between them: For the *Pillars* are of ſuch Various *Figures*, that all ſort of Interſtices, of what Shape ſoever, are entirely fill'd up by one or other of them. *eeee* the *Sides* of the *Pillars* which ſhew by their Outward Surface, that each *Column* conſiſts of many *Joynts* placed one above another, from Top to Bottom; and theſe *Joynts* *Fig.* 155.

ſo Cloſely Contiguous, that only a ſmall Creviſe or Line ſeems to ſever them; ſome with their *Convexities* Uppermoſt, as thoſe mark'd *c.* others with their *Concavities*, as thoſe mark'd *d.*

The *Triangular*, *Quadrangular*, and *Octangular Pillars* are much *Fewer* in Number than thoſe Other *Figur'd Columns*: So that they do not come Readily in ſight, except they be carefully ſearched after.

But this ſort of ſtone is not more Remarkable for being Cut thus Naturally into *Regular Geometrical Figures*, than for being found in ſuch *Plenty* and vaſt *Abundance* in many parts of this Country, for 4 or 5 *Miles* about. For, beſides what goes under the Vulgar Name of the *Giant's Cauſway*, which it ſelf alone is of a great Extent, and how far it may run into the Sea none can tell, there are many other Collections of the ſame Kind of *Pillars*, ſituated in and about this Place; as two Leſſer but more imperfect and Broken *Cauſways* as we may call them, that both lie at ſome Diſtance o'the Left Hand of the *Great* one, as you face the North; and a little farther into the Sea, ſome *Rocks* ſhew themſelves above Water, when the Tide is Low, that ſeem all made ſtill of the ſame ſtone. And if you Aſcend towards the Land in the Hill above the *Cauſway* next and immediately adjoyning to it, you meet with more of the ſame ſort of *Pillars*, but in a Different Situation, not Perpendicular and Erect, but Lying as 'twere on their ſides, in a *Slanting Poſture.*

Beyond this Hill Eaſtward, at ſeveral Diſtances, ſtand many ſets of Straight and *Upright Columns* Ranged in Curious Order along the ſides of the Hills: That Parcel of them which is moſt Conſpicous and neareſt the *Cauſway*, the Country People call the *Looms* or *Organs*, from its Formal Shape; which is ſo very *Regular*, that all its ſeveral *Pillars* may be Diſtinctly Counted, and they are juſt 50 in Number; the *Largeſt* and *Talleſt*, at leaſt 40 *Foot* High, conſiſts of 44 Diſtinct *Joynts*, and ſtands Directly in the Middle of all the reſt, they Gradually Decreaſing in Length on both ſides of it, like *Organ Pipes.*

Four *Miles* Weſtward of the *Giant's Cauſway*, a *Mile* and a *half* Diſtant from the Sea, 3 *Miles* from the Town of *Coleraine*, and about 2 from *Dunluce*, an old Seat of the *Marqueſſes* of *Antrim*, ſeveral Ranges of Tall *Pillars* ſhew themſelves, along the ſide of a Rock, for about 300 *Paces* together: a *Church* within a *Quarter* of a *Mile* of them, called *Ballywillan-Church*, I am told, was Built for the moſt part with Stone taken form thoſe *Pillars*, which are all of the ſame ſort of Stone with the *Columns* of the *Giant's Cauſway*, (as I find by carefully Examining and comparing together Pieces of them both I have now by me) and like thoſe too, Conſiſt of *Regularly* Cut, looſe and Diſtinct *Joynts*, placed one upon the Top of t'other; but in theſe Reſpects they Differ.

1. That ſome of theſe *Inland Pillars* are of much Larger *Size* than any in the *Cauſway*, being *two Foot* and a *half* in Diameter.

2. That there are only found among theſe, ſuch as have 3, 4, 5 and 6, *Sides*, and none that have 7, and 8, like ſome of the *Giant's Cauſway.*

3. That the *Joynts* of theſe do not obſerve that kind of *Articulation*, by *Cavities* and *Convexities*, as thoſe of the *Cauſway* do; but their Upper and Lower

Lower Surfaces Touch only in *Planes*, and they ſtand United by means of their Weight and Preſſure alone: ſo that a Small Force will ſever them.

But *I* find by obſerving the Manner of the *Commiſſure*, or way of *Articulation*, in *Six Couple* of the ſeveral ſorts of *Joynts* of 3, 4, 5, 6, 7, and 8, *Sides*, which *I* had raiſed on purpoſe, and taken out of the *Cauſway*, as they were naturally fellow'd in *Pairs*, that ſome of the *Joynts* actually want this *Cavity* and *Riſing*, as thoſe of 4 and 6 *Sides* I have now in my Houſe, and are only United to one another by Superficies touching cloſe in *Plains* that run a little Slanting and not Parallel to the Horizon. Yet this may be only a Chance Formation, ſince the Univerſal *Joynting* of the Whole *Cauſway*, is certainly otherwiſe. But *I* muſt take notice, that the *Hollows* and *Convexities* are not conſtantly form'd and moulded in the Stone with all that Accuracy and Circular Exactneſs, the Artiſt has pleaſed to expreſs them in the *Figures*.

Theſe *Cavities* in ſuch *Joynts* as are Uppermoſt, and lye expoſed to the Open Air on the Surface of the *Cauſway*, afford no ſmall uſe and Advantage to the Poorer ſort of the People in the Neighbouring Country, with whom it is a common Practice in the Summer Time, when they want *Salt*, to fill theſe natural Baſons with *Sea-Water*, which by Reaſon of their Shallowneſs are of ſo Commodious a ſhape, that in the ſpace of 4 *Tides* they find all the Water that was left in them Exhaled, and the *Salt* remaining Dry in the Bottom of the *Hollows*.

But there is another Irregularity *I* muſt take Notice of, which is, that one of the *Joynts* of the *Cauſway*, a *Pentagon*, ſent me hither to Town is *Convex* both at Top and Bottom: But the General Formation is this, that if a *Joynt* be *Concave* at one End, the other End is *Convex*.

The vaſt Towering Height of thoſe Strait *Joynted Pillars*, eſpecially of thoſe that are moſt ſlender and the perfecteſt among them, is truly very ſurpriſing. There are in the *Cauſway*, ſome of 32 others of 36 *Foot* High above the Strand, and as *I* ſaid before, ſome among the *Organs* equal 40 *Foot* in Height. How far theſe may be continued under Ground is not yet diſcovered: But a Gentleman of my Acquaintance Trac'd one of the Talleſt *Pillars* of the *Cauſway* by Digging into the Strand, and it continued ſtill of the ſame Make and Figure, *Joynted* as it was above, for the Depth of 8 *Foot* together, and he found no Reaſon to doubt but he might have trac'd it much farther.

This is Obſervable, that Commonly the *Joynts*, as well of the *In-land Pillars*, as thoſe of the *Cauſway*, as they have their Situation nigher the Earth, are Longer and Taller than thoſe towards the Top of the *Column*; but no Difference is Obſerved in the *Cavities* or *Riſings* of the *Joynts*, as they are placed Higher or Lower in the ſame *Pillar*, they continue much the ſame as to their Depth or Protuberance from Top to Bottom: Yet the Utmoſt Top of ſuch of the *Pillars* that ſeem Compleat and Entire, always Terminates with a *Joynt* that's *Flat* on the Upper

per ſide, and no way either *Concave* or *Convex* like all the reſt below it.

As to the *Internal Subſtance* of this ſtone, 'tis of an Extraordinary Hard, Cloſe, and Compact Texture: Its *Greet*, or *Grain*, ſo very Even and Fine that it hardly Appears, unleſs viewed near the Eye, and when the ſtone is newly Broke: Then it ſhews it ſelf on its Surface like a very minute ſmall Gliſning Sand thickly interſperſed with the reſt of the Solid; which by Reaſon its parts are ſo Firmly Combin'd together, has ſomething more of Gravity, in Proportion to its Bulk, than moſt other ſorts of Stone, unleſs ſuch as partake of the *Marchaſite* or *Pyrites* and are more Ponderous than uſual from a *Metalline* Principle, being an Ingredient in their Compoſition; of which this does not at all Participate, or at leaſt not in any conſiderable Quantity that I can diſcover.

It ſeems as if it were one Plain Homogeneous Body, without any Mixture of *Cochlite*, *Belemnite*, *Veins* of *Spar*, or ſuch like Extraneous Matter, ſo commonly met with in moſt other ſtony Concretes: Nor can there be Obſerved *Rays*, *Furrows*, *Striæ*, or any Manner of *Lines* running along its Superficies; ſo that it is Capable of a good *Poliſh*, and *I* find has in Perfection that Quality of the *Lapis Lydius*, *Baſanus* or *Touchſtone*, ſo much Celebrated of Old, for ſhewing the various Impreſſions Different Metals make upon it when Rub'd or Drawn along its Surface; but being a Stone naturally Divided into ſmall Pieces or *Joynts*, and of ſo Hard a Body, that it Turns or Breaks the Edges of the beſt Tools, when they offer to Cut it, it ſeems Unfit for the imbelliſhing of Houſes, and all the other greater Uſes of *Architecture* and *Statuary*.

Its Rough and Natural Outſide that's expoſed to the Open Ar, and Beating of the Weather, is of a *Whitiſh Colour*, much the ſame with that we ſee on Common Rocks, and Lime-ſtone; but the inſide, when you ſever one piece from another, is of a *Blackiſh Iron-Grey*, like that of the beſt *Black Marble* before 'tis Poliſhed, but ſomewhat of a Darker Shade. And indeed I can diſcover but Little, if any, Difference between the Subſtance of this Stone and that of *Marble*. 'Tis true, the moſt Common ſort of *Marble* is not near ſo Hard and cloſe a Body; yet that does not Import much, ſince 'tis known that ſeveral Kinds of *Marble* vary extreamly from one another in *Hardneſs*.

Georgius Agricola, in his Book *de Natura Foſſilium*, has a Paſſage (and which *I* find confirmed too, by a Later Author living in that Country, *Lachmand de Foſſilibus, &c.)* wherein he mentions a ſort of *Marble* found in the Diſtrict of *Hildeſheim* in *Germany*, that ſeems to bear in ſeveral Reſpects, a great Analogy or Agreement with this ſtone of the *Giants Cauſway*. *In* Hildeſheimo *quoque e regione* Arcis Marieburgi *Collis eſt plenus* Lapideis Trabibus *quarum Capita interdnm eminent, ſunt vero Perlongæ acervatim poſitæ, inque medio earum Terra eſt Colore Nigro, Ferro aut altero Lapide percuſſæ non aliter ac* Marmor Hildeſheimum *Cornu Uſti virus olent, omninoque ex eadem Materia ſunt.* He does not indeed tell us the preciſe Figure of theſe *Marble Beams*,

Fig. 152.

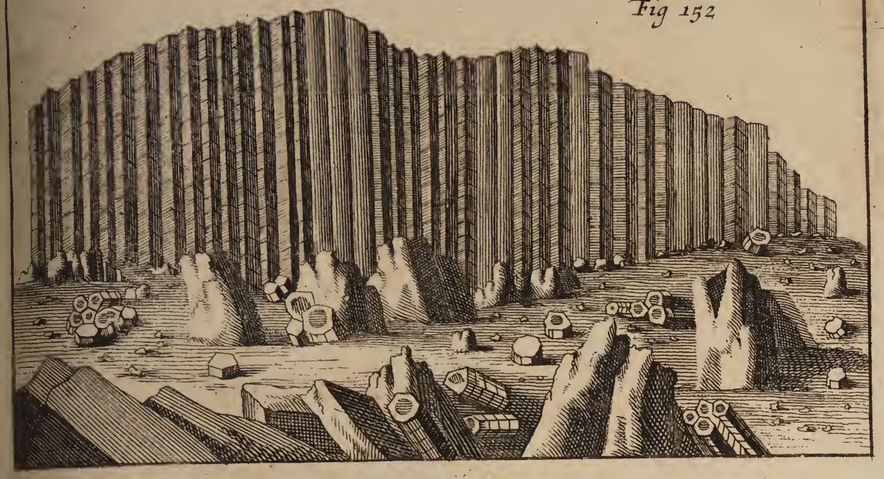


Fig. 156.

Fig. 154.

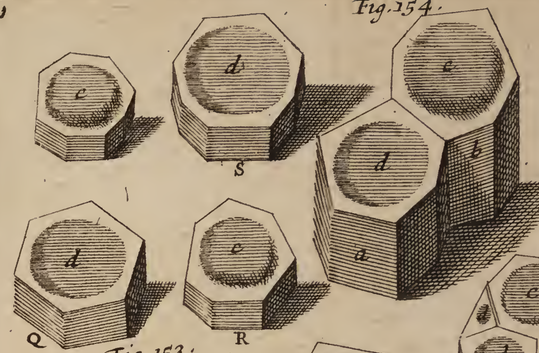


Fig. 155.

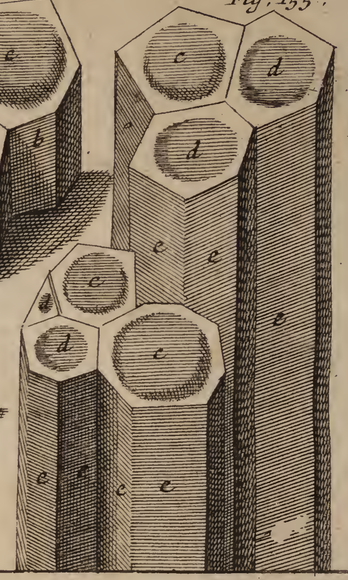


Fig. 153.

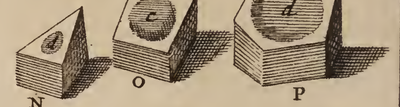


Fig. 151.

Beams, yet it ſeems probable at leaſt that ſome were *Square*, which makes him call them, *Trabes Lapideæ*. But however that might be, this I'm aſſur'd of from frequent Experiments, that the *Marble* of the *Giant's Cauſway*, like theſe *Stony Beams*, when forcibly ſtruck with another ſtone or a Bar of Iron, ſends forth a ſtrong offenſive ſcent like *Burnt Horn*.

LXXVII. The beſt way to explicate the *Vegetation* of *Rock-Plants* is, *firſt*, to Repreſent the ſeveral ways of the *Growth* of *Spar*, which (to paſs by the Account from *Helvetia*, that *Snow* by long lying and continual *Froſts* is Hardened into *Spar*) I obſerve to be three; *Either* 1. it takes a Being from *Steams* alone; or 2 from *Steams Coagulating*, either *Dew* as it falls on the Ground, or *Waters* iſſuing from the joynts of Rocks under ground; *or* 3 it Grows from *Earths* and *Clays*. We have an inſtance of the *firſt* in many *Grotto's*, where ſome *Spars*, produced from *Steams* alone, Hang from the Roofs like *Icicles*; *Lead-Ore* often growing in the ſame Manner: And as this *Spar* grows Downwards, ſo in many places from the ſides of it there iſſue little *Plants* of *Spar*, which ſhoot Upwards contrary to the Growth of the other. Thus *Spars* grow from *Steams* about the *Baths* at *Buda* in *Hungary*, according to the Relation of Dr. *Brown*. An Example of the 2*d* is given above; where 'tis ſaid, that at a certain place in *Italy*, *Cryſtals* (which are a ſort of *Spars*) are Produced in Clear Evenings by a *Coagulation* of *Dew* falling on *Nitrous Steams*. We have ſome, of the like Riſe, on *Mendip Hills*, our Miners finding ſometimes in Roads, where the Earth is bare, *Triangular Cryſtals* about 2 *Inches* in Length and an *Inch* over, not with Sharp Angles, like the *Triangular* Glaſs, but with Round and Blunt Angles, and carried up Round at the Ends like a *Coco-Nut*; none of theſe being ever found in Digging. I have alſo ſeen of the ſame ſort which were taken up in *Gloceſterſhire*. So again its commonly ſeen in *Grotto's*, that *Steams Coagulating Waters* iſſuing from the Joynts of the Clefts, Produce *Spars* of all *Colours*. As to their 3*d*. *way* of Generation, to wit, from *Earths* and *Clays*, becauſe I do not remember to have met, in any Author, with a Satisfactory Account thereof, I ſhall briefly relate to you what I have Obſerved herein.

The Growth of Spar, *and Formation of* Rock-Plants; *by Mr.* J. Beaumont. n. 129. p. 734. *Vid. Sup.* § LIX.

Vid. Sup. Cap. II. § XXXIX. *Vid. Sup.* § LX.

There are in *Mendip Hills*, and generally where *Mines* are, *Subterraneous Vaults* or *Grotto's*, whereof *ſome*, which are pretty Deep, and admit not Air too freely, and have other Conditions required, are ſaid by our *Miners* to be *Quick*, having often *Ore* in them, and ſtill Lively Coloured *Earths*, with ſome Moiſture and *Lively Spars*: *Others*, admitting Air 2 or 3 ways and having in them Black and Moiſt Rocks, and Dry and Rotten *Shelly Stones*, Dark Earths, Barren Sands, and the like, being ſaid to be *Dead*. I have often Searched *both*, and in ſome of the Former, particularly in one of them, which is 35 *Fathom* Deep, by a perpendicular Line (though the Oblique Deſcent of it makes it above 50 *Fathoms* to thoſe that go into it,) I Diſcovered this proceſs of Nature in the *Formation* of *Spar*. There are in the bottom of this *Grotto* ſome Beds of *Clay*, and others of a *Liver Coloured Earth* which I take to be as good a *Bole* as any now in Uſe; it is inſipid to the taſte,

Vid. Sup. § II.

but

Smells well, eſpecially when Dried; for, as it lies, it is Moiſt and like Paſte, made ſo partly by the Diſtilling Waters, and partly by a *Steam* Incumbent on the place Raiſed from thoſe *Waters* by the *Mineral Ferments*. This *Earth* and *Clay* there Shoots up every where in *Spires* in all proportions in Height, from the Firſt Buddings out of it, till it comes almoſt as High as a Man's Finger; the Biggeſt of them being in Thickneſs about an *Inch* Diameter. Theſe *Spires* are all Ruled up with Irregular *Ridges* and *Furrows*, and ſome ſooner ſome later, begin on the Top to be Congealed into *Spar*, and ſo gathering a *Cruſt* Downward by Degrees, are all at laſt Turned into an Abſolute *White Spar*, with ſome *Diaphaneity*. I Diſcovered the ſame *Earth* in ſome places there growing *Spherical*, which whilſt it is *Earth* it is ſtill ſticking to its *Bed*; but afterwards, as it comes to be *Cruſted* over and at laſt to be Turn'd into *Spar* like the other, it Grows clear off from it's *Root*, as Fruit falls from the Tree when Ripe. I have by me of theſe *Spherical Stones*, from the Bigneſs of an ordinary Bullet, to that of a Great Pins head, ſome Turning to *Spar* ſooner than others: I found ſome quite Grown off, ſome Half Grown, ſome *White Spar* Outwardly, and *Raw Earth* in the Middle, ſo that the Proceſs was as Plain to me as I could wiſh. I ſaw the ſame *Earth* in ſome places there growing in an exact *Oval* Form, and Turning into *Spar* not *Oval*, but Raiſed on both ſides with an *Edge* round it like *Apricock Stones*: And as theſe *Spherical* and *Oval Stones* are moſt exact in their Figure; ſo, notwithſtanding the Rector fails in this *Vault* to give a true *Sexangular Figure* to thoſe which I ſaid ſhoot up *Pyramidally*; yet there is a certain place on theſe *Hills*, where the *Spars* Grow all *Sexangular*, both Points of them Terminating into a *Pyramidal* Figure, *Sexangular* likewiſe, as the *Veins* of *Chryſtal* found in *Italy*, produced by a *Coagulation* of *Dew*; theſe with us probably having the ſame Riſe, Lying alſo on the Surface of the *Earth* Here I may acquaint you, that I find *Talc* on theſe *Hills* growing *Sexangular*; the Ruſt, which oftentimes lies over *Veins* of *Lead-Ore*, in many places Shoots up *Pyramidally*, and is bounded round with 6 *Angles*, and ſometimes with 5; *Lead Ore* it ſelf often Shoots up *Pyramidally* with rough Irregular Lines round it, and in ſome places I find it bounded round very Regularly with 4 *Angles*; in other places it Grows Branched like a *Plant*, as I have ſeen in a Mine where the *Stone Plants* grow.

As to that Opinion which generally ſolves thoſe various *Phænomena* of the ſeveral *Figured Stones*, which we find in *Mines* and elſewhere, by ſaying, That they are part of *Plants* and *Animals*, or Whole ones, *Petrified*; it ſeems not to be grounded on Practical Knowledge. Thus when we find ſeveral ſorts of *Shell-fiſh* in *Mines*, as there are ſome in the *Clay* where thoſe *Stone Plants* grow, we muſt not flie to *Petrifaction* as though they had been brought there by the *Sea*, or otherwiſe, and ſo Petrified; but we muſt take that to be (as it is truly) the Natural Place of their *Birth*; ſome of them being *Raw Clay*, others of the ſame Texture with the *Rock* where they grow, and others of as abſolute a *Shelly Subſtance* as any in the *Sea*; theſe being only different gradations of Nature, which can as well produce *Shells* in *Mines* as in the *Sea*,

there

there being no want of *Saline* or *Earthly* Particles. Nor is there any great Difference betwixt ſome ſorts of *Spars*, and *Sea-ſhells*; neither do I know, why *Shells* might not as well be produced in *Mines*, as any ſorts of *Spars* are in the *Sea*; for Inſtance, the *Fungi Marini*, which are of a *Sparry* ſubſtance, ſome of them having their Surface all wrought with Flowers, as it were, which are only the *Terminations* of *Sparry Cells*; as in *Coral*; and *Coral* it ſelf is a ſort of *Spar*, which ſo well reſembles our *Stone-Plants* in its growth, eſpecially if ſome of it be jointed, as Mr. *Ray* informs us, that I know not a more apt Name for theſe than to call them *Mineral Coral*; unleſs ſome haply will rather ſay, they are *Fluores Arboſcentes internodiis diſtincti*; and as I find the Bodies and Branches of ſome *Coral* are all Ruled up with *Lines*, ſo are many of theſe in ſome *Mines*, and are terminated with *Cells* like it.

Mr. *Liſter* Judges that *Shells* found in *Stone-Quarries* were never any *Part* of an *Animal*; and gives this probable Reaſon for it, becauſe *Quarries* of *Different Stone* yields us quite different *Species* of *Shells*, not only one from another, but from any thing in Nature beſides, which either the *Land*, *Salt*, or *Freſh Water*, does yield. I have Obſerved the ſame thing ſome Years ſince, and have now by me ſeveral *Species* of *Stone* reſembling *Shell Fiſh*, which I gathered from Plowed Fields and Quarries, that are ſcarce to be Parallel'd, as I judge by all the *Collections* of *Sea Shells* extant. *Vid. Sup.* Sect. XXX.

To examine this Opinion of *Petrification* further; I only find, that the Thing ſuppoſed to be *Petrifyed* becomes firſt *Cruſted* over with a *Stony* Concretion, and afterwards, as it Rots away Inwardly, the *Lapideſcent* Juyce inſinuates it ſelf by degrees into its room, and makes, at laſt a *firm Stone*; Reſembling the Thing in *Shape*; which may lead ſome to believe it really *Petrify'd*. But, though a Real *Petrifaction* were Allowed in ſome Caſes, it would not be rational to plead this in all the *Figured Stones* we ſee, in regard of thoſe many grounds we have for the contrary. But I take theſe to be the Chief Reaſons which make ſome ſo ready to Embrace ſo generally this Conceit of *Petrifaction*, becauſe they are Prepoſſeſt with an Opinion againſt the *Vegetation* of all *Stones*, and for that they think it Impoſſible for Nature to expreſs the *Shapes* of *Plants* and *Animals* where the *Vegetative Life* is wanting, this being a Faculty peculiarly belonging to the *Soul*; whereas they ſeem to Err in *both*; For, as what hath been ſaid concering our *Stone Plants*, may ſuffice to prove their *Vegetation*, ſo it will be as eaſie to ſhew, that Nature can and does work the *Shapes* of *Plants* and *Animals* without the Help of a *Vegetative Soul*, at leaſt, as it is ſhut up in Common *Seeds* and *Organs*. To be ſatisfied of this, let them view the *Figurations* in *Snow*; let them view thoſe delicate *Landskips* which are frequently (at leaſt in this Country) found depicted on Stones, carrying the reſemblance of whole *Groves* of *Trees*, Mountains, and *Valleys*, &c. let them Deſcend into *Coal-Mines*, where generally with us the Clifts near the *Coal* are all wrought with Curious Repreſentations of ſeveral ſorts of *Herbs*, ſome exactly reſembling *Fern-Branches*, and therefore by our *Miners* call'd the *Fern-Branch Clift*; ſome reſembling the *Leaves* of *Sorrel*, and ſeveral ſtrange *Herbs*, which haply the known *Vegetable Kingdom* cannot Parrallel; and though it could, here can be no Colour for a *Petrifaction*, it being only a *ſu-*

ſuperficial Delineation. The like may be ſaid of *Animals*, which are often found *Depicted* on *Stones*; as all *Mineral* Hiſtories will ſufficiently inform them. Now ſince here is no Place for *Petrifaction*, or a *vegetative Soul*, we can only ſay, That here is that *ſeminal Root* (though hindred by the Unaptneſs of the Place to proceed to give theſe things a *Principle* of *Life* in themſelves) which in the Firſt Generation of things made all *Plants*, and, I may ſay, *Animals* Riſe up in their *Diſtinct Species*; *God* Commanding the *Earth* and *Waters* to Produce both, as ſome *Plants* and *Animals* Riſe up ſtill in certain places, without any *Common Seed.*

It is a thing of very difficult Search, to find what this *Seminal Root* is, which is the *Efficient cauſe* of theſe *Figures:* But it ſeems to me not very Unapt to Explicate it according to the Saying of *Heraclitus*; *Lux Sicca, Anima Sapientiſſima*, that is, where there is a ſtrong Internal *Light* to Expand the *Ideas*, and a *Drought* to Terminate them, the Vertue of a *Soul* is ſtill Preſent which *Imprints* them in the Matter. Hence we find Nature is moſt Buſie in the Kind where her *Intentions* are highly raiſed by the Preſence of her chief *Principles*, *Salts*, *Sulphurs*, and *Mercuries*, promoting her *Ferments*, which cauſe ſome Internal *Light* and *Drought*, the *Ignes Fatui* being only ſhadowy Reſults from them: Thus we ſee Over and in Beds of *Clays* and *Marles*, which have ſtrong *Ferments*, being well Impregnated with *Salts*, there often lie Beds of *Marchaſites* full of *Luminous* Particles, and there we frequently find great numbers of *Lapides Serpentarii*, and *Marchaſites* reſembling *Snakes*; and ſo ſeveral other *Figur'd Stones*, as the *Belemnites*, *&c.* And in the Joints of the *Lias Stones*, growing over Beds of *Clay*, we often meet with a great plenty of Elegant *Landskips.* In *Coal-Mines*, where the *Sulphurs* are ſtrong, we find great Lumps of very Bright *Marchaſites*, and great Varieties of *Herbs* Depicted as is ſaid before. In *Mines* of *Metals*, where the *Mercuries* are generally Predominant, there are *Landskips* and *Repreſentations* both of *Land* and *Sea Animals*, whereof ſome carry a Bulk, others are only Superficially Delineated. Thoſe who endeavour to Explicate thoſe *Figurations* Mechanically, ſeem to have a harder Task; for, if they ſay with *Hippocrates*, *Spiritu Diſtenta omnia pro Generis Affinitate diſtant*; as though, when the *Mineral Spirits* had Extended the Matter, it fell into thoſe *Figures* upon a Spontaneous Receſs, according to its proper Weight, which gives Order and Meaſure to things; as he Mechanically ſhews by a *Bladder*, into which, if *Earth*, *Sand*, and *Filings* of *Lead* be put, and *Water* be added to them, and we give them Motion by Blowing in the *Bladder* through a Reed, firſt they are Mixt together with the *Water*, but in a while continuing in a gentle Motion they ſeparate themſelves and retire each to its like, the *Lead* to the *Lead*, *&c.* I ſay, if it be Explicated thus, it ſeems difficult to Conceive, how the matter ſhould come to have ſuch a Determinate Weight to run into ſuch *Figures*, without a *Specifical Rector* to Intend and diſpoſe it, unleſs a General one be Admitted, in whoſe Vertue all *Known* and *Poſſible ſpecies* are, which, firſt Introducing Diſpoſitions in the Matter, he Intentionally works; and, as ſometimes he gives that Weight to the Matter, not Endowing it with a *Principle* of *Life*, ſo he often diſpoſes it to Receive *Life* and introduces it; which Poſition I conceive will Hold good, notwithſtanding ſome late Induſtrious Eſſays to prove that there is

Lib. de Nat. Pueri.

LXXVIII. Here is lately found in *Cheſhire*, a *Rock* of *Natural Salt*, from which iſſues a Vigorous Sharp *Brine*, beyond any of the Springs made uſe of in our *Salt-Works*. There runs near it (at leaſt in the Winter Seaſon) a ſmall Rindle (or Gutter rather;) but it is wholly free from all Danger of Overflowing, which threatens all other *Salt-Pits* in this Country every great Shower, through the Vicinity of Rivers. The *Rock* of *Salt*, by the relation of the Workmen, is between 33 and 34 *Yards* diſtant from the Surface of the Earth That parcel of it which the Augur brought up was as Hard as *Allom*, and as Pure, and when Pulverized became an Excellent, Fine, and Sharp *Salt*. The firſt Diſcoverer of it was one *John Jackſon* of *Halton*, about *Lady-Day* laſt, (1670) as he was Searching for *Coals* on the behalf of the Lord of the Soil, *William Marbury* of *Marbury* Eſquire.

A Rock of Natural Salt *in* Cheſhire; *by Mr.* Adam Martindale. n. 66. p. 2015.

LXXIX. There are two Kinds of *Tranſylvanian Stone Salt*: The *Sal Gemmæ*, and that which is commonly uſed at *Table*. The Latter is found in moſt of the *Salt-Mines*; and is brought in great Quantities down the River *Tibiſcus*, and the Rivers running into it: Some of which is afterwards ſent Down the *Danube*, and Up the *Morava* to furniſh *Servia*, and the adjacent Provinces; and a great part of it Up the *Danube* into *Hungary*. But they bring it no Higher; Stone Salt being Prohibited by the Emperour, in *Auſtria* who hath a conſiderable Profit upon the *Boyled Salt* brought from *Hall-ſtadt* in that Province.

The Salt-Mines *in* Tranſylvania *and* Hungary; *by Dr.* Brown. n. 58. p. 1191.

I have alſo received an Account, that half an Hour's going from the City *Eperies*, there is a *Salt-Mine* of great Note; from the firſt place of Deſcent unto the Bottom, it is about 180. *Fathoms* Deep: Into this the Miners Deſcend firſt by *Ropes*, and at laſt by *Ladders*, unto the Lower parts. The *Mine* is for the moſt part in an *Earthy*, and not a *Rocky* Ground.

The *Veins* of *Salt* are Large, and there are Pieces to be found of 10000 *pound* Weight. They commonly Hew out the *Salt* into long ſquare pieces of 2 *Foot* in Length, and *one* in Thickneſs; and for uſe, it is Broken and Grinded between two Grind Stones.

The *Mine* is Cold and Damp, but the *Salt* being a *Stone-Salt*, is not eaſily Diſſolved, or at leaſt in any great Quantity, by Dampneſs or Moiſture: Yet the Water of the *Mine* is Impregnated with *Salt* in ſuch ſort, that being Drawn out in large Buckets, and afterwards Boyl'd up, it affords a *Blackiſh Salt*, which they give to their Cattle in the Country.

The Colour of the Ordinary *Stone-Salt* of this *Mine* is not very *White*, but ſomewhat *Grey*; yet being Broken and Grinded to Powder, it becomes as *White* as if it were Refin'd. This *Salt* conſiſts of *Pointed* Parts, or *Foſſets*: Another ſort of *Salt* there is, which conſiſts of *Squares* and *Tables*; and a Third, to be found of ſomewhat *Stirious* or *Long ſhoots*.

Nor is all the *Salt* of this *Mine* of one Colour, but of Divers; that which is found groſly Mixt with the *Earth*, receives ſome Colour from it: And e-

ven that, which is moſt Pure, and reſembleth *Chryſtal*, doth often receive Tinctures of ſeveral Colours. In the middle of a *Chryſtal Salt* with *Long Shoots*, I have ſeen a Delicate *Blew*; and Count *Rothal* hath a Large piece, of a Fair *Yellow*. There are alſo ſome pieces very Clear and Tranſparent, ſo Hard that they Carve them into divers Figures, as *Croſſes*, *Crucifixes*, and others.

I cannot omit to Advertiſe you, that whereas theſe *Salts*, though kept without Care, Remain'd *Dry* for many Months in other Countries, yet they began ſomewhat to *Relent* ſoon after I came into *England*, and if they be kept in a *Stove*, or very *Hot* Place, they will be apt to loſe their *Tranſparency*.

Sal-Gemme Mines *in* Poland; *by* ..... n. 61. p. 1099.

LXXX. The *Mines* of *Sal Gemme* in *Poland*, a mile diſtant from *Cracovia*, near the ſmall Town of *Wilizka*, which (the Church excepted) is altogether digged Hollow under Ground, hath 4 *Deſcents*: Of which the two Chief being in the Town it ſelf, are thoſe through which the *Salt* is drawn up; the other two do ſerve for letting down Timber and other Neceſſaries. Theſe *Deſcents*, or Holes, are ſquare, 4 or 5 *Foot* long, and as broad, lin'd downwards thorough with Timber. Above, is a great Wheel, with a Strong Rope, of the thickneſs of a Luſty Arm, drawn about by a Horſe, like as in a Horſe Mill.

He that will *Deſcend*, muſt cover himſelf with a Frock, and have another man that faſtens another Rope to the aforeſaid Big Rope, and having ſo tyed it about himſelf as to ſit in it, takes one in his lap and holds him faſt about; whereupon the Big Rope being let ſomewhat down, another faſtens likewiſe a piece of Rope to the other Thick Rope and does like the former, ſeating himſelf in it and taking and claſping another Man in his Lap; and being alſo let down a little way gives place to others to do the like; in which manner, 30, 40, and more Perſons may be let down all at once; of whom the Firſt having toucht the Ground ſteps out and goes aſide, the reſt following him and doing the like. And thus they Deſcend to the depth of 100 *Fathoms*. But then they take a Lamp and lead People about by ſtrange Paſſages and Meanders, ſtill more and more Deſcending, till they come to certain *Ladders* by which they go down 100 *Fathoms* deeper, where there are double Paſſages and Holes one above another, in abundance; for the Mine men dig on ſtill, and cut out every where and on all ſides, as long as the *Salt Vein* laſteth. The great Holes, to ſecure both the Town above, and the Work below from falling in, are very carefully filled out, and ſupported by ſtrong and well compacted Timber.

Out of theſe *Mines* they digg and cut out 3 ſorts of *Salt*; *one* is Common, Courſe and Black; the *Second* ſomewhat Finer and Whiter; the 3*d* very White, and Clear like *Cryſtal*. The Courſe and Black *Salt* is cut out in great pieces, Roundiſh and 3 *Polonian Ells* long, and one *Ell* thick, which coſts from 50 to 70 *Polonian Florins*.

Mean time the Inhabitants of *Cracow* have a Privilege, whereby a certain Number of pieces is to be Delivered to them, at 8 ſuch *Florins* the Piece.

The

The greateſt Pieces lye before their doors, where the Cattle paſſing to and fro, lick of thoſe *Salt Stones*; which afterwards by Mills and other Engines are Ground and Beaten ſmall for uſe. The Colour of theſe *Salt Stones* is *Darkiſh Gray*, with ſome Mixture of *Yellow*.

When this Salt Work was firſt found, (which is now above 400 years ago) the *Mine men* which firſt began to work in it were *Germans*; whence the *Poles* have retained the *German* Names of the *Tools*, but given them *Poliſh* Terminations. Theſe *Salt Works* belong to the *King* of *Poland*, who appoints and maintains the Officers of them; and 'tis one of his beſt *Royal Revenues*, amounting to a conſiderable Sum of Money. There is no leſs than 1000 Men, that are conſtantly employed in theſe *Mines*; and there was then a Proviſion of *Salt* valued at 2 *Millions*.

There are in theſe *Works* three Horſes, that ſtay always below, having their Stable and other Neceſſaries there: They Carry the *Salt* from the places, where 'tis Cut and Digg'd out, to thoſe whence 'tis, by the above mentioned *Wheel* and *Ropes*, drawn up by a Horſe above Ground going round about. The Horſes, after they have been a while under Ground, grow *Blind* from the Sharpneſs of the *Salt*; and one of them that had been longeſt in thoſe *Mines*, had the *Hoof* of his Feet grown as long again, as they are uſually; ſo that each *Hoof* was near a *Span* long. This *Salt Work* hath alſo beneath it certain *Salt Springs*, whence the *Salt Water* is by Channels conveyed to ſeveral places, where 'tis *Boyl'd* to *Salt*.

But there is yet another *Mineral Salt Work* in *Poland viz.* at *Bochna*; but not ſo well Ordered, as the former. Beſides, there are divers other Places in *Poland*, and in *Ruſſia* alſo, which yield *Salt*; as at *Holitz*, *Colomeja*, *Solum*, *Pintz*, *Oſwentz*, *&c.* In the *Podolian* Deſert, near the River *Boriſthenes*, is a *Salt-Lake* whoſe Water is by the Heat of the Sun Waſted, and turned to *Salt*, like unto *Ice*, ſo that the People there ride into it with Horſes and Waggons, and cut it into pieces and carry it away; as the *Poliſh* Hiſtorian *Cromerus* at large relateth; who alſo affirms, that in the aforeſaid *Salt-work* at *Bochna* they find a *Frozen* Subſtance, which by them is call'd *Carbuncle*, uſed by the People to Purge their Bodies, by Grating and Drinking it in a convenient Vehicle.

LXXXI. 1. The *Natron* of *Egypt* is an *Alkali Salt* perforated like a Sponge, and of a *Lixivial* Taſt; and thus I find it deſcrib'd by *Pliny*, *Mathiolus*, and *Agricola*.

The Natron *of* Egypt, *and* Nitrian Water, *Examin'd; by* Dr. Ch. Leigh. n. 160. p. 609.

Its *Principles* I take to be chiefly two; *viz.* a *Sal-Marine* and an *Urinous Salt*.

That it contains a *Sal-Marine* ſeems manifeſt by theſe Experiments; *firſt*, becauſe a *Solution* of the *Natron* has the ſame *Taſt* that a Solution of *Sal-Marine* hath; 2*dly* in Evaporation the Particles of the *Natron* incruſtated upon the Surface of the Water as the Particles of *Sea-Salt* do in Evaporation. 3*dly* becauſe the *Natron* is *Perforated*, which proceeds (as I ſuppoſe) from a *Sal-Marine*, for that, when it *Cryſtallizeth*, ſhoots with little Cavities. 4*ly* if the *Natron* be Mixt with *Salt* of *Tartar*, it emits the ſame *Spirit*, as *Sal Armoniack* when Mixt with the ſame *Salt*. And *laſtly*, that it contains a *Sea Salt* ſeems plain from

from *Ceſalpinus*, ſays he, *Efflorescit etiam ſponte non ſolum in* Salinis *ad ſimilitudinem* Lanugenis *Caneſcentis*; *ſed etiam in Vaſis in quibus* Sal *continetur.*

But here it is to noted, that though the *Nitrian Water* is of a Bluſhy Colour, and makes a Brisk *Fermentation* with an *Acid*; yet a Solution of *Natron* looks Clear, and will not *Ferment* with an *Acid*. The Reaſon why a Solution of the *Natron* looks Clear, though the *Nitrian Water*, which is but a Solution of the ſame *Salt*, is of a Bluſhy Colour, may perhaps be this; I ſuppoſe that the *Water* of *Latron* receives it Redneſs from a Red Clammy Subſtance, which ſerves chiefly to Cement the two *Salts* together: and this I the rather Conjecture, becauſe after a Solution of the *Natron* had paſt through a *Filtre*, there ſtuck to it a Red Clammy Matter, and the Solution was Clear. And the Reaſon why a Solution of the *Natron* will not *Ferment* with an *Acid*, I conceive to be this; becauſe that in a Perfect Diſſolution, its Parts being Seperated one from another by the Parts of the *Water*, their Struglings are too Weak to make an *Effervescency* with an *Acid*, and in this I was further confirm'd by theſe Two Experiments. I found that if into a *Solution* of the *Natron*, *I* pour'd an *Acid*, while the Water look'd Whitiſh or Diſturb'd the *Salt* not being perfectly Diſſolv'd, it made a Brisk *Fermentation*: But when the Water came to be *Clear*, the *Salt* then being perfectly Diſſolved, if *I* then poured an *Acid* upon it, it would not *Ferment*. I likewiſe found that this Solution being Evaporated to a Third part would *Ferment* again.

Its *Second Principle* I take to be an *Urinous Salt*; *firſt*, becauſe if Mixt with *Salt* of *Tartar*, it ſmells like *Sal Armoniack* when mixt with the ſame *Salt*. *2dly* when it was *Diſtill'd* with *Salt* of *Tartar* in a *Retort*, it afforded an *Urinous Spirit* as Piercing as the *Spirit* of *Sal Armoniack*.

The *Sal Marine* (being a *Foſſile Salt*) I take for granted it Receives from the Earth, but it ſeems to have its *Volatile Alkaly* from the Air; *firſt*, becauſe its ſaid by *Pliny*, *Spumam* Nitri (which is the *Natron* here ſpoke off) *Antiqui negabant fieri niſi cum* Ros *cecidiſſet*. By M. *de la Chambre* it is affirmed, that 3. or 4 *Days* before the *Nile* begins to Overflow, there falls a certain *Dew* which hath a *Fermenting* Vertue, and Leavens a Paſt expos'd to the *Air*, and at that time ſaith *Pliny*, and M. *de la Chambre* the *Nitre* Pits grow full of *Nitre*. And *Sands*, *Vanſlebius*, and ſeveral ſay, that though 500 in a *Day* Die in *Grand Cairo* of the *Plague* before the beginning of the *Inundation* of the *Nile*, yet the very *Day* After, there does not One Die; which doubtleſs could not proceed from any other Reaſon, than becauſe at that time, the *Air* was impregnated with this *Volatile Alkaly*; for at that time the *Nitre-Pits* grow Full and this *Dew* falls. This (I think) may ſufficiently Hint to us the great uſe of its *Volatile Spirit*, eſpecially in *Peſtilential* Diſtempers. *Laſtly*, about that time that the *Nile*, begins to *O'erflow*, thoſe *Specimens* which we had here at *Oxford* Grew Heavier by being Expoſed to the *Air*.

Here it is to be noted, that this *Alkaly* is not made ſo by *Fire*: I cannot therefore Conclude with *Helmont* that all *Alkalies* are made ſuch by that Element.

The

The Learned Dr. *Huntington* (who was at *Nitria*,) gives this Account of its ſeperation from the *Water* in *Latron*.

There is a Town in *Ægypt* called *Nitria*, which gives Name to the *Nitrian Deſert*, where there is a *Lake* called *Latron* taking up an Area of 6 or 7 *Acres*, ſituate about 30 *Miles* W. b. S. from *Terana*, a Town lower upon the *Nile* than *Grand Cairo*, and about the ſame Diſtance N. W. from the *Pyramids*; from the Bottom of this *Lake*, this ſort of *Nitre* call'd *Natron*, ariſeth to the Top (as they do apprehend), and there by the heat of the *Sun* Condenſes into this kind of ſubſtance. That all the *Nitre* comes from the Bottom to the Top, I dare not affirm, and ſhall therefore premiſe ſome *Phænomena* which it afforded in Evaporation, before I give you my Conjecture about it.

I took an *Evaporating Glaſs* which held about 4 *Ounces*, and poured into it 2 *Ounces* of the *Nitrean Water*, this I ſet upon a *Sand Furnace*, giving it Fire by Degrees; as ſoon as the Water was warm, the Particles of the *Nitre* began to ſwim upon its ſurface in ſtragling and uneven Numbers, theſe, after a while, United, and at laſt there aroſe *Salt* ſufficient to cover the whole Superficies of the Water; *I* took then a Thin Glaſs and Skim'd off this *Ice*, but could ſcarce take it all off, before it was ſeconded by another, and thus the *Salt* did riſe ſucceſſively in Films, as long as there was any *Water* in the Glaſs; theſe Films had the Colour and Taſte of the *Nitre* which came from *Nitria*, and did like it *Ferment* with an *Acid*. And theſe are they which by *Pliny* are called *Flos Salis*, and if *I* miſtake not the ſame with that which *Herodotus* ſays, they make their *Mummy* with. If therefore by the Languiſhing Heat of a *Digeſting Furnace*, the *Nitrous* Particles could Seperate themſelves from the Water, and over that ſpread themſelves in an *Ice*, it may be as probable, that by the greater Heat of the *Sun*, the *Nitre* of *Latron* is ſeparated from the *Water* after the ſame Manner. And as in the Evaporation of other Mineral Waters, when the Water is not ſtrong enough for to hold up the *Salt*, it is generally cover'd with a thin *Film*. So *I* ſuppoſe in Evaporation of the *Natron*, ſome Parts of the Water being flown away, the Particles of the *Sal Marine* branch one into another, and ſo Incruſtate upon the Surface of the Water.

In this *Hypotheſis* I was the farther Confirm'd by this Experiment; I took ſome of the *Natron* and diſſolv'd it in Water, and ſet it to Evaporate: And *I* found that the *Salt* did not incruſtate upon the Water, till 3 Parts of the Water was Evaporated. It did not therefore ſeem probable that the *Nitre* came all from the Bottom to the Top, and ſo was Condenſed by the Heat of the *Sun*; but that they Incruſtated, when the *Saline Particles* Brancht one into another, ſome of the Aqueous Parts being Exhaled.

The Reaſon why its *Volatile Alkaly*, in Evaporation, does not fly quite away, is becauſe it is held there by the *Sal Marine*.

By the Teſtimony of *Hippocrates*, *Gallen*, *Mathiolus*, *Diaſcorides*, *Pliny*, and *Agricola*, it appears to have been of great Uſe in *Phyſick*. But here it is to be Noted, that when *Nitre* is Preſcribed by them, that *Nitre* which is an Ingredient of *Gun-Powder*, is not to be underſtood.

Amongſt

Amongſt the *Moderns* we have this Account of it; M. *de Clos* is of the Opinion that moſt of the *Mineral Waters* in *France* are Impregnated with this ſort of *Nitre*, and that all their *Cures* are done by it.

Molenbrochius affirms a *Tincture* of *Aphronitrum* to be of Wonderful Efficacy in *Stone*. This I the rather Credit, becauſe it's ſaid by *Junken*, in his *Medicus*, the *Niter* of *Nitria* is of ſo piercing a *Spirit*, that it doth not permit either *Stone* or *Rock* to be thereabout.

In Treating of its Uſe in *Agriculture*, *I* think it convenient to Premiſe one *Phænomenon* which it afforded in *Evaporation*; when the *Salts* had ſpread themſelves over the Water in an *Ice*, thoſe *Thin Plates* after a while would Break and Aſcend in Perpendicular Lines to the very Top of the *Glaſs*; *I* do therefore conjecture, that *Nitre* may be ſaid to *Fertilize* the *Ground* after this Manner; it's *Volatile* Particles being *Heated* by ſome *Subterraneous Fire*, or elſe by the *Warmth* of the *Sun*, they do quickly *Aſcend* in the ſmall *Tubes* of the *Plant*, and ſo by their *Elaſtick* Nature, Carry along with them, or force before them, thoſe Particles which as they differently Convene together, Conſtitute the different parts of the *Plant*.

But this Conjecture will be made ſomething the more probable, by an Experiment in *Kircher*; where he ſays, if you take a Wooden Tube, and put into it *Tartar*, *Quick lime*, *Salt*, and the *Urine* of a *Wine-Drinker*, reduced into one Maſs, which is to be Hardned in the Sun; and after that ſet it in a Cold Cellar, by the Help of *Salt-Petre* from the before mentioned Maſs, you will, not without Admiration, ſee *Flowers* Branch out of it. Yea ſuch is the Force of *Nitre*, that if in a Glaſs kept cloſe ſhut, you put the Juices of ſome *Nitrous Herbs* on the before mention'd Maſs, the *Nitre* contain'd within it, being Pregnant with *Spirit*, will Force it ſelf through the very *Pores* of the *Glaſs*.

Mund. Subter. Cap. de Nitro.

M. *De la Chambre* ſays, *Plants* do grow in *Ægypt* in ſuch Abundance, that they would Choak one another, if they were not Hindred by throwing *Sand* upon the Fields: inſomuch that the *Ægyptians* muſt take as much Pains to leſſen the *Fatneſs* of their Land, as other Nations do to Encreaſe the *Fatneſs of it*.

In *Mechanicks* we have this Account of it: It's ſaid by *Pliny*, that a Company of Merchants being thrown upon a Shore where there were not any Stones to be found, were forced to take great Pieces of *Ægyptian Nitre* out of their Ships, and make Walls, upon which they heng their Boyling Kettle: the *Nitre*, being Heated by the Fire, Mixt with the *Sand*, and ran into ſeveral ſtreams of *Glaſs*, which afterwards Hinted the way of Making *Glaſs*. It is likewiſe of Uſe in *Dying*, for *Pliny* and *Vitruvius* affirm, that by the Help of this, the True *Azure* is made; and that without this, there cannot be a True *Shadow*.

Cap. de Vitri Juvent.

This *Nitre* is diſtinguiſh'd from *Salt Petre*; *Firſt*, by its *Fermenting*: it will *Ferment* with any *Acid*, but *Salt-Petre* will not. *I* found that it would *Ferment* with *Vinegar* as the Old Commentators obſerve in their Comments upon *Jeremiah* and the *Proverbs*, but *Salt Petre* will not: Which gave Occaſion to ſome, in thoſe Texts, to alter the Word *Nitre*.

2. *It*

2. It may be distinguisht from *Salt Petre* in its *Taste*; for *Natron* hath a *Lixivial Taste*, but the other not.

3. By the *Volatile Spirit* which it affords: For from the one comes over a *Volatile Alkaly*, but from the other a *Corrosive Acid*.

4. The *Natron* affords a *Red Clammy Substance*, *Insipid*, but the other not. This *Clammy Substance* (if I mistake not) is that which by *Pliny* is call'd *Ærugo Salis*: This it hath from the *Earth*, and therefore it is again said by *Pliny*, *Sunt ibi* Nitrariæ *in quibus &* Rusum *exit a Colore* Terræ.

5. Like *Salt Petre* it will not *Crystallize*.

6. In the *Fire*, it makes no *Detonation*.

But in this it resembles *Salt Petre*; as that by the *Flowers* of *Sulphur* is made into a *Sal Prunellæ*, so this, if you Drop *Spirit* of *Sulphur* upon it, Shoots into *Pyramidal Salt*, that is not by the Taste distinguishable from *Sal Prunellæ*, though its Taste before was *Lixivial*.

From *Sal Armoniac* it may be Distinguished; *First*, by its *Colour*, for the *Natron* is *Reddish*, the other not. *Secondly*, by the Texture of its Parts: In *Sal Armoniac* the Parts seem *Close* and *firmly knit together*, but the *Natron* is *Spongy* and *Perforated*. *Thirdly*, If mixt with *Sal Armoniack*, the *Sal Armoniack* Emits the same *Spirit*, as it doth when Mixt with *Quick-Lime*.

But *I* think it comes much nearer to the Nature of *Sal Armoniack*, than *Salt Petre*; *First*, Because it is compos'd of a *Sea-Salt* and an *Urinous Alkaly*; *Secondly*, Like *Sal Armoniack*, when Dissolved in *Water*, it makes it extreamly *Cold*: And, as *Franciscus Hernandez* says, It produces the same Effect when Dissolved in *Wine*.

Hist. of Mexico.

2. The *Nitre* of *Egypt*, by the Experiments made about it at *Oxford*, plainly appears to be little Different from *Sal Armoniack*: And Considering, that it *Rains* little or nothing, comparatively to the great Heats, in *Ægypt*: and that the *Lakes* there are only once a Year furnisht with fresh Water from the *Overflowings* of the *Nile*; also that Vast Tracts of Land there, and all over *Asia*, are naturally cover'd with *Fossile Salt*; again, that those *Lakes* are furnisht with vast Animals, as *Crocodiles*, *Hippopotami*, and without doubt great variety of other lesser Vermine; these things, *I* say, well consider'd, it is easie to think, that in a Years Time, most of the *Salt Water* of those *Lakes* has past through the Bodies of those Animals, and consequently is become *Urinous*, or *Saline Urinous*, as is the Nature and Composition of *Factitious Sal Armoniack*.

The Original of the Nitre *of* Egypt; *by Dr* Lister. n. 167. p. 837.

LXXXII. I am convinced that *Sulphur* is sublimed from the *Pyrites* according to the Opinion of Dr. *Lister*, especially that gathered upon Mount *Ætna*, *Vesuvius*, the *Solfatara*, and in the Stoves of St. *Gennaro*, not far from thence, for most of the Stones and Cynders, thrown out of those mighty Furnaces, do manifestly contain *Iron*, if we may believe the *Magnet*. As to the *Salt* (taken by many Writers to be a sort of *Sal Armoniack*) found together with the *Sulphur* in the forementioned Places, it appeared to me to be a kind of *Nitrum Calcarium*; for, as *I* remember, it had not any *Urinous* Qualities, that *I*

The Pyrites *and* Lapis Calcarius, *consider'd*; *by Dr.* Tanc. Robinson. n. 169. p. 924.

could perceive by Slight Tryals of Mixture; and *I* was the more confirmed in my Opinion after *I* had ſeen, and conſider'd, the great Quantity of *Lime-ſtone* round about *Naples*; many Beds of it lying up and down the *Terra di Lavoro*, or *Campania Felice*.

The Spontaneous Firing *of the* Pyrites; *by Dr.* Fred. Slare. n. 213. p. 218.

LXXXIII. The Maſter of a *Copperas* Work at *Whitſtable* in *Kent*, having Engroſs'd all the *Pyrites* or *Copperas Stones* to himſelf, laid up Two or Three Hundred Tun in a Heap, and Built a Shed over it to keep off the Rain: But in the ſpace of 6 or 7 Months it firſt Smoaked, and then *took Fire*, and Burnt for a Week. Some of it looked like Melted Metal, and other parts like Red hot Stones; and it diſcharged ſo Fætid, Sulphurous, or Stinking Exhalations, that the People in the Neighbourhood were miſerably Afflicted, and forced to uſe all their Endeavours to Extinguiſh it.

A Mineral at Liege, *yielding* Brimſtone *and* Vitriol, *by Sir* Rob. Moray. n. 3. p. 45

LXXXIV. The *Mineral* out of which *Brimſtone* and *Vitriol* are Extracted is one and the ſame, not much unlike *Lead Ore*, having alſo oftentimes *Lead* mingled with it, which is ſeparated from it by picking it out of the reſt. The *Mines* reſemble our *Engliſh Coal Mines*, dug according to the depth of the *Mineral*, 15, 20, or more *Fathoms*, as the Vein leads the Workmen, or the Subterranean Waters will give them leave.

To make *Brimſtone*, they break the *Stone* or *Ore* into ſmall Pieces, which they put into *Crucibles*, made of Earth 5 Foot Long, Square and Pyramide-wiſe: The Entry is near a Foot Square. Theſe *Crucibles* are laid Sloping, eight undermoſt, and ſeven above them, as it were betwixt them, that the Fire may come at them all, each having its particular Furnace or Oven. The *Brimſtone* being Diſſolved, by the violence of the Heat, drops out at the ſmall end of the *Crucible*, and falls into a *Leaden Trough* or *Receptacle*, Common to all the ſaid *Crucibles*, through which there runs a continual Rivulet of Cold Water, conveyed thither by Pipes, for the Cooling of the Diſſolved *Sulphur*, which is ordinarily 4 Hours in Melting. This done, the *Aſhes* are drawn out with a Crooked Iron, and being put into an Iron Wheelbarrow, are carried out of the Hutt, and being laid in an Heap, are covered with their other *Elixed* or *drained Aſhes*, the better to keep them Warm; which is Reiterated, as long as they make *Brimſtone*.

To make *Copperas* or *Vitriol*, they take a quantity of the ſaid *Aſhes*, and throwing them into a ſquare planked Pit in the Earth, ſome four Foot Deep, and Eight Foot Square, they Cover the ſame with Ordinary Water, and let it lie 24 Hours, or until an *Egg* will ſwim upon the Liquor, which is a ſign that it is ſtrong enough. When they will Boil this, they let it run through Pipes into the Kettles, adding to it half as much *Mother-Water*, which is that Water that remains after the Boiling of the *Hardned Copperas*. The Kettles are made of *Lead*, $4\frac{1}{2}$ Foot High, ſix Foot Long, and three Foot Broad, ſtanding upon thick Iron Bars or Grates. In theſe the Liquor is Boiled with a ſtrong Coal Fire twenty four Hours, or more; according to the ſtrength or weakneſs of the *Lee* or *Water*. When it is come to a juſt Conſiſtence, the Fire is taken away

and

and the Boil'd Liquor ſuffered to Cool ſomewhat, and then 'tis Tapp'd out of the ſaid Kettles through Holes beneath in the ſides of them, and Conveyed through Wooden Conduits into ſeveral *Receptacles*, 3 Foot Deep and 4 Foot Long (made and ranged not unlike our Tan-Pitts), where it remains 14 or 15 days, or ſo long till the *Copperas* Separates it ſelf from the *Water*, and becomes *Icy* and *Hard*. The Remaining *Water* is the above mentioned *Mother Water*; and the *Elixed* or *Drained Aſhes* are the Dregs or *Caput Mortuum*, which the *Lee*, whereof the *Vitriol* is made, leaves behind it in the Planked Pits.

LXXXV. 1. There is a *Stone* in *Sweden* of a *Yellow* Colour intermixed with ſtreaks of *White*, (as if compoſed of *Gold* and *Silver*) and Heavy withal. It is found in Firm Rocks, and runs in *Veins*, upon which they Lay Wood, and ſet it on Fire. When the *ſtone* is thus Heated, they caſt Water upon it, to make it Rend, and then Dig it up with Mattocks. This done they break it into ſmaller pieces, and put it into Iron Pots, of the Shape Repreſented by *Fig.* 153. the Mouth of the one going into the other. Theſe they place, the One in the Oven upon an Iron Fork ſloping, ſo that the *ſtone* being Melted, it may run into the Other, which ſtands at the Mouth of the Oven, ſupported upon an Iron. The firſt Running of the *ſtone* is *Sulphur*.

Sulphur, Vitriol, Allum, *and* Minium, *from a Stone in* Sweden; *by* Sir Gilb. Talbot, n. 21. p. 375.

Fig. 153.

The Remainder of the *Burned ſtone* is carried out, and laid upon a High Hill, where it lyes expoſed to the Sun and Air for the Space of two *Years*; and then *Taketh Fire of it ſelf*, Caſting forth a Thin Blew *Flame*, ſcarce Diſcernable in the Day-time. This being Conſumed, leaveth a Blew Duſt behind it; which the Workmen Obſerve, and Mark with Wooden pins. This they Dig up, and carry into the work houſe, and put it into great Tubs of *Water*, where it infuſeth 24 *hours*, or more. The *Water* they afterward *Boyl* in Kettles, as we do *Salt-Peter*, and put it into Cooling Tubs, where in they place Croſs Sticks, and on them the *Vitriol* faſtens, as *Sugar-Candy* doth.

The *Water* that Remains, after the Extraction of the *Vitriol*, they Mix with an 8*th* part of *Urine* and the *Lees* of Wood Aſhes, which is again Boyled very ſtrong, and being ſet to Cool in Tubs, Croſs Sticks are likewiſe faſtened and thereon the *Allum* faſtens.

In the *Water*, which Remains after the *Allum*, is found a *Sediment*, which being ſeparated from the *Water*, is put into an Oven, and Wood laid upon it and Fired, till it become *Red*, which makes the *Minium*, wherewith they Paint their Houſes, and make Plaiſter.

2. There is a Kind of *ſtone* in the North of *England*, yielding the *Same* Subſtances, except *Minium*.

The ſame in England; *by ... ib. p.* 376.

LXXXVI. *Copperas Stones*, which ſome call *Gold-ſtones*, are found on the Sea ſhore in *Eſſex*, *Hampſhire*, and ſo *Weſtward*. There are great Quantities in the Cliffs; but not ſo Good as thoſe on the Shore, where the *Tides* Ebb and flow over them.

Green-Copperas *Works*; *by Mr.* Daniel Colwal. n. 142, p. 1056.

The Beſt of them are of a Bright Shining *Silver Colour*; the Next, ſuch as are of a Ruſty deep *Yellow*; the Worſt ſuch as have Gravel and Dirt in them, of a Sadder *Umber Colour*.

In the midſt of theſe *Stones*, are ſometime found the *Shells* of *Cockles*, and other ſmall *Shell-Fiſhes*; ſmall Pieces of the Planks of Ships, and Pieces of Sea-coal.

In order to the making of *Copperas*, they make *Beds* according as the ground will permit; thoſe at *Deptford*, are about 100 *Feet* long, 15 *Feet* broad at the Top, and 12 *Feet* Deep, Shelving all the way to the Bottom.

They *Ram* the *Bed* very well, firſt with ſtrong *Clay*, and then with the Rubbiſh of *Chalk*, whereby the Liquor, which Drains out of the Diſſolution of the *Stones*, is Conveyed into a Wooden Shallow Trough, laid in the middle of the *Bed*, and Covered with a board; being alſo boarded on all ſides, and laid Lower at One End than the Other, whereby the Liquor is Conveyed into a Ciſtern under the Boiling Houſe.

When the *Beds* are indifferently well Dryed, they lay on the *Stones* about 2 *Feet* Thick.

Theſe *Stones* will be 5. or 6. *Years*, before they yield any Conſiderable Quantity of *Liquor*; and before that, the *Liquor* which they Yield is but Weak.

They Ripen by the *Sun* and *Rain*: Yet *Experience* proves, that Watering the *Stones*, although with Water Prepared by Lying in the Sun, and poured through very ſmall Holes of a Watering-Pot, doth Retard the Work.

In Time theſe *Stones* Turn into a kind of *Vitriolick Earth*, which will ſwell and Ferment like Leavened Dough.

When the *Bed* is come to *Perfection*, then once in 4 *Years* they Refreſh it, by laying New *Stones* on the Top.

When they make a New *Bed*, they take a good quantity of the Old *Fermented Earth*, and mingle it with New ſtones, whereby the Work is Haſtened. Thus the *Old Earth* never becomes Uſeleſs.

The Ciſtern before mentioned is made of ſtrong Oaken Boards, well Joyned and Calked. That at *Deptford* will Contain 700 *Tuns* of Liquor. Great Care is to be taken, that the *Liquor* doth not Drain through the *Beds*, or out of the Ciſtern. The beſt way to Prevent the ſame, is to divide the Ciſtern in the middle, by Oaken Boards, Calked as before; whereby One of them may be Mended in caſe of a Defect.

The more Rain falls, the More, but the Weaker will be the *Liquor*: The Goodneſs whereof is tryed by Weights prepared for that purpoſe; *Fourteen-Penny* Weight, is Rich: Or an Egg being put into the Liquor, the Higher it ſwims above the Liquor, the ſtronger it is. Some times the Egg will Swim near Half above the Liquor.

Within *one Minute* after an Egg is put in, the ambient Liquor will Boil and Froth; and in *three Minutes* the *Shell* will be quite Worn off.

A Drop of this *Liquor* falling on the Manufactures of *Hemp*, *Flax* or *Cotton Wooll*, will preſently *Burn* a Hole through it. As alſo in *Woollen* and *Leather*.

Out

Out of the aforesaid Cistern, the *Liquor* is Pumped into a *Boiler* of *Lead*, about 8 *Feet* Square, containing about 12 *Tuns*, which is thus ordered. *First* they lay Long Pieces of *Cast Iron*, 12 *inches* square, as Long as the Breadth of the Boiler, about 12 *inches* one from another, and 24 *inches* above the Surface of the Fire. *Then* Cross-wise they lay ordinary Flat Iron Barrs, as close as they can lye, the sides being made up with Brick work. In the middle of the Bottom of this Boiler is laid a Trough of *Lead*; wherein they put at first 100 *pound* Weight of *Old Iron*.

The Fewel for Boiling is *Newcastle Coals*. By degrees, in the Boiling, they put in more *Iron*, amounting in all to 1500 *pound* Weight in a Boiling. As the *Liquor* Wastes in Boiling, they Pump in Fresh Liquor into the Boiler: Whereby, and by a Defect in Ordering the Fire, they were Wont to be above 20 *dayes* before it was Enough; When that is, they Try, by taking up a small Quantity of Liquor, into a Shallow Earthen Pan, and observing how soon it will Gather and Crust about the sides thereof. But now of Late by the Ingenious Contrivance of Sir *Nicholas Crisp*, the work is much Facilitated. For at his Work at *Deptford*, they Boil off 3 Boilers of Ordinary Liquor in One Week; Which is done, *first* by Ordering the Furnace so, as that the Heat is Conveyed to all Parts of the Bottom and sides of the Furnace.

Then, whereas they were Wont to Pump Cold Liquor into the Boiler to Supply the Waste in Boiling, whereby the Boiler was Checked sometimes 10 *hours*, Sir *Nicolas* hath now a Vessel of Lead, which he calls a Heater, Placed at the End of the Boiler, and a little Higher, supported by barrs of Iron as before, and Fill'd with Liquor, which by a Conveyance of Heat from the Furnace, is kept near Boiling Hot; and so continually Supplies the Waste of the Boiler, without Hindring the Boiling. *Thirdly*, by putting due Proportions of *Iron* from time to time, into the Boiler; As soon as they perceive the Liquor to Boil slowly, they put in more Iron, which will soon Quicken it. Besides, if they do not continually supply the Boiling Liquor with *Iron*, the *Copperas* will Gather to the Bottom of the Boiler and Melt it; And so it will do if the Liquor be not Presently drawn off from the Boiler into a Cooler, so soon as it is Enough.

The Cooler is Oblong, 20 *Feet* Long, 9 *Feet* Over at the Top, 5 *Feet* Deep, Taper'd towards the Bottom, made of *Tarras*. Into this, they Let the Liquor run, so soon as it is Boil'd Enough. The *Copperas* herein will be Gathering or Shooting 14 or 15 *days*: And Gathers as much on the sides as in the Bottom; *sc.* above 5 *Inches* Thick. Some put Bushes into the Cooler, about which the *Copperas* will Gather: But at *Deptford* they make no use of any.

That which sticks to the sides, and to the Bushes, is of a *Bright Green*, that in the Bottom of a Foul and *Dirty Colour*.

In the end of 14 *Dayes*, they Convey the *Liquor* into another Cooler, and Reserve it to be Boiled again with New Liquor.

The *Copperas* they Shovel on a Floor adjoyning: So that the Liquor may Drain from it into a Cooler.

The *Steam*, which comes from the Boiling, is of an Acrimonious smell.

Copperas

Copperas may be Boiled without *Iron*, but with Difficulty; without it the Boiler will be in danger of Melting.

Sometimes in ſtirring the *Earth* upon the *Beds*, they find pieces of *Copperas*, Produced by lying in the Sun.

Oyl *of* Vitriol *Increaſing in Weight; by Dr.* Wil. Gold. n. 156. p. 496.

LXXXVII. Some Druggiſts have accidentally taken notice of an *Increaſe* of *Weight* in *Oyl* of *Vitriol* Expoſed to the *Air* (and perhaps have Improv'd it to their own Gain, though to the Detriment of the Buyer.) And the Induſtrious *Chymiſt* Mr. *White*, the Univerſity Operator at *Oxford*, had a Viol of that Liquor Unſtopt and Conſtantly running over: But ſince from thence no true Eſtimate of the *Juſt Increaſe* could be Collected, I ſhall here give you what has Occur'd more particularly on this Subject.

Vid. Sup. Cap. I. §. XVI.

Nov. 4. 1683. *Three Drams* of *Oyl* of *Vitriol*, ſo far *Dephlegm'd* as to *Burn* or *Corrode* a ſtrong Packthred aſſunder, was Expoſed to the *Air* in a Marmalade Glaſs of three *Inches* Diameter, and placed in a Nice pair of *Scales*, in a Room where no Fire nor Sun came; it's *Increaſe* for ſeven Natural *Days*, divided by leſs Portions of Time, was according to the following *Table*.

Nov. 1683		*Gain.*	*Space of Time.*	*Weather.*	*Wind.*	*Sum of Gain.*	*Natural Day.*
D.	*H*	ʒ Ə. gr	*H.*	*Moiſt*		ʒ Ə. *gr.*	
9	5. *p. m.*	3 o o					
	11 *p. m.*	o o 19	6 *h.*	*Moiſt and*	*Southerly*		
10	8 *m.*	o 1 12	9	*Windy.*	*N. Weſterly.*		*1ſt.*
	11 *m.*	o o 08	3	*Rainy Morn.*		1 o 8	
	5 *p. m.*	o o 09	6	*Clear.*			
	11 *p. m.*	o o 18	6	*Star lig. Cold.*			
11	8 *m.*	o 1 07	9	*Bright Morn.*	*N. W.*	o 2 18	*2d.*
	11 *m.*	o o 04	3	*Mild.*			
	5 *p. m*	o o 09	6	*Mild, Dry Weather.*			
	11 *p. m*	*fere* o 10	6	*Mild, Dry,*	*N. W.*		
12	8 *m.*	o o 17	9	*Clear Morn.*	*N.*	o 1 19	*3d.*
	11 *m*	o o 05	3	*Froſty.*	*N. more.*		
	5 *p. m.*	o o 07	6	*Overcaſt.*	*W.*		
	11 *p. m*	o o 06	6	*Cloudy Rain.*	*Weſterly.*		
13	8 *m.*	o o 09	9				
	11 *m.*	o o 03	3	*Cloudy.*	*S. W.*	o 1 $3\frac{1}{2}$	*4th.*
	5 *p. m.*	o o $05\frac{1}{2}$	6	*Mild.*			

	11 *p. m.*	0 0 06	6	*Cloudy. Moist.*	*S. E.*		
14	8 *m.*	0 0 08	9	*Cloudy Misty.*		0 0 18	*5th.*
	11 *m.*	0 0 02½	3	*Misty.*	*Southerly.*		
	5 *p. m*	0 0 01½	6	*Very Warm*			
	11 *p. m.*	0 0 02	6	*Cloudy, unusually Warm.*	*More S.*		
15	8 *m.*	0 0 06	9	*Cloudy.*	*S. E.*	0 0 15	*6th.*
	11 *m.*	0 0 03	3	*Cloudy Moist*	*more S.*		
	5 *p. m.*	0 0 04	6	*Clear Coldish.*	*Easterly*		
	11 *p. m.*	0 0 04½	6	*Dry Star light. Cold. Cloudy*	*Easterly.*		
16	9 *m.*	0 0 9	10	*but Cold.*		0 0 17	*7th.*
	11 *m.*	0 0 2	2	*Cloudy Windy.*	*S. E.*		
	5 *p. m.*	0 0 2	6	*Cl. very Mild.*			

From the 16*th.* in the succeſſive Spaces of 24 *Hours*, each *Gain'd* one of the Number of *Grains* following; as the 8*th.* Natural Day *Gained* 13½. The *Next*, 12. 9. 7. 6. 5. 5 4½. 3. 3. 3. 3 4. 3. (*Decem.*) 4. 4½. 4. 3. 3. *&c.* ſtill irregularly Decreaſing, till the Liquor was *ſatiated.* The *Diary* was continued to *Jan.* 4. 168/4 when the Increaſe, in 24 *Hours*, amounted ſcarce to *Half* a *Grain*, and probably had the *Weather* been then *Dry*, it might have been none at all; or rather the *Liquor* might have *loſt* what before it had *Gained.*

Hence 'tis Obvious that the more our Liquor was *Saturated*, the leſs was its *daily Increaſe*, though not Gradually leſs by an Even Deſcent each Day, but ſometimes two or more *Natural Days* together, it was exactly the ſame, a Day or two after leſs, and then again More the next Day following, according as the Liquor ſtood Affected by the *Heat* and *Cold*, *Dryneſs* or *Moiſture* of *the Weather*, the Differing time of the *Day*, and *Quarter* of the *Wind.* Thus upon the view of the whole Diary of almoſt two *Months*, it appear'd, the *Increaſe* was more in a *Moiſt*, *Rainy*, *Miſty*, and *Snowy*, but leſs in a *Froſty*, *Clear*, and *Dry* Seaſon; as alſo it was more in a *Cold* than in a *Warm* Air. When the *Wind* was *Northerly* or *Eaſterly* the *Gain* was leſs *cæteris paribus*, than when *Southerly* or *Weſterly*, and was leſs in the *Day* than in the *Night.* The *Primary Cauſe* of this *Phœnomenon* ſeems to be the *Moiſture* of the *Air*, which our Liquor (a Potential Fire) imbibes as greedily, as Actual Fire does the *Pabulum* of *Nitre*, yet we muſt allow that all the other Circumſtances of Seaſon juſt now mention'd have each their particular influences in Diverſifying the *Quantity* of the *Increaſe.* Thus it appears in the *Table*, that *Heat* alters the Progreſs of *Increaſing:* For on the 14 of *Nov.* from 11 *m.* to 11 *p. m.* (at which time, ſpecially towards *Night*) a very Unuſual and Troubleſome *Heat* in the *Air* was complained of by ſeveral here in *Oxford*; in 12 *Hours* the *Gain* was only 3½ *gr.* whereas in the like Time preceding, it was 10½ *Grains*, and in that juſt following 9 *Grains.*

Neither

Neither indeed can any thing otherwiſe be expected from *Heat*, ſince thereby the *Moiſture* might rather be Exhal'd; or at leaſt might be Suſpended, Agitated and intimately mixt with the Subſtance of the *Air*, and conſequently not ſo eaſily be Arreſted and Entangled by the Surface of the *Liquor*, as when the *Air* is Leſs *Hot*. However, allowing the Effect of this *Anomalous* Accident at a Time of the *Year* when leaſt expected, and conſidering that moſt commonly *Heat* keeps even Pace with the Seaſon of the *Year*, depending as to its Temper for the moſt part on the *Nearneſs* or *Remoteneſs* of the *Sun*, we may ſafely Conclude *Moiſture* the chief and only *Cauſe* of the *Increaſe* of *Weight* in *Oyl* of *Vitriol*, ſince in *Dry*, *Clear Weather*, it conſtantly *Increaſes* leſs than in *Moiſt* and *Cloudy*; the Circumſtance of *Heat* or *Cold* remaining the ſame in both.

But this will be clearly Evinc'd by an Inquiry made into the *Nature* of the Subſtance *Gain'd*, with the *Increaſe* of *Weight*: For by the Ordinary ways of Tryal it appear'd, the *Atmoſphere* afforded our *Liquor* nothing beſides ſome of its *Watry Particles*, wherewith it always abounds; but more eſpecially is ready to part with in *Moiſt Weather*.

The *Air*, without doubt, has great Variety of Different Subſtances floating in it, whereof ſome Particles do Adhere to this, ſome other ſort to that Body, according as either is Peculiarly Diſpos'd to receive one ſort rather than another. Thus the *Mortar* in the Joynts of *Old Walls* and *Vaults*, from Corpuſcles attracted from the *Air*, *Sprouts* out and Frames a peculiar kind of *Salt*. I have known a *Deal* Shelf, *Moiſten'd* only with the Liquor of *Fixt Nitre*, *Froſted* over with *Cryſtals* of a perfect *Inflammable Nitre* by Regaining the Proper *Acids* from the *Air*, all one as if ſo much *Spirit* of *Nitre* had been pour'd on the ſaid Liquor. I have ſeen a Viol Half Fill'd with *Oyl* of *Tartar per Deliquium* (by being left open to the *Air*) beſet above the Liquor with Peculiarly *Figur'd Cryſtals*, and at the Bottom were *Flat Chryſtalliz'd Plates* of a *Salt* which without *Flame* Crackled on a live Coal, and left behind a *Calx* much like Dr. *Liſter's Nitrum Calcarium*. And 'tis well known *Colcothar* of *Vitriol* Reimpregnated by the *Air*, will by a freſh Diſtillation give you its Proper *Acid* as at firſt. Now upon ſuch Hints as theſe, ſome (Fond of the Doctrine of *Alcali* and *Acid*) might perhaps expect, ſince Differing Bodies of an *Alcalizate* Nature do thus Regain their Proper *Acids*, that *Vice verſa* even this moſt *Acid* Liquor, *Oyl* of *Vitriol*, alſo might find its *Alcalizate* Aſſociate in the *Air*, from which the Violence of Fire had before Driven it: But we could Diſcover no ſuch Matter; the *Taſt* of our Augmented Liquor was Still purely *Acid* and only Weaker than before, whereas it would have been *Saltiſh* had an *Alcali* been Combin'd with it; and its *Colour* from a *Deep Reddiſh*, became *Limpid*, all one as if the like Quantity of Fair Water had been Mixt But to be more Certain in this Point, I *Diſtill'd* off the New *Gain'd* Subſtance: At firſt it came over as Inſipid as Clear Water; and urging the Fire farther, the Drops prov'd *Sower*, and the Remaining *Oyl* in the *Retort* was altogether as *Corroſive* as at firſt. Whence we may Infer, its Edge was not at all Blunted by any adjoyned *Alcali*: So that what the *Air* Afforded was nothing elſe but mere *Water* only.

As

As to the Quantity of the Whole *Increaſe* it can't be Determined by any General Rule, ſince it Varies according to the Different *Strength* of the *Oyl* of *Vitriol*: For it appears by the *Table*, the more Diluted the Liquor the Leſs Attractive it prov'd. This here imploy'd (as highly *Dephlegm'd*, I preſume, as any uſually is) gave a *Triple* and more than $\frac{1}{9}$ of its *Firſt Weight*, amounting in all from 3 to 9 *Drams*, and 30 *gr.* before it come to a Stand.

Which Proportion of *Increaſe* I found confirmed in Leſſer Quantities alſo; as, 3 *gr. Increas'd* to more than 9 *gr.* and *one Grain* gave the *Weight* of ſomething more than 3 *Grains*. But beſides the *Strength* of the Liquor, there are other Circumſtances, as the *Seaſon* of the *Year*, and *Poſition* of the *Place*, which will certainly ſomething Alter this Point; thus our Liquor will *Gain* more in *Winter* than in *Summer*; more in a *Cellar* and *Sunleſs* Room, than in a Room not ſo *Qualify'd*.

All theſe Circumſtances, which relate to the *Quantity* will alſo Influence very much the *Time* of the *Encreaſe*: But that which makes the moſt Peculiar and Principal *Variation* in this point, is the *Proportion* of the *Surface* to the *Bulk* of the *Liquor*. For I find the Greater or leſs the *Surface* is, the Quicker or Slower the *Encreaſe*. Thus 3 *Grains* Dropt and Diffus'd to near $\frac{3}{4}$ *Inch* Breadth on a piece of Glaſs, *Gain'd* 3 *Gr.* in 6 *Hours*; *one Gr.* in 6 more; *one Gr.* and $\frac{1}{2}$ in 12 *Hours* more; in the next 12 *Hours* it *gain'd* $\frac{1}{2}$ a *Gr.* and in the laſt 12 *Hours* it *gain'd* very little Obſervable, ſo that in Leſs than 48 *Hours*, having more than *Triple* its *Firſt Weight*, it was for ſome Time fully *Satiated*, till *Rainy* Weather added ſomething more.

But to diſcover more Nicely what intereſt the *Proportion* of *Surface* has in Haſtening or Retarding the *Increaſe* of *Weight*, I expos'd in the ſame Room, and to the ſame Temper of the *Air* (as near as I could gueſs) 3 *Drams* of the ſame *Oyl* of *Vitriol* in an Open Flat Glaſs *One Inch* broad, being only $\frac{1}{3}$ of the Diameter of that Glaſs uſed at *firſt* with the like Quantity. The Reſult was this; that whereas the other Surface of 3 *inches* Diameter *gain'd* (as in the *Table*) near 19 *Gr.* the *firſt* 6 *Hours*, this Leſs Surface *gain'd* a very little, perceivable, more than 2. *Grains* in the ſame ſpace of Time. Now ſince the *Area's* of *Circles* are to one another as the *Squares* of their *Reſpective Diameters*; as *One*, the *Square* of the Leſs, is to 9, the *Square* of the Greater Glaſſes Diameter, ſo was the *Weight* of a little more than 2 *Grains*, *Gain'd* in the Narrower Glaſs, to near 19 *Gr. gain'd* in the Broader: Wherefore the *Time* of *Increaſing* bears, as near as can be expected, an *Exact Proportion* to the *Surface* of the Liquor Expos'd; and the Liquor in the leſſer Glaſs having but $\frac{1}{9}$ part of the *Surface* of the Greater, could not be *Satiated* under 9 times as many *Days* as the Greater.

LXXXVIII. All I can find of the *Origine* of *White Vitriol* is out of *Borrichius de Docimaſtice Metallica*, that it is Produced from a certain *Lead Ore* boil'd Raw. (*Plumbi Nigri Vena* Vitriolum Album *producit, etiam non Cremata*) None, that I know of, of our *Engliſh Lead Ores* gives us any ſuſpicion of any ſuch *Vitriol*. It is True I have by me ſome ſorts of *White Lead-Ore, Spar-like*, plentifully yielding *Lead*: But I cannot ſay, that either thoſe,

White Vitriol; *by Dr.* Liſter. n. 256. p. 331.

or any *Colour'd Lead-Ores*, did give me any Reaſon to Suſpect, after diverſe Experiments upon them, that they yielded *White Vitriol.*

As to the *Cryſtals* of *White Vitriol*, they are very Difficult to Deſcribe: and ſeem to me to be a Congeries of Infinite ſmall *Needles*; for which Reaſon it is of a moſt *Speedy Operation*, and Irritates the Stomack *Suddenly*, before they can be well diſſolv'd or Broken.

Allum-Works; *by Mr.* Dan. Colwall. n. 142. p. 1052.

LXXXIX. Allum is made of a *Stone*, of *Sea-weed* and *Urine.*

The *Stone* is found in moſt of the Hills between *Scarborough* and the River of *Tees* in the County of *York* As alſo near *Preſton* in *Lancaſhire.* It is of a Blewiſh colour, and will cleave like *Corniſh Slate.*

The *Mine* which lies Deep in the Earth, and is indifferently well Moiſtned with Springs, is the Beſt. The Dry *Mine* is not good: And too much Moiſture Cankers and Corrupts the *Stone*; making it *Nitrous.*

In this *Mine* are found ſeveral Veins of *Stone* called *Doggers*; of the ſame Colour, but not ſo Good. Here are alſo found thoſe that are commonly called *Snake-ſtones.* The People have a Tradition, that the Country thereabouts being very much annoyed with *Snakes*, by the prayers of St. *Hilda*, there inhabiting, they were all turned into *Stones*, and that no *Snake* hath ever ſince been ſeen in thoſe Parts.

For the more convenient working of the *Mine*, which ſometimes lies 20 *Yards* under a Surface or Cap of Earth, (which muſt be taken off and barrowed away) they begin their Work on the Declining of a Hill, where they may be alſo well furniſhed with *Water.* They digg down the *Mine* by Stages, to ſave Carriage; and ſo throw it down near the places where they *Calcine* it.

The *Mine* before it is *Calcined* being expoſed to the Air, will Moulder in pieces, and yield a Liquor whereof *Copperas* may be made: But being *Calcined* its fit for *Allum.* As long as it continues in the Earth, or in Water, it remains a Hard ſtone.

Sometimes a Liquor will iſſue out of the ſide of the *Mine*, which by the Heat of the *Sun* is turned into Natural *Allum.*

The *Mine* is Calcined with *Cinders* of *New Caſtle-Coal*, *Wood*, and *Furzes.* The *Fire* made about 2 *feet* and an *half* Thick, 2 *Yards* Broad, and 10 *Yards* long. Betwixt every *Fire*, are ſtops made with Wet Rubbiſh; ſo that any one or more of them may be Kindled, without prejudice to the reſt.

After there are 8 or 10 *Yards* Thickneſs of broken *Mine* laid on this Fewel, and 5 or 6 of them ſo covered: Then they begin to Kindle the *Fires*: And as the *Fires* Riſe towards the Top, they ſtill lay on Freſh *Mine.* So that to what Height you can Raiſe the Heap, which is often times about 20 *Yards*, the Fires without any further help of Fewel will Burn to the Top, ſtronger than at the firſt Kindling; ſo long as any *Sulphur* Remains in the *Stones.*

In *Calcining* theſe *Stones*, the Wind many times does hurt, by forcing the *Fire* in ſome places too Quickly through the *Mine*, leaving it Black and Half Burnt; and in others, Burning the *Mine* too much, leaving it Red. But where the *Fire* paſſeth ſoftly and of its own accord, it leaves the *Mine* White; which yields the beſt and Greateſt quantity of Liquor.

The

The *Mine* thus *Calcin'd* is put into *Pits* of *Water*, ſupported with Frames of Wood, and Rammed on all ſides with *Clay:* About 10 *Yards* long, 5 *Yards* Broad, and 5 *Feet* Deep, ſet with a Current that Turneth the Liquor into a *Receptory*, from whence it is Pumped into another *Pit* of *Mine*. So that every *Pit* of Liquor, before it comes to Boiling, is Pumped into 4 ſeveral *Pits* of *Mine*; and every *Pit* of *Mine* is ſteeped in 4 ſeveral Liquors, before it be Thrown away; the laſt *Pit* being always *Freſh Mine*.

This *Mine* thus ſteep'd in each of the ſeveral Liquors 24 *hours*, or there about, is of courſe 4 *Days* in paſſing the 4 ſeveral *Pits*, from whence the Liquors paſs to the *Boiling Houſe*.

The *Water*, or *Virgin Liquor*, oft times Gains, in the *firſt Pit*, 2 *pound* Weight. In the 2*d* it encreaſeth to 5 *pound* Weight; in the 3*d* to 8 *pound* Weight; and in the *Laſt Pit*, which is always Freſh *Mine*, to 12 *pound* Weight; and ſo in this proportion, according to the goodneſs of the *Mine* and the well *Calcining* thereof. For ſometimes the *Liquors* paſſing the 4 ſeveral *Pits*, will not be above 6 or 7 *pound* Weight: At other times above 12 *pound* Weight, ſeldom holding a Conſtant Weight, one week together. Yet many times Liquor of 7 or 8 *pound* Weight produceth more *Allum*, than that of 10 or 12 *pound* Weight, either through the Illneſs of the *Mine*, or, as uſually, the Bad *Calcining* thereof. And if by paſſing the Weak Liquor through another *Pit* of Freſh *Mine*, you bring it to 10 or 12 *pound* Weight: Yet you ſhall make leſs *Allum* with it, than when it was but 8 *pound* Weight. For what it gains from the *Laſt Pit* of *Mine*, will be moſt of it *Nitre*, and *Slam*, which Poyſons the Good Liquors, and Diſorders the whole Houſe, until the *Slam* be Wrought out.

That which they call *Slam*, is firſt perceived by the Redneſs of the Liquor when it comes from the *Pit*, occaſioned either by the Illneſs of the *Mine*, or, as commonly, the Over or Under *Calcining* it, as aboveſaid; which in the *Settler* ſinks to the Bottom, and there becomes of a Muddy ſubſtance, and of a Dark Colour. That Liquor which comes *Whiteſt* from the *Pits*, is the *Beſt*.

When a work is firſt begun, they make *Alum* of the Liquor only that comes from the *Pits* of *Mine*, without any other Ingredients. And ſo might continue, but that it would Spend ſo much Liquor as not to quit Coſt.

Kelp is made of a *Sea-weed*, called *Tangle*, ſuch as comes to *London* on *Oyſters*. It grows on Rocks by the Sea-ſide, between High-Water and Low-Water Mark. Being Dryed, it will Burn, and Run like Pitch; when Cold and Hard 'tis beaten to *Aſhes*, ſteeped in Water, and the *Lees* Drawn off to 2 *pound* Weight, or thereabout.

Becauſe the Country People, who furniſh the work with *Urine*, do ſometimes Mingle it with Sea-water which cannot be diſcovered by Weight: They try it, by putting ſome of it to the Boiling Liquor. For ſo, if the *Urine* be good, it will Work like Yeſt put to Beer or Ale, but if Mingled, it will *Stir* no more than ſo much Water.

It is Obſerved, that the beſt *Urine* is that which comes from Poor Labouring people, who drink little Strong Drink.

The *Boiling Pans* are made of *Lead*, 9 *feet* long, 5 *feet* Broad, and 2 and

a *half* Deep: Set upon Iron Plates about 2 *inches* Thick; which *Pans* are commonly new Caſt, and the Plates Repaired 5 times in 2 *Years*.

When the work is begun and *Alum* once made, then they ſave the Liquor which comes from the *Alum*, or wherein the *Alum* ſhoots, which they call *Mothers*. With this they Fill two Third parts of the *Boilers*, and put in one third part of Freſh Liquor which comes from the *Pits*. Being thus Filled up with Cold Liquor; the *Fires* having never been drawn out, will *Boil* again in leſs than 2 *hours* time. And in every 2 *hours* time the Liquor will Waſte 4 *Inches*, and the *Boylers* are Filled up again with Green Liquor.

The Liquor if Good, will in *Boiling*, be Greaſy, as it were, at the Top: if *Nitrous*, it will be Thick, Muddy and Red. In *Boiling* 24 *hours*, it will be 36 *pound* Weight. Then is put into the *Boiler* about a Hogſhead of the *Lees* of *Kelp*, of about *two Penny* Weight, which will Reduce the whole *Boyler* to about 27 *pound* Weight.

If the Liquor is Good, as ſoon as the *Lees* of *Kelp* are put into the *Boiler*, they will Work like Yeſt put to Beer: But if the Liquor in the *Boiler* be *Nitrous*, the *Kelp Lees* will ſtir it but very little; and in that caſe, the workmen muſt put in the more and ſtronger *Lees*.

Preſently after the *Kelp Lees* are put into the *Boiler*, all the Liquor together is drawn into a *Setler*, as big as the *Boiler*, made of *Lead*, in which it ſtands about 2 *hours*; in which time moſt of the *Nitre* and *Slam* ſink to the Bottom.

This *Separation* is made by means of the *Kelp Lees*. For when the whole *Boiler* conſiſts of Green Liquor, drawn from the *Pits*, it is of Power ſtrong enough to caſt off the *Slam* and *Nitre*: But when *Mothers* are uſed, the *Kelp Lees* are needful to make the ſaid *Separation*.

Then the ſaid Liquor is Scooped out of the *Setler*, into a *Cooler*, made of Deal Boards, and Rammed with Clay. Into this is put 20 *Gallons*, or more of *Urine*, more or leſs according to the goodneſs or badneſs of the Liquor. For if the Liquor be Red, and conſequently *Nitrous*, the more *Urine* is required.

In the *Cooler* the Liquor in Temperate Weather, ſtands 4 *days*. The 2*d day* the *Alum* begins to ſtrike, gather and Harden about the ſides, and at the Bottom of the *Cooler*.

If the Liquor ſhould ſtand in the *Cooler* above 4 *days*, it would as they ſay Turn to *Copperas*.

The Uſe of *Urine*, is as well to caſt off the *Slam*, as to keep the *Kelp Lees* from Hardning the *Alum* too much.

In Hot weather, the Liquors will be *One day* longer in *Cooling* and the *Alum* in gathering, than when the weather is Temperate. In Froſty weather the Cold ſtrikes the *Alum* too ſoon, not giving time for the *Nitre* and *Slam* for to ſink to the Bottom, whereby they are Mingled with the *Alum*. This produceth double the Quantity: But being Foul, is conſumed in the *Waſhing*.

When the Liquor hath ſtood 4 *Days* in the *Cooler*, then that called *Mothers* is ſcooped into a Ciſtern, the *Alum* Remaining on the ſides and at the Bottom; and from thence the *Mothers* are Pumped back into the *Boiler* again. So that every 5 *Days*, the Liquor is *Boiled* again, until it Evaporate or Turn into *Alum* or *Slam*.

The

The *Alum* taken from the ſides and Bottom of the *Cooler*, is put into a Ciſtern and *Waſhed* with Water that hath been Uſed for the ſame purpoſe; being about Twelve *Pound* weight. After which it is *Roached* as followeth.

Being *Waſhed* it is put into another *Pan* with a quantity of Water, where it Melts and Boils a little. Then it is Scooped into a great Cask, where it commonly ſtands 10 *Days*, and is then fit to take down for the Market.

The Liquors are *Weighed* by the *Troy Weight*; ſo that *Half* a *Pint* of Liquor muſt Weigh more than ſo much Water, by ſo many *Penny Weight*.

XC. *Vitriol* is of ſeveral Kinds, being for Colour, *White*, *Yellow*, *Green*, or *Blew*; uſually of the two laſt mentioned: And is made either of *Mineral Waters*, Boiled up to a convenient Conſiſtence; then ſet to *Cryſtallize*: Or Extracted by Common Water out of *Earths* impregnated therewith. 'Tis alſo afforded by many ſorts of *Stones*, commonly called *Pyrites* and *Marcaſites*, which expoſed ſome Months to *Aerial* Influences, are reſolved into Powder, and the *Saline* Part Diſſolved in Rain or other Water; then Boil'd and ſet to Shoot, yield ſtore of *Vitriol*, eſpecially with the Addition of *Copper* or *Iron*. It is often Aſſociated with *Earth* and *Stones*, wherein *Metals* are Contained; and with many Natural *Recrements* of *Metals*, ſuch as *Miſy*, *Sory*, *Chalcitis*; from which 'tis uſually ſeperable by the Common Method with Water; ſometimes not to Be Extricated until the *Mineral* be firſt *Calcined* or Burnt. It is alſo frequently found Pure and Perfect in the *Caverns* of the Earth, being an *Efflorescence* of ſeveral *Minerals*; and this is accounted by all *Naturaliſts*, the Beſt, both for *Medicinal* and *Spagyrical* uſes. Laſtly, it is Copiouſly Contained in common *Mineral Sulphur*.

Experiments about Vitriol, Sulphur, *and* Alum; *by* ..... n. 103. p. 41.

Vitriol conſiſts of *Inſipid Phlegm*, *Earth* or *Oker*, ſome *Metal*, *Mineral Sulphur*, an *Acid Salt* or *Spirit*, together with ſome ſmall Portion of the *Volatile Aerial Salt*. That it contains *Water*, needs no great Proof, ſince no *Saline* Subſtance can *Cryſtallize* without it; and *Diſtillation* will Convince any Perſon, that it exceeds in Quantity any of the other Principles.

The *Earth* or *Oker* may be thus ſeperated. Diſſolve *Vitriol* in fair Water, immediately a *Yellow* Powder will ſeperate, and in a ſhort time Subſide. The greater the Quantity of Water imployed, the More *Oker* Precipitates: The Weaker the *Lixivium*, the leſs able to ſupport Bodies more Ponderous than Common Water; And the Lighter the Water (as if Diſtilled Rain-Water, or *Phlegm* of *Vinous Spirits*,) the more *Earthy* Parts Subſide, upon the ſame *Hydroſtatical* Principle. I have above 20 times repeated this *Diſſolution*, Seconded by *Filtration* and *Coagulation*, and each time ſeperated ſome Quantity of this *Earth*: And *I* am perſwaded, had *I* long continued the Operation, the Succeſs would have been the ſame; only *I* obſerved the Quantity ſeperated each time, ſenſibly to Diminiſh. But *I* have found a more Eaſie and Expedite way of Effecting this *Seperation*. Take a good quantity of the *Common Dantzick*, or *Hungarian Vitriol*; having Powder'd it, put it into a ſlender *Cucurbite*; Place it in Water; keep under it an Equal Conſtant Fire 3 or 4 Days: The *Vitriol* will, without Addittament, become Fluid, as if

Diſſolved

Diſſolved in Water, and the *Oker* with moſt of the *Metalline* parts, with the Groſs *Sulphur*, will Subſide, and become a Hard Cake at the bottom, the *Vitriol* being fluid about it, which in the Cold again *Cryſtallizeth*; excepting a ſmall quantity of *Liquamen* of the ſame nature with that we ſhall hereafter Mention. This Repeated once or twice, the *Vitriol* attains unto a High Degree of Purity, and is eaſily capable of many Alterations, whereunto it was not ſubject before this Purification. This Operation will not ſucceed in a Dry Digeſtion; *I* mean, *Aſhes*, *Sand*, *Filings* of *Iron* or *Steel*, *Open Fire*, or even *Flame* of *Lamps*, whether fed with *Oil* or *Spirit* of *Wine*. This *Earth* may be alſo Obtained in a great Proportion, though in another Form, if after a long and Intenſe *Calcination*, the *Vitriol* is freed from its Remaining *Salt*, by frequent *Ablutions* with warm Water: The far greateſt part of this *Dulcify'd Colcathar* is *Inſipid Earth* with ſome ſmall proportion of *Metal*. The ſame may be *Precipitated* by *Salt of Tartar*, or any other *Alcalies*, or *Filings* of *Zink*, or other Immature *Minerals*, out of a Solution of *Vitriol* in Common Water. It being alſo *ſeperated* from *Metalline* and *Saline* parts, by a Method *I* ſhall hereafter mention, there remains a great quantity of an *Inſipid* Subſtance nearly reſembling *Burnt Allom*. Beſides, whereas *Salt*, *Nitre*, &c. require in *Diſtillation* a large quantity of *Earthy* Subſtance, to Disjoin the *Saline* Parts, and prevent *Fuſion*: *Vitriol* and *Allom* need it not; an unqueſtionable Proof, that *Earthy* Parts abound therein.

That *Vitriol* contains *Sulphur*, is Evinced by the *Sulphureous* Smell it emits in *Diſtillation*, eſpecially if urged with a ſtrong Fire from the beginning; and the *Spirit* thus drawn being *Rectifyed*, the Liquor, which firſt ariſes, hath a Highly *Sulphureous* Smell; as hath alſo that we ſhall hereafter mention, Diſtilled from *Vitriol* deprived of its *Metallick* parts. The *Colcothar Dulcify'd*, or *Metallick* parts Precipitated by an *Alcali*, or *Immature Mineral*, *Sublimed* with *Sal Armoniack*, an *Inflamable* Sulphur may be many ways ſeparated, both from the *Sublimate* and *Caput Mortuum*. The Common *Oyl* of *Vitriol* digeſted on *Antimony*, then Diſtilled, yields a much greater quantity of *Sulphur*, than would have been produced, had any other *Acid* Liquor been Imployed; and the ſame *Oyl* of *Vitriol* digeſted with *Spirit* of *Wine*, and Diſtilled, yields an *Oil*, and at the latter end, ſtore of *Sulphureous* Inflammable Flowers.

As for the *Acid Saline* Principle, I ſuppoſe no Perſon who hath Taſted of the *Spirit* of *Vitriol*, and, that abuſively called, its *Oil*, will Queſtion its abounding in that Subject.

In order to the Reſolution of ſome Enquiries about this *Saline* Principle, *I* made theſe Experiments. I took 4 or 5 *Gallons* of the *Vitriolate* Water, which was conveyed by Artificial Channels at *Deptford*, from the Beds of *Pyrites* or *Marcaſites* into the Great Ciſtern. I Diſtilled therefrom, in Glaſs Veſſels, two Thirds of *Inſipid Water*, letting the Glaſſes Cool, the Water let fall a *Vitriol* of a lovely Dilute Colour, together with a great Quantity of that Yellow Sediment which we formerly call'd *Oker*. Then Evaporating a Third part of the remaining Liquor, I received more *Vitriol* of a Paler Colour than the former, and *Oker* as before, though leſs. The 5th time this Opera-

Operation was repeated, instead of *Vitriol* it afforded a *Yellow*, and ever after a *White Salt*, which did differ exceedingly from *Vitriol*, not only in Colour, but also Taste; being Fiery and Pungent; and did partake little of that Abominable Rough Astringent Smack which is Peculiar to *Vitriol*. It was also *Unctuous*, like *Salt* of *Tartar*; made the Hands soft and Supple, cleansing like a *Sapo*; whereas Common *Vitriol* renders them Rough and Harsh: Being Dissolved in Water, it appeared to the very Eye very *Fatty* and *Oleaginous*.

From 5 *Pounds* and an half of *Lixivium*, I received 4 *Pounds* of this Fiery *White-Salt*, besides *half* a *pound* of *Liquamen*, which remained Fluid, and would not *Coagulate*. I do the rather mention this; for that it is one of the most eminent Instances, I ever met withal, of so great a quantity of *Salt* kept fluid in the Cold, by so small a Quantity of *Water*.

The remaining *Liquamen* was very Fiery, Acidly Pungent, and extreamly Ponderous; no whit Inferiour, in my Opinion, in any of these respects to Common *Oil* of *Vitriol*; it seeming to me strange, and Unusual, that so strong a Liquor should be obtained without any considerable degree of Fire.

This *Liquamen* being exposed unto the *Air*, soon Attracted double its Quantity of *Moisture*; I cannot recollect, that I did ever observe any Fluid Body, which approached near unto it for this Property: Though *I* am not ignorant, that all *Corrosive Saline* Liquors will borrow considerably from their neighbouring Element. *I* always observed this *Liquamen* to acquire more or less *Moisture*, according to the Constitution of the Season, Rising sensibly in Moist Weather, and little in *Dry*.

The *White Salt*, last mentioned, was Distilled in a *Sand Furnace*, and the far greater part came over in the Form of a *Spirit* highly *Acid*, especially that which came last in small Drops. This Liquor *Rectified* in a very Tall Body, immediately upon the Approach of the Smallest Degree of *Heat*, a *Volatile Sulphureous* Spirit did arise, Clear as Rock Water, almost, nay I think altogether *Insipid*; yet the *Smell* so Subtile and Penetrating, that 'twas Insupportable: And such it continued many *Years*, not Letting fall any Sediment, and thereby losing its strength, as doth the *Volatile Spirit* made out of common *Vitriol*. The *Spirit* which remained after the *Separation* of the more *Volatile*, was in all respects like that of *London Vitriol*; only seemed more Gratefully *Acid*, and might, like it, be seperated into *Spirit* and *Oil*, corruptly so stiled.

Vitriol freed, as is before declared, from its *Earthy* and *Metallick* parts, by *Zink*, or other *Imperfect Minerals*, is much of the same nature, and yields its *Spirit* in *Sand*, as this we have now mentioned; is also *White*, and more *Unctuous*; hath a grain more like *Nitre* than *Vitriol*; as hath also the *Goslar Vitriol* which is *White*, and comparatively *Unctuous*, because it hath little *Metal*, and less *Mineral Sulphur* than the *Common*; whose *Metalline* part detains the *Saline*, and will not dismiss it until long Urged by a very intense degree of Heat. What remained in the *Retort*, after this *Distillation* was not Red or Purple, like the *Caput Mortuum* of the common *Vitriol*, but *White*, *Light*, and *Spongious*, like *Burnt Alum*, and altogether as *Insipid*; although, after it was some time Exposed unto the *Air*, it received many strange Impressions and Alterations.

I

I cannot but take notice here of the great Affinity that is between *Vitriol*, *Alum*, and *Mineral Sulphur*; the *Saline* Principle, which is in each of them by far the Chief, both in Quantity and Energy, having One Nature and the
n. 104. p. 66. same Properties. This will appear Evident to thoſe who will Compare with the common *Spirit*, or *Oyl* of *Vitriol*, the *Acidity* of *Sulphur* afforded by *Brimſtone* Inflam'd under a Glaſs Bell; which being *Rectify'd*, is not to be Diſtinguiſh'd, by any ſenſible Property, from the well *Rectifyed Acidity* or *Oyl* of good *Vitriol*; and they may, I am confident, be ſafely ſubſtituted for each other, producing in *Men* and *Metalls* the very ſame Effects, being in my Apprehenſion, no leſs alike in their *Internal* and ſecret, than in their *External* ſenſible Qualities.

The Quantity indeed of *Acidity*, which is obtained in the ordinary ways of Operation, is very ſmall, a *pound* of *Brimſtone* not yielding above one *Ounce* or 10 *Drachms*; the far greater part being by the rapid motion of the Flame *Sublimed* in the form of *Flores*, which differ not from the common *Flowers*. I have been often aſſured by a Kinſman of that admirable Mechaniſt *Cornelius Drebbel*, that his Uncle did, by the means of conveniently ſhaped Veſſels, ordinarily obtain out of a *pound* of good *Brimſtone*, 8, and in a very *Moiſt* Seaſon, 10 *Ounces* of *Acidity*; and was confident, he could, by improving the Contrivance, recover the entire weight of the *Sulphur*; the *Moiſture* of the *Air* acquired, making abundant recompence for the Avolation of what is *Incoagulable*. I have my ſelf, by the Means of ſeveral *Menſtrua*, reduced common *Brimſtone* into the form of an highly *Acid Corroſive* Liquor; and even *Spirit* of *Nitre*, or *Aqua-fortis* well Rectified, being Digeſted on the *Flowers* of *Brimſtone*, then Diſtilled in *Aſhes*, this Repeated 5 or 6 times, after the laſt *Cohobation* there will remain with the *Flowers* near their Weight of an *Acid Spirit*, like that made by a *Bell*; the *Spirit* of *Nitre* being ſcarcely changed from what it was before the Operation. And I ſuppoſe, that being Reiterated frequently, eſpecially if Freſh Spirit be employed, the whole may be *Tranſmuted*, abating ſome few Earthly and Metallick particles; the *Sulphureous* being capable of a Fluid form, and are copious in *Oyl* of *Vitriol*, *Aqua-fortis*, and many other *Acid Menſtrua*, eſpecially if any Imperfect *Sulphureous* Minerals were imployed with the other Ingredients in their Production.

I once made out of *Vitriol*, *Common Salt*, and *Antimony*, a Liquor Clear as any Fountain Water; yet the *Smell* intolerably *Sulphureous*, continuing ſo many Years: And True Inflammable *Sulphur* may ſeveral ways be Recovered out of *Oyl* of *Vitriol*, or *Sulphur*, many times Rectified, and in appearance Free from ſuch Mixture. We formerly mentioned its *Separation* by means of *Vinous Spirits*. Alſo, if Mixt with *Oyl* of *Turpentine*, and *Diſtilled*, at the latter end ſtore of *Brimſtone* will *Sublime*: I ſuppoſe, none will Aſcribe this to the *Vegetable Oyl*, which is only the Means of its *Seperation*, being an appropriate *Menſtruum* or Diſſolvent of *Sulphureous* bodies. This recalls into my Mind what I have often obſerved, (and I ſuppoſe it always Happens) in the Preparations of *Balſom* of *Sulphur* with the ſaid *Oyl* of *Turpentine*: After the *Oyl* is Satiated with *Sulphur*, it lets fall ſtore of fair *Cryſtals*: an evi-

dent

dent Proof of its *Saline* Nature: For, although theſe *Cryſtals* Broken within appear full of *Sulphur*, their Outward parts or Superficies ſeem perfect *Salt*, by Vertue whereof they are diſpoſed to *Cryſtallization*. It may indeed be Objected, that *Cryſtallization* is not a ſufficient Proof of a *Saline* Nature, the *Eſſential Oyles* (as they are called) of *Anniſeeds*, *Fennel ſeeds*, and of many other Subſtances being very Prone to *Cryſtallize*. But moſt *Eſſential Oyles* abound no leſs with *Salt* than Common *Sulphur*, into which I have often Converted them without Additament or Suſpicion of *Tranſmutation*.

The *Affinity*, I had almoſt ſaid *Identity* of the *Saline* Principle in *Sulphur* and *Vitriol*, further appears by the Following Experiment. Take thin plates of *Copper*, Cement them carefully with common *Brimſtone*, *Stratum ſuper Stratum*, Repeat the Operation 4 or 5 times with Freſh *Sulphur*; moſt of the *Copper* will be converted into *Vitriol*. which Diſſolved in Water, and moſt of that Evaporated, yields very Beautiful *Azure Cryſtals*. The ſame may be Effected with *Iron*. Or, take the *Acidity* of *Sulphur* (corruptly called its *Oyl*) Moiſten therewith Filings of *Copper* or *Iron*; then free them by Fire or Air from Superfluous moiſture; Repeat this twice or thrice; and afterwards with common Water you may Extract a Fair *Vitriol*, which by the *Chymiſts* is called *Vitriolum Martis* or *Veneris*, according as the one or other Metal was imployed in order to its Production; which ſame Metals being Diſſolved in any *Acid Menſtrua*, and *Cryſtallized*, are Converted into *Vitriol*. This is ſignified unto us by the common name of *Vitriol*, Vulgarly ſtiled *Cuperoſum*, *quaſi Cuprum Eroſum*; that being the Metal wherewith 'tis uſually Aſſociated, *Sulphur* indeed is found mixt with moſt Metals and Minerals, *Gold* and *Silver* not being Excepted; the moſt expert Mineraliſts in *Peru* accounting abundance of *Sulphur* an eſpecial *Sign* of Rich *Ore*: And among the Richeſt *Ore* of the Mountain of *Potoſi* are ſuch Quantities of *Brimſtone*, that the Cavities and Hollow places are preſently filled with *Flame* if a Candle touch or come near their ſides. Yet they do not ordinarily find *Vitriol* in Mines of *Gold* and *Silver* (unleſs Mixed with other *Metals*) becauſe thoſe Bodies are ſomething too Compact for the *Sulphureous Spirit* to Diſſolve aſſiſted with a ſmall degree of Heat; whereas all *Ores*, which touch on *Copper* or *Pyrites* abounding in *Sulphur* do alſo afford *Vitriol*; *Copper* being an Open Body, and more eaſie Soluble than any other Metal, For it will preſently, though Crude, Diſſolve in, and give a deep Tincture to common *Volatile Urinous Spirits*: Which cannot be affirmed of any other Metal, howſoever Prepared; and therefore no wonder if it be not by the Steam of *Sulphur* ſo eaſily converted into *Vitriol*. And in the Bowels of the *Earth* it is, I do conjecture, moſtly produced after this manner; An *Acid Salino Sulphureous* ſteam (ſuch we have Proved that of common *Sulphur* to be) inſinuating it ſelf into a Vein of *Copper*, Corrodes it, and Uniting therewith becomes *Vitriol*, So it doth by mixture with *Iron* and other *Minerals*; whence being Waſhed with Water, it Produces *Acidulæ* of divers kinds, according to the Nature of the *Minerals*, wherewith the *Acid* is United. And that *Vitriol* and *Vitriolate Waters* are thus Produced, is hereby confirmed, that many *Ores* and *Pyrites* being Diſtilled *per Deſcenſum*, yield abundance of common *Sulphur*: The Remainder there after affords ſtore

Alonſo Barba's *Art of Metals*. *Lib.* I.

of *Vitriol*, although before *Calcination* it would have yielded none; the Fire enabling the *Sulphur* to Corrode, and Associate with the *Metallick* parts, that which is without Mixture of *Metal*, or which hath thereof a very small Proportion, continuing under the form of *Brimstone*.

This to me seems the Reason, why *Vitriol* and *Brimstone* are usually found together: Those *Minerals* and *Pyrites* that abound with one, being usually impregnated with the other; *Vitriol* not being a distinct Principle, but the Genuine off-spring of *Sulphur* its Material Cause, and Fire and Air the Efficient causes of its Production.

I speak of *Vitriol* Generated in the Bowels of the Earth; for it may be, and is often, Produced above Ground, by the *Aerial Salt* United with *Mineral* substances copiously contained in *Marcasites*, which it Extricates, and Coagulating therewith becomes a *Vitriol*. This *Aerial Salt*, which I have many ways procured, whilst in the *Air*, is altogether Unspecificate, I mean Freed from all Union with, or Determination by, any *Seminal* Principle, (the *Primordials* of all *Species* in the Universe being in my Opinion *Spermatical*; but being once at the Command of the *Architectonick* Power of any *Species*, whatsorver that be, it is by it, with other Matter, Determined in order to the Formation and Augmentation of the *Individuum*, and Propagation of the *Species*, and upon the Dissolution of its Dwelling, returns whence it Descended. Besides this there is also in the *Air* an *Acidity*, as is Evident in *Iron* Bars, whose Superficies is thereby Resolved into a Subtile *Crocus*; also in the Tarnishing of *Polish'd* Metals, where *Pit-Coal* is much Burnt, near unto and on the *Sea*, and where Exposed to certain *Winds*.

This *Acid Spirit* with the *Salt* last mentioned, are Instruments by Nature imployed in almost every Operation; especially the *Salt*, without which no Perfect *Animal* can subsist a Minute and all *Vegetables* Deprived thereof, do immediately Decay. Its well known that several *Minerals* and *Pyrites*, which are to the Taste altogether insipid and Elixiviated, and would yield not a *Grain* of *Salt*, being exposed unto the *Air* are Resolved into a Powder, and Afford some *Allum*, others *Vitriol* Copiously. Sometimes the *Minerals* require Previous *Calcination*, which Opens and Relaxes the Compages of the Bodies: So that the *Air* may have more easie ingress. And it is, I think, by most allowed, that after all the *Salt* is Extracted out of *Earth* Impregnated with *Vitriol*, *Allom* or *Nitre*, the said *Earth* being Exposed a sufficient time unto the *Air*, acquires Fresh Supplies: Which must be Derived from the *Air*. And it is particularly Remarkable in *Vitriol* and *Allum* that their *Spirit* being put into a Commotion or *Fermentation* by either Heat or Contrary-Natur'd *Spirits*, the Glasses which contain them being well Closed, although Large and Strong, will be Crack'd or Broken in pieces; which seems to proceed from the Expansion of some of those prodigiously Active *Springy* particles, wherewith the *Air* abounds, which together with the *Aerial Salt* were Arrested by the *Vitriolifying* Principle, and set at Liberty by the *Tumultuating*

tuating Liquor, the Change of whoſe Contexture might occaſion their Diſmiſſion the unbending of their *Springs*, and the Effects which thereupon enſue.

The *Affinity* between *Vitriol* and *Natural*, not *Factitious*, *Allum*, thus appears: *Vitriol* not only in *England*, but in ſeveral other Parts of the World, is ordinarily found in the ſame *Vein*, and ſometimes in the ſame Parcel, which Yields the *Allum*: Which may by ſeveral Methods be ſeparated from each other. The *Mineral* of *Allom*, if Mature, *Elixiviated* yields its *Salt* preſently; if leſs Mature, it requires Previous *Calcination*; if very immature, it muſt not only be *Burnt*, but long Expoſed unto the *Air*.

The Cauſe whereof ſeems the very ſame, with that we lately mentioned in our account of the Production of *Vitriol*; the *Allom*, as that is, being Produced by the *Sulphurs* Acting on, Corroding of, and Coagulating with, ſome *Mineral* ſubſtance, which uſually partakes more of *Terrene* and *Stony*, than *Metallick*, Nature: Although yet *Metal* is often found to be Contained in the *Allom-Stone* or Ore. And that the *Sulphur* is the chief Efficient and Material Cauſe of its Production, appears from hence, that many *Allom-Stones* (as the *Vitriolate*) *Diſtill'd per Deſcenſum*, Yield good *Brimſtone*; and all *Allom-Stones* or Ore, during *Calcination* Emit a *Sulphureous* ſteam. An inquiſitive Naturaliſt of my acquaintance did gather from the very ſame *Rock*, and that within a Few *Inches* of each other, *Vitriol*, *Allom*, and *Sulphur*, all of them Excellent and Perfect in their Kind. Indeed they are ſo nearly Allied, that I can by ſome pretty Artifices (too long to be here deſcribed) Convert *Allom* into *Vitriol*, or *Vitriol* into *Allom*, which ſhall be the *Same*, to all intents and purpoſes, (as we commonly ſpeak) with the *Natural*.

Allom Diſtilled into an *Acid Spirit* with *Copper* or *Iron*, becomes good *Vitriol*; and *Vitriol* freed from its *Metallick* parts becomes *Alluminous*; and Diſtill'd, yields a *Spirit* ſcarcely to be Diſtinguiſh'd not only by Taſte, but even by the Nice and Accurate ſcrutiny, from that of *Allom*. And (which doth in ſome meaſure Illuſtrate this *Affinity*) I have often Obſerved Rectified *Oyl* of *Vitriol* and *Spirit* of *Sulphur* to *Coagulate*, and become Solid Tranſparent Concretions, exactly reſembling *Allom Cryſtallized*, with which Compared, I am confident, the moſt Judicious Eye, without the Aſſiſtance of the Palate, would find little Difference.

The *Salt* in *Brimſtone* is thus Derived. *Brimſtone* conſiſts of *Mineral Sulphur* and an *Acid Salt*, which being United it is no Difficult matter to Conceive how it ſhould become *Volatile*, if we Reflect on *Cinnabar* and *Sublimate* In one, *Mercury* is ſo Diſguiſed by a little *Sulphur*, that it ſeems a *Mineral* ſubſtance of another Nature, and abating the Colour, not unlike *Antimony*: In the other, *Salts* very *Acid* and *Fixt* are Rendered ſufficiently *Volatile*. Now whence the *Brimſtone* ſhould Derive its *Sulphureous* Particles, will appear very Obvious to them, who have obſerved how much the Bowels of the Earth abound with *Bituminous* Subſtances. What elſe Feed all the *Subterraneous Fires*? What an Immenſe Quantity thereof is lodged in the Earth, will be atteſted by our Large and Numerous *Coal-Mines*, and by thoſe Eruptions of *Bituminous* Subſtances in many Quarters of the World; among which that

call'd *Naphtha*, is ſo purely *Sulphureous*, ſo Free from Mixture with any other Materials, that upon the very approach of Fire or Flame it is immediately *Inflamed*, and ſcarcely to be Extinguiſh'd until wholly Conſumed. As for the *Saline* Principle of *Sulphur*, I conclude it to be *Common Salt*, which, together with the *Aerial Salt* before mentioned, is the Foundation of all *Saline* Subſtances in the Univerſe. And I aſſure you I can with *Common Salt* make both *Vitriol* and *Allum*, hardly Diſtinguiſhable from the *Natural*.

The Efflorescence *of certain* Mineral *Glebes*; *by Dr.* Liſter. n. 110. p. 221.

XCI. I kept by me certain big pieces of *Crude Allom-Mines*, ſuch as it was taken out of the *Rock*. I had alſo in the ſame Cabinet like pieces of the Ordinary *Fire-Stone* or *Marcaſite* of the *Coal-Pits*, which here we call *Braſs-Lumps*.

In proceſs of Time, both the *Glebes* ſhot forth *Tufts* of long and ſlender *Fibres* or Threads: Some of them half an *Inch* long, Bended and Curled like Hairs. In both theſe *Glebes* theſe *Tufts* were in ſome meaſure *Tranſparent* and *Cryſtalline*. Theſe *Tufts* did as often Repullulat, as they were ſtruck and wiped clean off.

The *Alluminous Fibres* were of a *Taſte* very *Allomy* and Pleaſantly Pungent: The *Vitriolique*, *Steptique* and Odious. Again, the *Allom* ones, being Diſſolved in Fair Water, raiſed a ſmall *Ebullition*: Whereas the *Vitrolick Fibres* Diſſolved *Quietly*. The *Allom-Fibres* were generally ſmaller, and more *Opaque*, Snow-like: The *Vitriolick* larger, many Fibres equalling an Horſe-Hair in Thickneſs, and more *Cryſtalline*. The Water wherein the the *Allom-Fibres* were diſſolv'd, did give no *Red* Tincture with *Gall*; not by all the means I could deviſe to Aſſiſt them: the *Vitriolick* did immediately give a *Purple* Tincture with *Gall*.

Having laid pieces of the ſame *Marcaſite* in a *Cellar*, they were in a few *Months* covered over with *Green Copperas*; which was theſe *Fibres* ſhot and again Diſſolved, by the Moiſt Air, Clodder'd and Run together: Expoſing other pieces of the ſame *Vitriolick Glebe* in my *Window*, where the Sun came, they were Covered over with a *White Farinaceous* matter; that is, with theſe *Fibres* Calcined by the Rays of the Sun and Warm Air, beating upon them.

I take theſe *Fibrous* and *Thread like* Shootings of *Allum* and *Vitriol* to be moſt Genuine and Natural: And their *Angular* Shootings, after Solution, into *Cubes* and *Rhomboides*, to be Forc'd and Accidental; *Salts* of very Different Natures, as well *Vegetable* as *Foſſile*, by a like Proceſs in *Cryſtallizing* of them, being Obſerved to ſhoot into like Figures.

Amianthus; *by* ..... n. 72. p. 2167.

XCII. 1. Signior *Marco Antonio Caſtagna*, ſuperintendant of ſome *Mines* in *Italy*, hath lighted, in one of them, upon a great Quantity of that *Lanuginous Stone*, call'd *Amianthus*: Which he knows ſo to Prepare as to render it like either to a very White *Skin*, or to a very White *Paper*; both which Reſiſts the moſt Violent *Fire*. The *Skin* was Covered with Kindled Coals, whence it took *Flame*, but being taken out, after it had been left there a while,

while, the Fiery Colour Presently disappear'd, and it became *Cold* and *White* again as before; the Fire, it seems, passing only thorough, without Wasting or Altering any thing of it: Whereas some of the Hardest and Solidest *Metals*, as *Iron* and *Copper*, reduced to very thin Plates, and kept as long in the Fire as this Substance was, would cast Scales. Again, this *Skin* being made as Thin as *Paper*, doth not only yield that *Antient* and so much Admired *Amianthus*: But is also Perfecter than that which comes from *Cyprus*; and not inferior to that which sometimes, though but seldom, comes out of *China*. This *Paper* was also try'd in the *Fire*, and there it remain'd likewise without any Visible Detriments, or without the least *Change* of its first Whiteness, Fineness, or Softness. Of the same matter this Artist hath wrought a *Week*, never to be consumed as long as 'tis fed, nor altering its Quality after the Aliment is Wasted away.

2. The *Lapis Amianthus*, or *Linum Fossile Asbestinum*, is found in no small quantity in *Llan Fair yng Hornwy* in the Northern part of *Angleſey*; where it runs in *Veins* through a Rock of *Stone*, in Hardness and Colour not unlike Flint. These *Veins* are generally about $\frac{1}{4}$ of in *inch* Deep; which is the length of the *Amianthuss*, and is seldom longer, but often Shorter. It is compos'd of a *Lanuginous* matter, exactly resembling that of *Pappous Plants*: But so closely Compact, that till you draw a Pin, or any such sharp thing, cross the Grain of it, it appears only a Shining *Stone*; there being not the least Fil'ment of *Lint* to be perceived in it. In its Natural Form, some of it looks Whitish, and some straw-coloured, but all Shining: But if Pounded in a Mortar, the Brightness disappears, and the whole becomes Whitish. Note that Above and beneath the *Veins* there's a very thin *Septum* of Terrene matter, betwixt the *Amianthus* and the *Stone* whereto it adheres. I put a small Quanty of the *Lint* in the *Fire*, which grew Red Hot: But though it Remained there $\frac{1}{4}$ of an *hour*, I could not perceive that it was any thing Consumed. I Twisted also some of it in the form of a *Week*, and dipping it in *Oyl* it gave as good a *Flame* as other *Weeks*, till the *Oyl* was Consumed; the *Week* remaining of the same Proportion as at first. Being satisfied it was *Incombustible*, I pounded some quantity of it in a *Stone* Mortar, till it became a *Downy* substance: Then I sifted it through a fine Searce, by which means the Terrene parts (being reduced to a Powder) came through the Searce, the *Linum* remaining. I then brought it to a *Paper Mill:* and putting it in Water in a Vessel just Capacious enough to make Paper with such a Quantity, I stirred it pretty much, and desired the Workmen to proceed with it in their usual method of making *Paper*, with their *Writing Paper-Mould*; only to stir it about ever before they put their *Mould* in, considering it as a far more Ponderous substance than what they Used, and that consequently if not immediately taken up after it was Agitated, it would Subside. *Paper* thus made of it proved but very *Course*, and too apt to Tear: But this being the first Tryal, I have some reasons to believe it may be much Improved.

By Mr. Edw. Lloyd. n. 166. p. 823.

XCIII. I here send you the account of the *Incombustible Linnen Cloath*, which I received of it from one *Conco*, a Natural *Chineſe*, resident in the City of

Incombustible Cloth; *by Mr.* Nich. Waite. n. 172. p. 1049.

of *Batavia* in the North-East parts of *India:* Who, by means of *Keay arear Sukradana* (likewise a *Chineſe*, and formerly Chief cuſtomer to the old *Sultan* of *Bantam*) did after ſeveral Years diligence, procure from a great *Mandarin* in *Lanquin* (a province of *China*,) near ¾ of a *Yard* of the ſaid *Cloth*; and declared that he was credibly informed, that the Princes of *Tartary*, and others adjoyning to them, did uſe it in *Burning* their *Dead*; and that it was ſaid and believed by them, to be made of the Under part of the *Root* of a *Tree* growing in the Province of *Sutan*, and was ſuppoſed, in like manner to be made of the *Todda trees* in *India*; and that, of the Upper-part of the ſaid *Root*, near the Surface of the Ground, was made a Finer ſort, which in 3 or 4 times *Burning* I have ſeen Diminiſh almoſt half. They Report alſo, that out of the ſaid *Tree* there Diſtills a Liquor, which not Conſuming, is uſed with a *Wick* made of the ſame Material with the *Cloth*, to Burn in their *Temples* to Poſterity.

By ..... ib p. 1050.

2. A Hankerchief, or Pattern of this *Incombuſtible Linnen*, which was ſhewn the *Royal Society*, was a foot long and juſt ½ a foot broad.

There were two Proofs of its *Reſiſting Fire*, given at *London:* one, before ſome of the Members of the *Royal Society*, privately, *Aug.* 20. 1684; when *Oyl* was permitted to be Poured on it whilſt Red-Hot, to Enforce the Violence of the *Fire*. Before it was put into the Fire this firſt trial, it Weighed 1 *Ounce*, 6 *Drams*, 16 *Grains:* And Loſt in the *Burning* 2 *drams* 5 *grains*.

The ſecond Experiment of it was publick before the *Society*, *Novem.* 12 following, when it Weighed (as appears by the *Journal* of the *Society*) Before it was put into the *Fire*, 1 *Ounce*, 3 *Drams*, 18 *Grains*. Being put into a Clear Char-coal Fire, it was permitted to continue Red Hot in it for ſeveral *Minutes:* When taken out (though Red-Hot) it did not Conſume a piece of White Paper on which it was laid: It was preſently *Cool*, and upon Weighing it again, was found to have loſt 1 *Dram*, 6 *Grains*.

Decem. 3. Mr. *Arthur Baily*, one of the Fellows of the *R. S.* Preſented them with a piece of this *Linnen* in the Name of Mr. *Waite*. At the ſame time, the ſame Mr. *Bayly* Preſented Dr. *Plot* with another piece of it: which being brought to *Oxford*, the Experiment was again Repeated on it, *Decem.* 16 it being put into a ſtrong Char-coal-Fire in the *Natural Hiſtory School*, in a full meeting of the *Philoſophical Society* of that *Univerſity*; where after it had continued Red Hot for ſome Conſiderable Time, it was taken forth again little Altered when Cold, ſaving that it ſeemed a little *Whiter* and Cleaner than before.

By Dr. Rob. Plot. *ib p.* 1051.

3. This kind of *Linnen-Cloth* was eſteemed by the Antients, though then more common, and perhaps better known, than 'tis yet amongſt us; equally Pretious with the beſt of *Pearls*.

Nor is it now of Mean Value even in the Country where made, a *China Covet* (*i. e.* a Piece 23 *inches* and ¾ long) being worth 80 *Tale. i. e.* 36 *l.* 13 *s.* 4 *d.*

The

The *Reality* of ſuch a Being has been Doubted, or Deny'd by very good Authors: Who though they Owned ſuch a *Mineral* as *Amianthus*, out of the *Wooly* part whereof this, ſort of *Linnen* was always Antiently ſaid to be made, yet Queſtioned the Poſſibility of its having been actually done. But *Pliny* ſays Expreſly (and I Dare believe him in any thing he ſpeaks of his own Knowledge) that he himſelf had ſeen *Napkins* thereof, which being taken Foul from the Board at a great Feaſt, were Caſt into the *Fire*, by which means they were better Scoured, and looked Fairer and Cleaner, than if they had beeen Waſh'd in Water.

And beſides the Teſtimony of ſeveral Curious Perſons in all Ages, we have Now ſeen a piece of this *Linnen*, paſs the *Fiery Trial* both at *London* and *Oxford*.

This *Lanuginous* Mineral is call'd from its ſtrange Qualities) ſometimes *Amiantus*, *quod in* Ignem *injectus non* μιαίνεται, the *Fire* being ſo far from Defiling it, that it rather gives it a Luſtre. 2. It is called *Albeſtos*. and 3. *Salamandra*, in *Engliſh*, *Salamanders-wool*: I ſuppoſe from the *Thryallides*, or *Candle-Wicks*, ſaid to be Antiently made of it, which being put into *Lamps* of *Inconſumable Oyl*, would never Waſt, or go out; which I take to be the True Reaſon of the impoſition of theſe *Names* upon it, whether there ever were any ſuch *Lamps* or no.

4 From a *Pungent* Quality *Agricola* ſays it has on the Tongue without *Aſtringency*, it is call'd *Alumen*: Having the Diſtinguiſhing Epithet *Plumeum* added to it, taken from its *Downy* Filaments, to Diſcriminate it from all the reſt of them *Allums*.

5. From the *Light Gray* Colour of its *Lanuginous* parts, it is called by ſome *Polia*; by others, *Corſoides*; and from its likeneſs to the Hoary Fibres of ſome ſort of *Mat-Weed*, *Spartapolia*.

6. From the Capacity it has of being Spun into Thred, it is alſo call'd *Linum*, with ſome Diſtinguiſhing Epithet taken either from its Quality, ſuch as *Asbeſtinum*, or *Vivum*; or from the Place where found in General or Particular: It being called in General *Linum Foſſile*; in *Engliſh*, *Earth Flax*, and in Particular: *Linum Indicum*, *Creticum*, *Cypricum* & *Carpaſium*, or *Caryſtium*. But beſide the Places that have given theſe Epithets to the Head made of it, it is alſo found in *Tartary*; at *Namur* in the *Low Countries*; at *Eisfield* in *Thuringia*; amongſt the *Mines* in the old *Noricum*; ſome where in *Ægypt*; and in the Mountains of *Arcadia*; alſo at *Puteoli*; and lately in ſome *Mines* in *Italy*; and it has been yet latelier met with in a ſmall Iſland belonging to *William Robinſon* Eſquire, called *Ynis Molroniad*, *i. e.* the Iſland of *Sea Calves*, in the pariſh of *Llan Fair Yng Hornwy* in *Angleſea* in *Wales*.

It is commonly by the *Lithographers* reckoned among *Stones*: But I rather ſhould Judge it a *Terra Lapidoſa*, or Middle ſubſtance between a Stone and an Earth. But whether the one or the other, it is made of a Mixture (I gueſs) of ſome *Salt* or other, a Pure *Earth* without *Sulphur*, Coagulated in the Winter, and Hardned to Perfection by the Heats in Summer; Which *Salt Johannes Heſſus* proves by a very Cogent Argument to be *Alumen Liquidum*

dum, deſcribing it as *Matthiolus* alſo does, to be of a Whitiſh Lacteous ſubſtance, ſome what inclining to Yellow, that ſweats out of the *Earth*, and ſmells like *Rotten Cheeſe*; whereof having gathered a quantity at *Puteoli*, together with the other Species's of *Alum*, and kept it a while by him, when he came to look on it again, he found it to have loſt the *Smell*, and a great part of it changed into *Alumen Plumeum*, the *Saline* part (I ſuppoſe) Shooting into Threads, and the Pure *Earth* Uniting them, as found in the Places wherever Generated; whether ſweating from the *Earth*, as *Pliny* and *Matthiolus* would have it, or Percolated through *Rocks*, as we find it in *Wales*, the *Veins* of it there Running through a Rock of *Stone* in Hardneſs and colour not Unlike *Flint*.

And yet ſeems to be made of ſuch an *Alum*, as that of *John Heſſus* at *Puteoli* was, ſome of it being *Straw coloured*, as if it ſtill retained the *Yellowneſs* that his *Liquid Bitumen* was ſaid to have: Which is a Colour not given to it by any Author, moſt of it being ſaid to be *White*, or *Cinereous*; ſome of it *Red*; and ſome of an *Iron Colour*, as *Agricola* tells us; and I have ſome of the *Cyprian* by me, ſent from *Aleppo* by Dr. *Rob. Huntington* whereof ſome is of a *Light Blue*, or *Pearl-Colour*, and ſome of it has a Caſt of *Sea-Green*.

But however the whole *Mineral* ſubſtances found at ſeveral Places may Differ in *Colour*, yet I do not find but the *Woolly* part of them all ſeems to be much the ſame, *viz.* of a *White-Silver Colour*, the Threads very Fine and Slender, yet very Ponderous, the ſmalleſt particles of them throughly Wet, Sinking in water, as I alſo found a very ſlender Thrumm of the *Incombuſtible Linnen* given me by Mr. *Baily*, which Mr. *Waite* brought from *India*, would alſo do: Which Renders it very Probable that it is not a *Vegetable*, but a *Mineral* ſubſtance, notwithſtanding the Informations of *Conco* and *Keay arear Sukradana* mentioned in Mr. *Waites* Letter. I ſay *Renders it Probable*, there being ſeveral *Woods*, ſuch as *Box*, *Red Wood*, *Perſian Wood*, *&c.* that will *Sink* in Water.

De *Region Orientalibus.*

Marcus Paulus Venetus acquaints us, that it is found in *Tartary* in a certain Mountain in the Province of *Chinchinthalas*, and made into *Cloth*, as he was informed by one *Curficar* a *Turk*, who was ſuperintendent of the *Mines* in that Country, after this manner; The *Lanuginous Mineral*, or *Amianthus* being firſt Dryed in the Sun, is next Pounded in a Braſs Mortar, and the *Earthy* part Separated from the *Woolly*, which is afterward Waſht from all filth whatever that may ſtick to it; and ſo, being thus Purged, is Spun into Thread like other *Wool*, and after Wove into Cloth: Which if *Foul*, or *Spotted*, they *Cleanſe* he ſays, by Throwing it into the *Fire* for an *hours* time, whence it will come forth Unhurt, as White as *Snow*. Which very Method (as *Strabo* deſcribes it) ſeems alſo to have been Uſed in ordering the *Cretan Amianthus*: Only with this Addition, that after it was pounded, and the *Earthy* part ſhook from the *Woolly*, he ſays it was *Comb d*; and ſo does *Agricola*, which argues there was ſome of a Greater Length then any I have yet ſeen.

Of

Of this *Linnen* (as *Pliny* informs us) Shrouds were Antiently uſed, at the *Royal Obſequies*, to Wrap up the Corps in, ſo as that the *Aſhes* of their *Bodies* might be preſerved Diſtinct from thoſe of the *Wood*, which made the *Funeral Pile*: And the Princes of *Tartary*, as *Keay-arear Sukradana* was credibly informed (and I have it well Confirmed from other Hands) do uſe ſuch at this Day, for *Burning* their *Dead*. It muſt be acknowledged, it does Diminiſh every time it undergoes the Violence of the *Fire:* Yet this hinders not, but it may, and will, do that Service Divers Times, before it be Rendred altogether Uſeleſs. Some of the Ancients are ſaid to have made themſelves *Cloths* of it; particularly the *Brachmans* amongſt the *Indians*. The *Wicks* for the *Perpetual Lamps* of the *Antients* were alſo made of this Subſtance: And we are told, that *Septalla*, Canon of *Millan*, had *Thread*, *Ropes*, *Net works*, and *Paper* of it. *Marco Antonio Caſtagna*, who lately found this *Mineral* ſome where in *Italy*, knows how to Prepare, and Render it Tractable and Soft: Which he can Thicken and make Thin to what degree he pleaſeth, and maketh it thereby, like either to a very *White Skin*, or a very *White Paper*. We have alſo made *Paper* of our *Welſh Amianthus* but lately here at *Oxford*, which will both bear *Fire* and *Ink* well enough, the *Ink* only turning *Red* by the Violence of the *Fire*.

To ſhew the Reaſon whence it is that this ſubſtance ſhould be ſo Strangely Privileged by nature, we muſt conſider, that the Qualities and Power of the *Fire*, according to *Ariſtotle*, are Διακρίνειν τὰ μὴ ὁμόφυλα συνκρίνειν δὲ τὰ ὁμόφυλα; to *Separate* things of a *Different*, and *Unite* thoſe of a *like Nature*. Hence it is that the Subjects moſt apt to take *Fire*, and be Diſſolved by it, we find to be ſuch *Heterogeneous* bodies, in whoſe Pores the moſt *Sulphurous*, *Bituminous*, and *Aqueous* particles are Lodged: Which being Seized by *Fire*, are quickly put into Motion, Dilated and Separated, and being thus made capable of Flying away, are at laſt Conſumed; and Diſſolve the Frame of thoſe bodies whoſe Parts before were United by them. When theſe are Fled and gone, the *Fire* naturally goes out, as having nothing now Left to Work upon; nothing remaining, but the *Salts* and *Earth* in the form of *Aſhes:* Which in all ſorts of *Compounds* are the things that Reſiſt this Element moſt, and will Remain after the moſt Exalted Operation it can be forced to. Nor do the *Salts* only of *Mixt Bodies* thus Baffle the force of *Fire*: But the *Simple* ones much more, as being more *Homogeneous*, as we ſee in the *Decrepitation* of *Common Salt*, and *Exſiccation* of *Vitriol*, which when the *Aqueous* parts are once Evaporated, are now a *Pure Simple Homogeneous Body*, no more Senſible of the *Fire*, the *Decrepitation* Ceaſing, and nothing Remaining that can be Dilated any further to break the Corns of *Salt*. Now whatever the *Fire* cannot Dilate, it cannot *Separate*, nor conſequently *Deſtroy*, or Carry any thing from it, but what is *Heterogeneous* and accidentally Adhering to the outſide of it: Which is perfectly the Caſe of our *Incombuſtible Linnen*, whoſe Threads being altogether *Homogeneous*, and nothing elſe but the Pure *Striæ* of *Liquid Allum*, as was ſhewn above, holding nothing of *Sulphur*, *Bitumen* or *Water*, or any thing that is Different or *Heterogeneous* to it ſelf, that can be Dilated or Separated, it is in no Poſſibility of being liable to the *Fire:* Which may indeed

paſs through it, as we ſee it does when it is made *Red Hot*, but can carry nothing from it, but ſuch Accidental Filth as has been put upon it, or Accrued by Uſing.

Lapis Calaminaris; *by Mr.* Giles Pooley. n. 198. p. 672.

XCIV. The *Lapis Calaminaris*, or *Calamine*, which is digg'd and prepared near *Wrington* in *Somerſetſhire*, is found ſometimes in Meadows, ſometimes in Arable, ſometimes in Paſture; and as I have obſerved, moſt commonly in Barren and Rocky ground. The *Waters* thereabouts are much of the ſame Colour, Taſte, Clearneſs, and Wholeſomneſs with other Water. The *Graſs* upon the Ground, and the *Leaves* of the *Trees*, are as Freſh where *Calamine* lyes as in any other place. But this I obſerve that the *Groovers* always Dig for it upon, or near *Hills*; for they expect none in thoſe Grounds which have no Communication with *Hills*.

To Find out a *Vein* they digg a Trench till they come to the Rocks, where they expect it Lies; which Trench they generally digg from the North to South, or near upon that Point, the *Courſes* Uſually lying from Eaſt to Weſt, or at 6 *a Clock*, as their Term is, but ſometimes the *Courſes*, *Seams*, or *Rakes* as they call them, lie at 9 *a Clock*, and ſometimes are *Perpendicular* which they call the High time of the Day, or 12 *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 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.

The *Calamine* it ſelf is of ſeveral *Colours*, ſome White, ſome Reddiſh, ſome Greyiſh, ſome Blackiſh which is counted the beſt, and 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*: Though I think in *Lead-Mines* they do not always find *Calamine*. In Landing of the *Calamine* ſome pieces are Bigger than others, and Mixt with a gritty Earth; I have been informed that they have found one Entire Piece of 8 or 10 *Tun*, which by reaſon of its Bigneſs was forced to be broken in the *Groove* before it could be Landed: But generally it Riſeth in ſmall Particles; ſome about the bigneſs of a Nut, they call a ſmall *Calamine*. In Ancient Works *Damps* and *Staunches* ſometimes ariſe, but never in New-Works.

When they have Landed a good quantity of the *Calamine*, 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 and often Turn their *Calamine*, and the impure and Earthy parts the Running Water carries away, and leaves the *Lead*, and the *Calamine*, and the other Heavier Stony and Sparry parts behind. When they have thus Waſhed the *Calamine*,

as

as *Clean* as they can, having Rak'd up the Bigger Pieces both of the *Lead* and *Calamine*, they put the ſmaller Parts into *Sieves*, made of Strong Wire at the bottom: And theſe they often Dip and Shake up and Down in a great Tub of Water, whereby the parts of the *Lead* which are mixt amongſt the *Calamine* Sink to the Bottom of the *Sieves*, the *Calamine* remains in the Middle, and the other Sparry and Traſhy parts Riſe up to the Top; which they Skim off and Throw away, then they take off the *Calamine*, and after that the *Lead*. When they have thus Cleanſed the *Calamine*, they are forced to Spread it abroad, and ſo Pick out with their Hands the Traſh and Stones that remain. But all of it does 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.

Their *Calamine* being thus Prepared they carry it to the *Oven*, which, at leaſt that which I ſaw, is much Bigger than any *Baker's-Oven*, and made much in the ſame Faſhion: Only 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 4 or 5 *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 Coal-rakes; when it is ſufficiently Burned, Baked, and Dried, they Beat it to a Powder with long Iron-Hammers, like Mallets, upon a thick Planck, picking out what Stones they find amongſt it; ſo that at laſt the *Calamine* is reduced to *Duſt*, and then it is fit for the Merchant.

I have been credibly informed that the *Duſt* of *Calamine* conduces much to the curing of *Sore-Eyes* of Men: And that its Frequently made uſe of, for the taking off *Films* from the *Eyes* of *Horſes* and other Beaſts.

XCV. 1. Take of *Antimony* 1 *pound*; Flux it Clear: Have 1 *Ounce* or 2 of the *Cawk Stone* (by and by to be deſcribed) in a Lump Red Hot in readineſs. Put it into the Crucible to the *Antimony*; continue the Flux a few *minutes*: Caſt it into a Clean and not Greaſed Mortar, *Decanting* the Melted Liquor from the *Cawk*.

To Vitrify Antimony *with Cawk*; *by Dr.* Mart. Liſter. n. 110. p. 225.

This proceſs gives us above 15 *Ounces* of *Vitrum* of *Antimony*, like poliſht Steel, and as bright as the moſt Refined Quickſilver. The *Cawk* ſeems not to be Diminiſhed in its Weight but rather Increaſed; nor will be brought to Incorporate with the *Antimony*, though Fluxt in a ſtrong Blaſt.

This *Cawk-Stone* is a very Odd *Mineral*, much a kin to the *White Milky Mineral Juices* of the *Lead-Mines*, which *Vitrifies* in like manner. Beſides theſe I could never Light upon any One *Mineral* Subſtance, which had any ſuch Effect upon *Antimony*.

Vid. Sup. §. XLVI.

Cawk is a Ponderous White Stone, found in the *Lead Mines*; it will draw a White Line like *Chalk* or the *Gallactites*; but it is more Fine and hath a ſmooth and Shining grain, *Sparr like*, yet not at all Tranſparent.

The Vertue of Antimony; *by* .....n.39.p.774.

2. I Try'd that a *Boar*, to whom I had given an *Ounce* of *Crude Antimony* at a time, putting him into the Sty, would be Fat a fortnight before another, having no *Antimony*, upon the like feeding. *Antimony* will Recover a *Pig* of the *Meaſles*; by which it appears to be a great *Purifyer* of the *Blood*. I knew a *Horſe* that was very Lean and Scabbed, and could not be fatted by any Keeping, to whom *Antimony* was given for 2 *Months* together every morning, and that upon the ſame Keeping he became exceeding Fat. One of my own Horſes having had the *Faſhions*, and being cured, had notwithſtanding extream running Legs; ſo that after he had paſſed the Courſe of Farryers Twice, to be Cured, it was not done; but upon my giving him *Antimony* one week, he was preſently Healed.

The manner of uſing it, is this. Take one *drachm* of *Crude Antimony* Powder'd for one *Horſe*, and when you give him his *Oats* in a Morning, ſhake it out amongſt his *Oats*: or make it in *Balls*.

A Black Shining Sand *from* Virginia, *Examined by Dr.* All. Moulen. n. 197. p. 624.

XCVI. A ſmall Vial fill'd with Ordinary White *Sand*, and containing only ℥. i. *gr.* xi. being fill'd with the *Virginia Sand* was found to contain ℥ ij, ℈ ij. *gr.* 1.

This *Sand* did Apply to the *Magnet* both before and after *Calcination*: but the latter did Apply better to it than the former.

A Parcel of this *Sand* Mixed 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 *Loadſtone* than either of the former.

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*.

I *Flux'd* it alſo with *Salt Petre* and *Powder'd Charcoal*, dropping pieces of Charcoal afterwards into the *Crucible*. It continued 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.

I *Flux'd* another Parcel of it with *Salt-Petre* and *Flowers* of *Brimſtone*, without being able to procure any *Regulus*.

I pour'd good *Spirit* of *Salt* on a Parcel of this *Sand*, but could obſerve no *Luctation* thereby produced.

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*.

I pour'd *Single Aqua Fortis* upon another Parcel of it, without being able to perceive any *Ebullition* worth noting.

I pour'd *Double Aqua-Fortis* upon another Parcel of it, which, for ought I could Diſcover, had no more Effect on it than the Former.

I pour'd alſo ſome *Aqua Regia* on a Parcel of it, without diſcovering any ſenſible effect. I pour'd good *Oil* of *Vitriol* upon another Parcel of this *Sand*, but ſeeing no *Bubbles* thereby produc'd, I weaken'd the *Oil* with Water, but without any ſenſible Effect.

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

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 contained any ſuch: for there is no *Metal* nor *Oar* that ſome of theſe *Menſtruums* will not work on.

I Powder'd a Fragment of a *Loadſtone*, 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*.

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

A Black Sand *from* Italy; *by Mr.* Butterfield. n. 244. p. 336.

XCVII. The *Black Sand*, which in *Italy* they uſe inſtead of Duſt to their Letters, is found 6 *Miles* from *Genes* near St. *Piere d' Araine* on the Sea-Shore. It hath the Properties of the *Loadſtone*, and I do believe that it is *Loadſtone*, or *Powder* of *Loadſtone*, for it followeth the *Loadſtone*; it ſticketh to a *Knife* that is touched with the *Loadſtone*; it Draweth a *Magnetick Needle*; it doth not *Ferment* with *Aqua-Fortis*, as *Iron-Duſt* doth; it doth not Ruſt with any *Acid* that can be put to it; it doth not *Sparkle* in the *Flame* of a Candle, as *Steel-Duſt* doth, when it is thrown into the *Flame*. It is commonly found on the Sea-Shoar after Great Storms.

To make Metal Run Smooth *and* Cloſe; *by* ..... *at* Franckfort *on the* Main. n. 94. p. 6040.

XCVIII. A Certain *Powder* lately invented in *Germany* maketh *Metal* ſo *Cloſe* and *Smooth*, that it leaves not the leaſt Pit in the Piece; A Gun ſo Caſt needs no *Boaring*, and one third of the *Metal* may be ſpared. Such *Guns* remain Clean and Neat a long while. *July* 9. 1672. there was Caſt a *Demy-Cannon*, Weighing 34 Hundred, which was Tryed with a *Bullet* of 34. ℔. and the *firſt* time 12. ℔. of ſtrong *Powder*, the ſecond time as much, the *third* time 15. ℔. and the fourth time 24. ℔. all which it endur'd very well. With a ſmall *Petard*, of 2. ℔. of this *Metal*, I broke in pieces a beam of a *Rhine-foot* ſquare, the Petard remaining Entire and Perfect.

This *Powder* is not only eaſie to Make, but alſo of ſmall Expence.

XCIX. The

Iron-Works, *in* Glocesterſhire; *by Mr.* Hen. Powle. n. 137. p. 931.

XCIX. 1. The *Foreſt* of *Dean* (lying betwixt the *Wye* and *Severn*) conſiſts generally of a Stiff Clay. The Country is full of Hills, but they are no where High: Betwixt them run great ſtore of little *Springs*, of a more Browniſh Colour than ordinary Waters, and often leave in their Paſſage Tinctures of *Ruſt*. The Ground is naturally inclin'd to *Wood*, eſpecially *Haſle* and *Oak*: but 'tis now almoſt Devoured by the Increaſe of the *Iron-Works*. Upon the Surface of the Earth, in many places, lie an abundance of Rough Stones, ſome of them of a vaſt Bulk; but where they Sink their *Mines*, they rather meet with *Veins* of *Scaly Stone*, than Hard and Solid Rocks. Within the *Foreſt* they find great plenty of *Coal* and *Iron-Ore*; and in ſome places *Red* and *Yellow Oker*.

The *Iron-Ore* is found in great abundance in moſt parts of the *Foreſt*; Differing both in Colour, Weight, and Goodneſs. The Beſt, which they call their *Bruſh-Ore*, is of a Blewiſh Colour, very Ponderous and full of little ſhining ſpecks like Grains of *Silver*. This affords the greateſt quantity of *Iron*: but being Melted alone produceth a *Metal* very Short and Brittle. To Remedy this inconveniency, they make uſe of *Cynder*, which is found in great Quantities through all parts of the Country, where any former *Works* have ſtood; For in former Times, their Bellows being mov'd only by the ſtrength of Men, their *Fires* were much leſs Intenſe than in the *Furnaces* they now Employ: So that they Melted down only the Principal part of the *Ore*, and Rejected the reſt as uſeleſs. This is call'd *Cynder*, and being Mingled with the *Ore* in a Due Quantity, gives it that Excellent Temper of *Toughneſs*, for which this *Iron* is Preferr'd before any that is brought from *Foreign Parts*.

The *Ore* is firſt *Calcined* in *Kilns*, much after the Faſhion of Ordinary *Lime Kilns*; which they fill up to the Top with *Coal* and *Ore*, *Stratum ſuper Stratum*: Then putting *Fire* to the bottom, they let it Burn till the *Coal* be Waſted. This is done without *Fuſion* of the *Metal*; and ſerves to conſume the more Droſſy parts of the *Ore*, and to make it friable. From hence they carry it to their *Furnaces*, which are built of Brick or Stone, about 24 *foot* ſquare on the out ſide, and near 30 *Foot* in Height. Within not above 8 or 10 *foot* over in the middle, the Top and Bottom having a Narrower Compaſs, much like the ſhape of an Egg. Behind the *Furnace* are placed Two Huge Pair of *Bellows*, whoſe Noſes meet at a little Hole near the Bottom. Theſe are Compreſſed together by certain Buttons, placed on the *Axis* of a very Large *Overſhot Wheel*.

The *Furnaces* are at firſt filled with *Ore* and *Cynder* intermixt with *Fuel*, which in theſe works is always of *Charcoal*; laying them Hollow at the Bottom, that they may more eaſily take fire: But after they are once Kindled, the Materials run together in a hard Cake or Lump, which is ſuſtained by the Faſhion of the *Furnace*, and through this the *Metal*, as it *Melts* Trickles down into the *Receivers*, where there is a Paſſage open, by which they take away the *Scum* and *Droſs*. Before this lies a great *Bed* of *Sand*, wherein they make furrows of what Faſhion they pleaſe; into theſe they let in their *Metal*; which is made ſo very fluid by the violence of the *Fire*, that it continues

nues Boyling for a good while. The *Furnaces* are kept at work Night and Day for many *Months*; ſtill ſupplying the Waſte of the *Fewel* and other Materials with Freſh, poured in at the Top.

From theſe *Furnaces*, they bring their *Sows* and *Pigs* of *Iron* (as they call them) to their *Forges*. Theſe are of two ſorts, though ſtanding together under the ſame Roof: one they call their *Finery*, the other the *Chafery*. Both of them are upon Hearths, on which they place great Heaps of *Sea-Coal*, and behind them *Bellows*, like to thoſe of the *Furnaces*, but nothing near ſo large. Into their *Finery*, they firſt put their *Pigs* of *Iron*, placing 3 or 4 of them together behind the *Fire*, with a little of one End thruſt into it; Where ſoftning, by degrees, they Stir and Work them with long Bars of Iron, till the *Metal* Runs together into a Round *Maſs* or *Lump*, which they call a *Half-bloom*. This they take out, and giving it a few Strokes with their *Sledges*, they carry it to a great Weighty *Hammer*, raiſed likewiſe by the motion of a *Water-wheel*: where applying it Dexterouſly to the Blows, they preſently Beat it out into a Thick Short Square. This they put into the *Finery* again, and Heating it Red Hot, they work it out under the ſame Hammer, till it comes to be the ſhape of a Bar in the Middle, with two ſquare Knobs on the Ends. Laſt of all they give it other Heatings in the *Chafery*, and more Workings under the *Hammer* till they have brought their *Iron* into *Bars* of ſeveral Shapes and Sizes. If they Omit any One Proceſs it will be ſure to want ſome-part of its Toughneſs, which they eſteem its Perfection.

For the *Backs* of Chimneys, *Hearths* of Ovens, or the like, they take the Melted *Metal* out of the *Receivers* in great Ladles, and pour it into Moulds of Fine Sand.

2. 1. At *Milthrop-Forge* in *Lancaſhire*, they have ſeveral ſorts of *Iron Stone*; ſome of it making *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 they 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 firſt Burn the *Iron-Stone*; and then for every 17 *Baskets* of this Burnt Stone they put in one of *Limeſtone* Unburnt to make it Melt freely, and Caſt the Cinder; which they always take off from the Melted *Iron*, before they let it Run. *In* Lancaſhire; *by Mr.* John Sturdy. n. 199. p. 695.

The Bottom of the *Furnace* is about 2 *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 Top Hole (where they throw in Baskets of *Stone* and Fewel) is but $\frac{1}{2}$ a *Yard* Square. When they find it to have Subſided about a *Yard* and $\frac{1}{2}$ then they fill the *Furnace* again.

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The *Oar* is got in *Furneſs* (a Diviſion of *Lancaſhire*) at leaſt 15 *Miles* from *Milthrop*. Some of it is Hard, but feels Soft and Smooth on the outſide, like Velvet. Some is ſoft as *Clay*; but all is Red; and one ſort ſeems to be good *Hæmatites*

Ib. p. 697. 2. The Forge is very much like that of a Common Black ſmiths, about 1 ½ *Yard* over, and the ſame Height. The *Hearth* is all of *Sow-Iron*, much of the Shape of a Broad-brim'd Hat, with the Crown Downwards. This Hollow Place they fill and Upheap with *Charcoal*, and lay the *Ore* (firſt broken into pieces as big as a Pigeons Egg) all round about the *Charcoal* upon the flat Hearth to Bake it, as it were, or Neal it, and thruſt it in by little and little into the Hollow, and keep Blowing for ſome 12 *Hours*. Then they pull out a Stopple at the Bottom of the *Wall*, and out comes all the *Glaſſie Cynder* being very Liquid, leaving the *Iron* (which is never in a perfect *Fuſion*) in a *Lump* at the Bottom. This they take out with great *Tongs*, and turn it under heavy *Hammers* (played with Water) which at the ſame time Beat off, or rather ſqueeze out, the fluid *Scoriæ* (eſpecially at firſt taking out of the *Furnace*) and Form it after ſeveral Heats into *Barrs*. They uſe no *Limeſtone* or other thing to promote the *Flux*. They get about an *Hundred* weight of *Metal* at one *Melting*, which is the Product of about 3 times ſo much *Ore*.

Ib. p. 699. *Steel* is not made from that they call *Steel-Ore*, but *Iron*, ſuch as is made from the reſt.

The ſeveral ſorts of *Ores* lye in one *Vein*, which is ſometimes an *Inch*, ſometimes a *Foot*, and ſometimes 3 or 4 *Yards* Broad, and many Fathoms Deep, between Grey *Limeſtone* Rocks: but the *Hard Ores* lye uſually next the Rocks on each ſide, and the *Soft Ore* in the Midſt. They uſe the *Soft Ore* frequently and with good 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*.

By Dr. Liſter. *ib.* 3. This *Clay Hæmatites* is as Good, if not Better, than that which is brought from the Eaſt-Indies; Witneſs the *Tea-pots* made of it in *Staffordſhire*.

The True Way of Making of Steel. *by Dr.* Mart. Liſter. n. 203. p. 865. C. Thoſe Famous and Stupendious Monuments of *Antiquity*, the *Ægyptian Obelisks* are all of *Porphyry*, and moſt of them curiouſly *Carved* with a vaſt number of *Figures*; one way of *Writing* of the *Ancient Egyptians*: Theſe Witneſs the Facility that Nation had of *Graving* in *Porphyrie*; a Stone which no *Tool* will now *Touch*, nor nothing leſs Affect, than *Emery* or *Diamant-Powder*

Vid. inf. Vol. III. *par.* II. *Cap.* II. §. XLIV. 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*: And the *Proceſſes* now uſed by moſt Nations, are Fraudulent, and

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a *Poiſoning* of *Iron*, by certain *Mineral Salts*, rather than a True Making of *Steel*.

Ariſtotle tells us, That *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 Defecated, and made Clean, this is *Steel*. But this "they do not often, becauſe of the much Waſte, and for that it loſes much "Weight in *Fining*. But *Iron* is ſo much the more Excellent, the leſs *Ex-*"*crement* it hath. This Account is a little Confuſed, and not well Under-ſtood: It is indeed True, that *Iron* is ſtill better, the more it is Purged. It is as true that even wrought *Iron* may be Melted as often as you pleaſe; and as oft as it is Melted and Purged, it loſeth much of its Weight. But after all, *Iron* of it ſelf, how oft ſoever it is Purged and Refined, will never become *Steel*; yet of this ſo Purged, the Beſt *Steel* doubtleſs may be made. *Meteor.* l. 4. c. 6.

The manner of making *True Steel*, is thus faithfully deſcribed by *Agricola*. And this way by *Kircher* is 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. *De re Metal.* l. 9.

"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 *Vitriolick Ore*, may melt; yet it is Soft, or Fragil, or Eager. Let a Par-"cel 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 "Smith's *Forge* or *Hearth*, a *Crucible* or Diſh of *Crucible Metal*, a *Foot* and an "*half* Broad, and a *Foot* Deep; fill the *Diſh* with good *Charcoal*, and Com-"paſs 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 Work man put on by Little and Little, all the Mix-"ture of *Iron* and *Stone* he purpoſes.

"When it is *Melted*, let him thruſt into the middle of it, three or four, or "more pieces of *Iron*, and Boil them therein 5 or 6 *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 Con-"ſume, and Thin the more groſs Particles of the *Iron Pieces*; and are as it "were, a *Ferment* to them, and make them Tender.

"Let the Work man 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 *Anvill* 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 one of which let him, as ſoon as it is Red Hot, Beat
" into a Bar, upon the Anvil, and Caſt it Hot as it is into *Cold Water*. And
" thus *Iron* is made into *Steel*; which is much Harder and Whiter than *I-*
" *ron*.

Pliny, ſpeaking of *Iron*, ſays, *Forniacum maxima Differentia eſt: in iis equi-*
Lib. 34. c. 14. *dem* Nucleus Ferri *excoquitur ad Indurandam Aciem, alioque modo ad Denſan-*
das 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*. And it is plain that the *Nucleus Ferri* (by which muſt be meant well purged *Iron*; the ſame which *Ariſtotle* calls ἐιρχασμένον σίδηρον) was melted down in both. But in my Opinion with this difference, in Making *Steel*, they not only *Boil'd* their *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; *Ferrum 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.* Whereas in *Steeling* their *Tools*, they Boiled their *Tools* in *Sow-Metal*, to ſuch a Degree of *Hardneſs* or *Temper*, as was Requiſite, and did not afterwards Hammer them. For *Iron* this way made into *Steel*, becomes a kind of *Electrum*, and is filled with an exceeding Brittle and Hard Body; for which purpoſe 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*: For it is Certain that *Steel*, as well as *Iron*, by *Ignition*, is Spoiled or Corrupted. Hence it was that the *Ancients* well knowing that in making their *Tools* out of *Steel*, they could not but conſiderably Loſe and abate of their Temper; they 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.

Copper-Mines in Hungary; by Dr. Edward Brown. n. 59. p. 1042.

Cl. 1. *Herrn Ground* is a little Town in *Hungary*, ſeated very high between two Hills, upon a part of Land of the ſame Name, an *Hungarian Mile* diſtant from *Newſol*. In this Town is the *Entrance* into a Large *Copper Mine*, very much Digged.

I went in through a *Cuniculus*, call'd *Tach ſtoln*. The ſteep Deſcents are made by *Ladders* or Trees ſet Upright, with deep Notches or Stairs cut in them to ſtay the Foot upon. They are not troubled with *Water*, the *Mine* lying High in the *Hill*: But they are moleſted with Duſt and *Damps*.

The *Veins* of this *Mine* are Large, many of them Cumulate, and the *Ore* very Rich; in an hundred *Pounds* of *Ore*, they ordinarily find twenty *Pounds* of *Copper*; ſometimes thirty or forty, *half Copper*, and even to ſixty in the *Hundred*. Much of the *Ore* is joined ſo faſt to the Rock, that it is ſeperated with much Difficulty. There are diverſe ſorts of *Ore*; but the chief difference is between the *Yellow* and the *Black*; the *Yellow* is pure *Copper Ore*, the *Black* contains alſo a Proportion of *Silver*.

They

They find no *Quickſilver* here: The Mother of the *Ore* is *Yellow*; and the *Copper Ore* heated and Caſt into *Water*, maketh it become like that of ſome *Sulphureous Baths*.

They ſeperate the *Metal* from the *Ore* with great Difficulty. The *Ore* commonly paſſes 14 *times* through the Furnaces: Sometimes it is Burned, and other times Melted, ſometimes by it ſelf, and ſometimes mixt with other Minerals and its own Droſs.

There are diverſe ſorts of *Vitriol* found in this *Mine*; *Green*, *Blew*, *Reddiſh* and *White*. There is alſo a *Green Earth*, or ſediment of a *Green Water*, called *Berg-grun*. There are likewiſe *Stones* found of a beautiful *Green* and *Blew* colour, and one ſort, on which *Turcoiſes* have been found; therefore called the *Mother* of the *Turcois*.

There are alſo two Springs of a *Vitriolate Water*, which are affirmed to turn *Iron* into *Copper*. They are called the *Old* and the *New Zimeut*. Theſe Springs lie deep in the *Mine*. The *Iron* is ordinarily left in the *Water* 14 *Days*. I took diverſe pieces formerly *Iron*, now appearing to be *Copper*, out of the *Old Zimeut*. They are hard within the *Water*, and do not totally loſe their Figure, and fall into Powder; they will eaſily *Melt*, without the Addition of any other Subſtance.

They make Handſome Cups and Veſſels out of this ſort of *Copper*.

2. There is a Heap of *Copper Ore* by *Darwent* near *Keſwick*, but I ſuppoſe the Weather hath eaten out all the *Copper* that was in it. It is reported, that the Thickneſs of the *Vein* at *Gouldſcope* in *Newlands* was 6 *Foot*. There is no *Shafts* now in being either at *Newlands* or *Caldbeck*. There are diverſe *Adits*; but they are uſeleſs, the Workmen having wrought down the *Ore* far below them. There is part of an Adit wrought at *Caldbeck*; but it is uncertain what it may coſt finiſhing; for ſome Stone may be wrought for 20 *Shillings* a *Fathom*, and ſome of it may prove ſo Hard, that it may coſt 10 *Pound* a *Fathom*. *In* Lancaſhire *and* Cumberland; *by Mr.* Dav. Davies, *to Dr.* Liſter. n. 200. p. 737.

A Thouſand *Pound* Stock will be enough to begin with, to get *Ore* at *Caldbeck-Mines*, and then there muſt be *Smelting-Houſes* built, which coſt 500 *Pound* or more. And before *Copper* be made ready for ſale at the Market, and the Work come to pay it ſelf, it will be 6 or 7 *Years* at leaſt, and by that time 10000 *Pound* will be *Stock* little enough.

3. The *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*. This Work was left good, and had been Wrought from the *Day* to the *Evening End* of the ſaid Work 40 *Fathoms*, or thereabouts. The *Seam* or *Vein* of *Copper Ore* then Left, was above 3 *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 200 *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*. *By* ..... *to Dr* Liſter, ib. p. 741

The *Second Work* is called *White Work* or *New Work*, about 40 *Fathom* from

the Firſt ; was wrought about 10 *Fathom* deep. The *Seam* then left was about 22 *Inches* of Good *Copper Ore*.

The *Third*, is called *Toung-Brow*, a little diſtant from the laſt ; being Wrought about 30 *Fathom*, and the *Seam* about two *Foot* thick of the like *Ore*.

The *Fourth*, is called *God's Bleſſing*, or *Thurdlehead* ; being Wrought about 20 *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 to be much of it *Gold Ore*.

The *Fifth*, called *Hen-Cragg*, is a *Mile* from the Laſt, Wrought about 2 *Fathoms* ; a ſmall *Seam*, but excellent *Ore*.

The *Sixth* Work is called *Sumy-Work* at *Levers-Water*, at the Water ſide, and a little above that, *Hauch Clockers-work* ; a little above that, *George Towers* and *William Dixſon's work*; *Bartle Clocker's Work* ; near the laſt, *Richard Tower's Work* ; then *John Saclock's Work*, and *Hanch Mire's Work* ; being all, *Seven Works*, and lie altogether, and about a *Mile* from the *Fifth Work* aboveſaid ; 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*. If the *Tarn* was drained (its thought) that all theſe 7 *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*, wrought hut a little, the *Seam* about 18 *Inches* Thick, of as Good *Ore* as any of the other Works.

The *Eighth* is called *John Dixon's Work* in *Brumſell*, was wrought about 2 *Fathom*, the *Seam* about 24 *Inches* Thick, and eſteemed the Beſt *Ore*, except *God's Bleſſing*. It is about Half a *Mile* from the laſt *Work*.

The *Ninth* Work is called the *Wide Work*, or *Thomas Hirn's Work*, wrought about 60 *Fathom*, and left a *Seam* above 26 *Inches* Thick, when the *Work* was given over, of very good *Ore*. It has a *Shaft* or *Pump* to Draw the *water* away, and it is from the laſt Work about 2 *Miles*.

The *Tenth Work* is called *Three Kings* in *Tilburthwait*, being 3 *Works*, and wrought above 40 *Fathoms* a piece, the *Seam* being above 14 *Inches* of very Good *Ore*.

Theſe are all the *works* that have been wrought in *Coniſton-Fells* : Moſt of them have ſmall *Seams* near the *Copper*, of a Grey ſort of *Ore* in ſmall Threads.

There are lately Diſcover'd 3 *Veins* in *Torverwell*, and about 10 in other Places, and all within *Two Miles* of the *Firſt work* in *Coniſton Fells*, and as Hopeful as thoſe that have been Wrought in.

When the *Ore* which was got at *Coniſtone*, came to be *ſmelted* at *Keſwick*, they found it ſo much to exceed the *Copper Ore* of either *Caldbeck* or *Newlands*, that they let fall theſe *works*, and ſent the Workmen to *Coniſton-Fells* ; ſo that there was one Hundred forty Men kept conſtantly at the *Works* there ; and the *Ore* that they got, did ſufficiently furniſh and ſupply the *Smelt Houſes* at *Keſwick*.

The

The Rate that was given for getting of *Copper Ore* was according to its Goodneſs, from 8 *Shillings* a *Kibble* to 2 *Shillings* and *ſix pence*, 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.

There was near the *Firſt VVork* a *Stamp-Houſe*, which went by Water, and ſeveral Perſons were employed to bring the *Refuſe* from Each *VVork*, that the *Miners* did Throw away, to the *Stamp houſe*, where it was Stamped, waſhed, and Order'd, and they had 2 *ſhillings* and *ſix pence* for their Pains.

CII. *Calamine* is Digged out of ſeveral *Mines* in the *VVeſt* of *England* (as about *Mendipp*, *&c.*) about 20 *Foot* deep. It is Burned or *Calcined* in a *Kiln* or *Oven* made Red Hot, then Ground to Powder, and ſifted into the fineneſs of Flower, then mix'd with Ground Charcoal, becauſe the *Calamine* is apt to be Clammy, to Clodd, and not ſo apt or Capable of Incorporating. Then they put about 7 *Pound* of *Calamine* into a *Melting Pot*, of about a *Gallon* content, and about 5 *Pound* of *Copper* uppermoſt; the *Calamine* muſt be Mixt with as many Coals as will fill the Pot. This is let down with *Tongs* into a *VVind Furnace* 8 *Foot* deep, and remains 11 *Hours* therein; they *caſt* off not above Twice in 24 *Hours*. One *Furnace* holds 8 *Pots*. After *Melting* it is Caſt into *Plates* or *Lumps*.

To Make Braſs; *by Mr.* Tho. Povey. *n.* 200. p. 735. *n.* 260. p. 474.

45 *Pound* of *Raw Calamine* produces 30 *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 Procur'd 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 Sounder, as *Lead* and *Pot-Metal*; *Bell Metal* being *Copper* and *Tin*; and *Pot Metal*, *Copper* and *Lead*. About 20 *Pound* of *Lead* is uſually put into a 100 *Pound* of *Pot-Metal*: But about 6 *Pound* is ſufficient to put into 100 *Pound* of *Gun-Metal*.

The *Calamine Stones* were heretofore fetched from *Poland*; but ſince fetched from Hence by the *Dutch*.

The Manufacture of *Braſs* was Privately kept in *Germany* for many *Hundred Years*; wherein many *Thouſands* were Imployed, and all were maintained; ſome having thereby raiſed themſelves to Great Eſtates.

CIII. It is ſuppoſed by the *Miners*, That there was a great *Concuſſion* of the *Waters* in that *ſeparation of the Waters from the Waters* at the *Creation*, when the *Dry Land* firſt Appeared, or at *Noah*'s *Flood*; or at both times: Whereby the *Waters* Moved and Removed the (then) Surface of the *Earth*. That till then the Uppermoſt ſurface of *Mineral Veins*, or *Loads*, did (in moſt Places) lie even with the (then Real, but now Imaginary) Surface of the Earth, which is now call'd the *Shelf*, or *Faſt Country*, or Ground that was never Moved. But at this Concuſſion of the Waters, the Surface of the Earth, together with the Uppermoſt of thoſe *Mineral Veins*, were looſed, and torn off, and by the Deſcending of the Waters into the Valleys, both the Earth, or

The Tin Mines *in* Devon. *and* Cornwall; *by* ----- n. 69. p. 2096.

Grewt,

Grewt, and thoſe *Mineral Stones* or Fragments, ſo torn off from their *Loads* (which are conſtantly Termed *Shoad*) were, together with, and by the Force of the Waters carried beneath their proper Places, and from ſome Hills even to the Bottoms of the Neighbouring Valleys; and from thence by Land Floods many *Miles* down the Rivers.

Trayning a Load.

1. Upon theſe Suppoſitions we proceed in *Trayning* a Load, thus;

1. Where we ſuſpect any *Mine* to be, we diligently ſearch that Hill and *Country*, that we may the better know the *Grewt*, and *Stones*, when we meet with them at a Diſtance in the neighbouring Valley.

2. Then we obſerve the *Frets* in the Banks of Rivers that are newly made by any great *Land-Flood*, which uſually are then very Clean, to ſee, if happily we can Diſcover any *Metalline Stones* in the Sides or Bottoms thereof, together with the Caſt of the *Country*, (*i. e.* any Earth of a different Colour from the reſt of the Bank) which is a great help to Direct us, which ſide or Hill to ſearch into. The *Mineral Stones* are Diſcovered either by their *Ponderouſneſs*, or by their *Poroſity*; for moſt *Tin-ſtones* are *Porous*, not unlike great Bones, almoſt throughly Calcined; yet *Tin* ſometimes lies in the *firmeſt Stones*: Or by *Vauning*, which is performed by Pulveriſing the Stone or Clay, or what elſe may be ſuſpected to Contain any *Mineral* Body, and placing it on a *Vanning-Shovel*; the Gravel remains in the Hinder part, and the *Metal* at the Point of the *Shovel*, whereby the Kind, Nature, and Quantity of the *Ore* is very nearly Gueſt at.

3. If no *Shoad* be found in theſe *Frets*, we truſt not to any found in the *River*, it being uncertain from whence the Water may have brought them. But we go to the Sides of thoſe Hills moſt ſuſpected, where there may be a conveniency of bringing a little ſtream of Water (the more the better) and Cut a *Leat*, *Gurt*, or Trench, about 2 *Foot* over, and as deep as the *Shelf*, in which we turn the Water to Run 2 or 3 *Days*; by which time the Water, by waſhing away the filth from the *Stones*, and the looſer parts of the Earth, which eaſily diſcover what *Shoad* is there. If we find any, we have a Certainty of a *Load* in the Upper part of the Hill, or at leaſt a *Squatt*.

4. Sometimes *Shoad* may be found upon the Open Surface of the Ground, but then 'tis brought thither by ſome Accident, for the Corruption of Vegetables and other Creatures, have in a long Tract of Time ſince the *Deluge*, begotten a new Surface, Heightned in ſome places a *Foot* or more above the *Shelf*; and this is Demonſtrable to the Eye in every *Tin Work*.

5. At the Foot or Bottom of the Hill, we ſink an *Eſſay Hatch*, or a Hole, about 6 *Foot* long, and 4 *Foot* Broad, and always as deep as the *Shelf*. If we find no *Shoad* before, or when we come to the *Shelf*, there is none to be expected: Yet ſometimes the *Shoad* is Waſhed away Clean, when you come within two or 3 *Foot* from the *Load*, which then lies ſo much farther up in the Hill. If we find *Shoad*, we are almoſt at a certainty: And this is held as an infallible Rule, that the nigher the *Shoad* lies to the *Shelf*, the Nigher the *Load* is at Hand, *& vice verſa*.

6. If we find no *Shoad* in this *Firſt Hatch*, we aſcend commonly about 12 *Fathom*, and ſink a *ſecond hatch*, ● the former. And in caſe none appear in this,

this, we go then as many *Fathom* on each Hand at the ſame Height, and ſink there as before; and ſo Aſcend proportionably with *Three* or more *Hatches* (if the ſpace of Ground requires) as it were in Breaſt, till we come to the top of the Hill, and if we find none in any of theſe *Hatches*, then farewel to that Hill.

7. But if we find any *Shoad* in any of theſe *Hatches*, we keep our Aſcending *Hatches* in a direct Line; and as we draw nearer the *Load*, we leſſen our firſt Proportion of Twelve *Fathom*, to Six or leſs, as our Conjecture Guides us.

8. If finding *Shoad* lying near the *Shelf* in one *Hatch*, and None in the next Aſcending, we conclude that we have certainly over-ſhot the *Load*; and then we ſink nigher that *Hatch*, wherein we laſt found *Shoad*.

9. Sometimes we find two Different *Shoads* in the ſame *Hatch* at different Depths, and then we have a certainty of another *Load* above the Former; and it may be in *Training* up to the *Second*, we meet with the *Shoad* of a *Third*. Some *Tinners* affirm that 7 *Loads* may lie parallel to each other in the ſame Hill, but yet one only *Maſter Load*; the other 6 (three on each ſide) being the Leſſer Concomitants. So may Five lie in like manner; three are Common.

10. Every *Load* has (as it were) a Peculiar Coloured Earth or *Grewt*, about it; which is found likewiſe with the *Shoad* in a greater quantity, the Nearer the *Shoad* lies to the *Load*, and ſo leſſened by degrees to about a $\frac{1}{4}$ of a *Miles* Diſtance; farther than which, that peculiar *Grewt* is never found with the *Shoad*.

11. A Valley may ſo lie, as at the Feet of 3 ſeveral Hills; and then we may find 3 ſeveral *Deads*, *i. e.* Common Earth, or that looſe Earth which was moved with the *Shoad* in the *Concuſſion*, but not Contiguous to the *Load* in its firſt Poſition, (which is alſo termed by us the *Run* of the *Country*) with as many different *Shoads* in the midſt of each. And here the Knowledge of the *Caſt* of the *Country*, or each *Hill*, in reſpect of its *Grewt*, will be very neceſſary, for the ſurer *Training* of them one after another, as they lie in order, according to the foregoing Rules of *Eſſay Hatches*: For the Uppermoſt will direct you, with which Hill to begin firſt.

12. It may be that after we have *Trained* up the Hill, inſtead of a *Load*, we find nought but a *Bonny* or *Squat*, which likewiſe have their *Shoad*: whoſe Form is about 2 or 3 *Fathom* long, and half as Broad; few larger, moſt leſs; which Communicates with no other *Load* or *Vein*, neither doth it ſend forth any of its own; but is entire of it ſelf, and may go down into the *Shelf* 5 or 6 *Fathoms* deep, and there Terminate.

2. When we have found the *Load*, the laſt *Eſſay Hatch* is then called a *Tin Shaft* or *Tin Hatch*, which we ſink down about a *Fathom*, and then leave a little long ſquare Place, Termed a *Shamble*, and ſo continue *Sinking* from *Caſt* to *Caſt*, (*i. e.* as high as a Man can conveniently throw up the *Ore* with a Shovel) till we find either the *Load* to grow ſmall, or degenerate into ſome ſort of *Weed*, which are diverſe; as *Mundick*, or *Maxy* Corrupted from *Marchaſite*) *White*, *Yellow*, and *Green*; *Daze*, which is a kind of Glittering

Digging the Ore, ib. p. 210.

Stone

Stone Enduring the Fire, of different Colours, *White*, *Black*, and *Yellow*; *Iremould*, *Black* and *Rusty*; *Caul*, Red, (differing both from *Mundick* and *Sparr*, Enduring the Fire) which *Marcasite* will not; *Glister*, Blood Red and Black.

2. We then begin to make a *Drift* 3 *Foot* wide, and 7 *Foot* High: And if the *Load* be not Broad enough of it self, as some are scarce $\frac{1}{2}$ a *Foot*, then we usually break down the *Deads*, or that part of the *Shelf* which Contains no *Metal* but Encloseth the *Load*, as a Wall, between two Rocks, and then we begin to *Rip* the *Load* it self.

3. The *Instruments* we make use of, are, 1. A *Beele*, or *Cornish Tubber*, (*i. e.* Double Points) of 8 *Pound* or 10 *Pound* weight, sharped at both Ends, well Steeled and Holed in the Middle; it may last in a Hard *Country* $\frac{1}{2}$ a *Year*, but New Pointed every *Fortnight* at least. 2. A *Sledge*, flat Headed from 10 *Pound* to 20 *Pound* Weight, 'twill last about 7 *Years*, New ordered once a *quarter*. 3. *Gadds*, or *Wedges*, of 2 *Pound* weight, 4 Square, well Steeled at the Point; they will last a *Week*; 2 or 3 *Days*, then sharpned. 4 *Ladders*, 5 *Wheel-Barrows*, to carry the *Deads* and *Ore* out of the *Drifts* or *Adits*, to the *Shambles*.

4. There are two *Shovel-Men*, and 3 *Beele-men*; which are as many as one *Drift* can Contain, without being an Hindrance to each other. The *Beele-men* Rip the *Deads* and *Ore*; the *Shovel-men* carry it off, and Land it, by casting it up with *Shovels* from one *Shamble* to another, unless it be where we have a *Winder* with 2 *Keebles* (or *Buckets*) one of which comes up as the other goes down.

5. It is generally observed that most of our *Tin Loads* run from *West* to *East*, and then they constantly *Dip* towards the *North*, sometime they *Underlye* (that is, Slope down towards the *North*) 3 *Foot* in 8 perpendicular: Yet in the Higher Mountains of *Dartmoor* there are some considerable *Loads*, which Run *North* and *South*; these *Underlye* towards the *East*.

6. *Four* or *Five* Loads may Run Parallel to each other in the same Hill, and yet (which is rare) Meet altogether in one *Hatch*, as it were in a *Knot* (which well *Tins* the Place;) and so seperate again, and keep their former Distances. Such a *Knot* hath been Observed, and Wrought on *Hingston*, a known *Mineral-Down* or *Common*, in *Cornwall*.

7. The Breadth of *Master-Loads* may generally be from 3 to 7 *Foot*, seldom larger; unless where several *Loads* may chance to make a *Knot*, or send forth *Strings* or *Veins*. Neither Retain they their usual Breadth in all parts; for they may be 6 *Foot* at one place, and not 2 at another; nay sometimes scarce $\frac{1}{2}$ *Inch* over; but that is to be understood of *Strings*, and the Narrowest Places of the *Concomitant Loads*.

8. The *Load* is usually in a Hard Rocky *Country*, made up of *Metal*, *Sparrs* and other *Weeds*, at it were all along a continued Rock: But it hath many *Veins* and *Joints*, as we speak; but in some softer *Countries*, the *Tin* may lie in a softer Consistence, as that of Clay in a manner Petrify'd.

9 In most Places we meet with *Water* at some *Feet* deep from the *Loady* Surface, in other some not at many *fathom* deep: It runs continually thro' the

the Heart of the *Lo1d*. When it begins to Trouble us, we begin at the foot of the Hill a *drift*, or *Adit*, ſcarce half ſo bigg as that of the *Load*, and work it on a *Level*, till we come up to the *Load*. But if we have not this Conveniency of an *Adit*, or if we Paſs that *Level*, we are forced to draw it with *Winders* and *Keebles*, or with *Pumps*: Some, but very Few, *Works* may be Dry.

10. We obſerve, that if we have *Water*, we never want *Air* ſufficient for *Reſpiration*, and our *Candles* to Burn in: Yet ſometimes in a ſoft Clayie *Country*, our *Air* is ſo much Condenſed, that it becomes in a manner a *Damp*, and requires an *Air-ſhaft* for Vent; which *Damps* are ſometimes Enlarged by Working of the *Mundick* with the *Ore*.

11. If the *Country* be not ſtrong enough, we underprop our *Drifts* with *Stemples*, and *Wall-Plates*, placed much like a Carpenter's Square, on the one ſide, and over Head

12 To know which Way the *Load* Enslines, or to bring an *Adit*, or to *Sink* an *Air ſhaft* to the deſired Place, the uſe of the *Dial* is needful, which we term *Plumming* and *Dialling*, and is thus performed. A Skilful Perſon firſt faſtens the end of a Long Line at a Known Place, and then exactly obſerves the *Point* at which the *Needle* of his *Dial*, or *Compaſs* reſts; and at the next Flexure he makes a Mark on the Line, and again notes the *Point* at which the *Needle* ſtands at this ſecond *Station*; and ſo proceeds from Turning to Turning, ſtill Marking the *Points*, and his Line, till he comes to the intended Place. He then repeats Above Ground what he had done Below, and his *Dial* and *Line* leads him, till he come exactly over the place where he Ended in the *Mine*.

Dreſſing of the Tin.

3. When the *Ore* is Landed, and the greater *Stones* Broken at the Top of the *Mine* by the *Shovel-men*, 'tis brought on Horſes to the *Stamping* or *Knocking-Mills*, and Unloaded at the Head of the *Paſs* (*i. e.* 2 or 3 Bottom-Boards with two Side boards ſloping wiſe,)in which the *Ore* ſlides down into the *Coffer*: But that it may not Tumble down all at once, there is placed a *Hatch* nigh the lower end of the *Paſs* (*i. e.* a Thwart Board to keep up the *Ore*); beneath that comes in the *Cock-Water* in a Trough cut in a long Pole, which with the *Ore*, falls down into the *Coffer*, (*i e.* a long ſquare Box of the firmeſt Timber, 3 *foot* long, and 1½ *foot* over,) wherein the 3 uſual *Lifters*, placed between two ſtrong broad *Lones*, having two *Braces*, or Thwart pieces, on each ſide to keep them ſteady as a Frame, with *Stamper-heads* weighing about 30 or 40 *pound* a piece, of *Iron*; which ſerve to Break the *Ore* in the ſaid *Coffer*. Theſe *Lifters* about 8 *foot* long, and ½ a *foot* Square, of *Heart-Oak*, and having as many *In-timbers*, or *Guiders*, between them, are Lifted up in order by double the Number of *Tappels*, (faſtened to as many *Arms* paſſing Diametrically through a great Beam, Turned by an *Overſhot water-wheel* on 2 *Boulſters*) which exactly, but eaſily, meet with the *Tongues* ſo placed in the *Lifters*, as that they quickly ſlide from each other, ſuffering the *Lifters* to fall with great Force on the *Ore*, thereby breaking it into ſmall Sand, which is waſhed out by the *Cock-water* through a *Braſs Grate*, Holed very thick, and placed within 2 *Iron Barrs* at one end of the *Coffer*, into the *Launder*, *i. e.* a

Trench Cut out in the *Floor*, 8 *foot* long, and 10 *foot* over,) ſtopt at the other end with a Turf, ſo that the *Water* Runs away, and the *Ore* ſinks to the Bottom; which when full, is taken up and emptied with a Shovel.

2. The *Stamping-Mill* is thus contrived to go 2 *Hours*, or more, after we give over our Attendance on it. We have a *Tiller* (*i. e.* a long Pole) faſtened without at one end to the *Slew* or *Ponder* (*i. e.* that looſe and laſt part of the *Trough* that conveys the *Stream* to the *Mill-Wheel*) and at the other end is tyed a Short Rope with a Tranſverſe Stick at the End of it, curiouſly, but Trap-ways Hitcht at both ends under two little Pins faſtned in the *Lones* for that purpoſe; there's another Pin ſet in one of the *Lifters*, at ſuch an Exact Height, as that if there be no *Ore* in the *Coffer* to keep that *Lifter* high enough, the purpoſed Pin, in deſcending, Knocks out the Water, carrying it quite over the *Mill-wheel*; ſo that when the *Coffer* is emptied, the *Mill* reſts of its own accord.

3. The *Launder* is divided into 3 parts, *i. e.* the *Fore head*, the *Middle*, and the *Tail*. That *Ore* which lies in the *Fore-head*, *i. e.* within $1\frac{1}{2}$ *foot* of the *Grate*, is the Beſt *Tin*, and is taken up in a Heap apart. The *Middle* and *Tails* in another, accounted the Worſt.

4. The latter *Heap* is thrown out by the *Trambling Buddle*, *i. e.* a long ſquare *Tye* of Boards, or Slate, about 4 *Foot* Deep, 6 long, and 3 over; wherein ſtands a Man Bare-footed with a *Trambling Shovel* in his Hand to Caſt up the *Ore*, about an *Inch* thick, on a long ſquare Board juſt before him, as High as his Middle, which is termed the *Buddle-Head*, who dexterouſly with the one Edge of his Shovel Cuts and Divides it longways in reſpect of himſelf, about half an *Inch* aſunder; in which little Cuts the Water coming gently from the Edge of an Upper plain Board, carries away the Filth and lighter part of the prepared *Ore* firſt, and then the *Tin* immediately after: All falling down into the *Buddle*, where with his bare Foot he ſtrokes and ſmooths it Tranſverſly to make the Surface the plainer, that the Water and other Heterogeneous Matter, may without Let paſs away the Quicker.

5. When this *Buddle* grows full, we take it up; here diſtinguiſhing again the *Forehead* from the *Middle* and *Tails*; which are *Trambled* over again: But the *Forehead* of this with the *Forehead* of the *Launder*, are Trambled in a ſecond *Buddle*, but not different from the *firſt*, in like manner. The *Forehead* of this being likewiſe ſeperated from the two other parts, is carried to a *third*, both *Drawing*, *Buddle*, whoſe difference from the reſt is only this, that it hath no *Tye*, but only a plain ſloaping Board, whereon 'tis once more Waſhed with the *Trambling Shovel*, and ſo it new names the *Ore*, *Black Tin*, *i. e.* ſuch as is compleatly ready for the *Blowing-Houſe*.

6. We have another more curious way Termed *Sizing*, that is, inſtead of a *Drawing Buddle*, we have an Hair Sieve, through which we *ſift*, caſting back the Remainder in the Sieve into the *Tails*, and then new Tramble that *Ore*. After the *ſecond Trambling*, we take that *Forehead* in the *ſecond Buddle*, and *Dilve* it (*i. e.* putting it into a Canvas Sieve, in a large Tub of Water luſtily ſhake it) ſo that the Filth gets over the Rim of the Sieve, leaving the

Black

Black-Tin behind, which is put into *Hogſheads*, Covered and Lockt, till the next *Blowing*.

7. The *Tails* of both *Fuddles*, after two or three *Tramblings*, are caſt out into the firſt *Strake*, or *Tye*, which is a Pit purpoſely made to Receive them; and what over-ſmall *Tin* elſe may waſh away in *Trambling*. There are commonly three or four of them ſucceſſively, which contain two ſorts of *Tin*; the One, which is too ſmall, the other too Great. The latter is New Ground in a *Craze mill* (in all reſpects like a *Greiſt-mill* with two Stones, the Upper and the Nether) and after that Trambled in Order. The former, by reaſon of its exceeding ſmallneſs, is dreſſed on a *Reck*, provided for that purpoſe (that is a Frame made of Board about three *foot* and a *half* Broad, and 6 long, which turns upon two Iron Peggs faſtened in both Ends, and the whole placed on two Poſts, ſo that it hangs in an *Æquilibrium*, and may, like a Cradle, be eaſily removed either way) with the Shovel and Water.

Blowing of Tin

4. When we perceive much *Mundick* in our *Tin*, (which makes it Britly Hard) we are Neceſſitated to burn away the *Weed* in a *Tin-Kiln*. This *Kiln* is four ſquare, and at the Top a large Moor-ſtone about 6 *foot* long, and 4 Broad; in the Middle thereof is an Hole made about *half* a *foot* Diameter. About a *foot* beneath this *Stone*, is placed another not ſo long by half a *foot*, becauſe it muſt not reach the Innermoſt or Back part of the Wall, which is the Open Place through which the *Flame* Aſcends from a Leſſer Place below that, where a very ſtrong Fire of *Furze* is conſtantly made. The fore-part is like a Common Oven; but near the Back on the one ſide, there is another little ſquare Hole. When the *Kiln* is throughly Heated, the *Black Tin* that is to be Burnt, is laid on the *Top-ſtone*, and as much of it is Caſt down at the Square Hole upon the *ſecond* or *Bottom Stone* as will cover it all over about 3 or 4 *Inches* Thick. Then the Hole at the Top is immediately Covered with Green Turfs, that the *Flame* may *Reverberate* the ſtronger: And a *Rake man* with an *Iron Coal-Rake*, conſtantly ſpreads and moves the *Tin*, that all parts of the *Mundick* may get uppermoſt of the *Tin*, and ſo be *Burned* away; which we certainly know by this, that then the *Flame* will become *Yellow* (as uſual) and the *Stench* leſſened; for whilſt the *Mundick* behind, Burns, the *Flame* is exceeding *Blew*. Then with the Rake, he thruſts it down, at the open place into the *Open Fire*, and receives a New ſupply of *Tin* from Above. Now when the place Beneath, where the *Fire* is made, grows full of *Tin*, *Coals*, and *Aſhes*, with his Rake he draws it forth with the *Coals*, at the little ſquare Hole on one ſide, near the Back, where the *Ore* (Fiery Hot and Red) lies in the Open Air to cool, which will ſcarce be in 3 Days, becauſe of the *Coals* that lie hid in it: But in caſe we cannot ſtay ſo long, then we Quench it with Water, and it is like Morter. Albeit we let it Cool, of it ſelf, or with Water, we muſt new *Tramble* it, or Waſh it (as before) before we put it into the *Furnace*, which is no other than an *Alman Furnace*. *Moor-Tin* (*i. e.* ſuch as is Digged up in the *Moors*) we find *Runs* or *Melts* beſt with *Moor-Coal*, *Chark't*: But our *Tin*, which lies in the Countrey, *Runs* beſt with an Equal Proportion of *Charcoal* and *Peate* (*i. e. Moor Coals*) for the *Firſt running*; but when we come to *Remelt* our *Slags*, then we uſe *Charcoal*. When

all is *Melted* down and *Remelted*, there ſometimes Remains a Different *Slag* in the Bottom of the *Float*, which we Term *Mount Egg*; and that is moſtly an *Iron Bodie*, though of a *Tin Colour*; as I accidentally Aſſured my ſelf, by applying one of the *Poles* of a *Loadſtone* to it, and quickly Attracted it, yet not ſuch a Quantity, by far, as that of *Iron*.

By Dr. Chr. Merret. n. 138. p. 949

2. The Stones from which *Tin* is wrought, are moſt uſually found betwixt two *Walls* of Rocks (which are commonly of an *Iron Colour*, of little or no Affinity with the *Tin*) in a *Vein* or *Lead* (as the *Miners* call it) betwixt 4 and 18 *Inches* Broad, or thereabout. Sometimes there is a Rich and Fat Metal, ſometimes Hungry and ſtarved; ſometimes nothing but a Droſſy Subſtance, not purely Earth nor Stone, nor Metal; but a little reſembling the rejected Cynders of a Smith's Forge: appearing ſometimes of a more flouriſhing Colour, tending to *Carnation*; and ſometimes more *Umbratile*; and where this is found, the *Miners* judge the Metal to be *Ripe*. The *Pits* are ſometimes above 60 *Fathoms* Deep.

The *Load* being very Rich and Good, above that is 10 *Fathoms* from the *Graſs*, or thereabouts. And below that, there's a ſtrange *Cavity* or Empty Place, wherein is nothing but *Air* for many *Fathoms* deep; as the Miners have tryed with long Poles and Pikes. This *Cavity* lies between hard ſtony *Walls*, diſtant one from another about 6 or 9 *Inches*. The Labourers tell Stories of Sprights or ſmall People, as they call them: And that when the *Damp* ariſeth from the ſubterraneal Vaults, they hear ſtrange Noiſes, Horrid Knockings, and fearful Hammerings. Theſe *Damps* render many Lame, and *Kill* others outright, without any Viſible Hurt upon them.

Though *Tin*, for the moſt part, be made from the *Stones* in which it is Incorporated: Yet ſometimes it is, as it were, mixed with a ſmall Gravelly Earth, ſometimes White, but for the moſt part *Red*. From this Earth it is eaſily *ſeperated* with bare *waſhing*: This Gravelly *Tin* is called *Pryan Tin*; and is ſcarce half the goodneſs of the other.

The *Mundic Ore* is eaſily diſcover'd by its Glittering, yet ſad Brownneſs wherewith it will ſoon Colour your Fingers. This is ſaid to Nouriſh the *Tin*; and yet they ſay, where much *Mundick* is found, there's little or no *Tin*. Certain it is, if there be any *Mundick* left in *Melting* the *Tin*, it makes it Thick and *Cruddy*, that is not ſo Ductile as otherwiſe; and therefore uſually draws down the Metal to an Abatement, from 5 *ſhillings* to 8 *ſhillings* in the *Hundred weight*. This *Mundick* ſeems to be a kind of *Sulphur*. Fire only *ſeperates* it from the *Tin*, and Evaporates it into Smoke. Little Sprigs or Boughs being ſet in the *Chimney*, the Smoke gathereth upon them, into a Subſtance which they call *Poyſon*, and think it a kind of *Arſenick*; which being put into Water eaſily Diſſolves, and produces very good *Vitriol*. The Water wherein it is Diſſolved, ſoon changeth ſmall Iron Rods put into it; and they ſay, that in a very little Time, it will Aſſimilate the Rods into its own Nature. 'Tis generally concluded, that *Fiſh* will die in thoſe Waters whereinto *Mundick* is caſt: And they commonly impute the Death of ſome of their Neighbours to their Drinking of *Mundick*-waters. When they Burn it, to

ſeperate

ſeperate it from the *Tin*, there proceeds from it a *Stench* very Loathſome and Dangerous.

There alſo Occurrs a ſort of *Spar*, of a Shiny Whitiſh Subſtance which caſteth a White Froth upon the Water in Waſhing it. When firſt taken out of the Earth 'tis Soft and Fattiſh; but ſoon after it grows ſomewhat hard. It is ſeldom found growing, but only Sticking to the Metal. The Miners call it *White Spar*; and ſome of them think it is the Mother or Nouriſher of the Metal. But 'tis certain that *Sparr* is often met with in *Mooriſh Grounds*, where they never hope to find any *Ore*: Yet no *Tin Mines* are without it.

The *Corniſh Diamonds*, ſo called, lie intermixed with the *Ore*, and ſometimes on Heaps. They are hard enough to Cut Glaſs, and ſome of them are of a *Tranſparent Red*, and have the Luſtre of a Deep *Ruby*. Theſe *Diamonds* ſeem to me to be but a Finer, Purer and Harder ſort of *Sparr*.

Godolphin Ball is the moſt famous of all the *Balls* or *Mines* in *Cornwall*, for the Quantity of Metal. Though ſome of late years pretend another *Mine* (which ſome call the *Silver-mine*, others the *Lead-mine*) more Rich than that. I have ſeen an Eſſay made of ſome of that *Ore*, as 'twas ſaid, brought from thence; whereof 10 *Pound* weight yielded $2\frac{1}{4}$ *Ounces* of *Fine Silver*.

The Beſt *Ore* is that which is in Sparks; and next to this, that which hath Bright *Sparr* in it.

When the *Ore* has paſſed the *Stamping-mill*, and is well *Waſhed* and *Seperated* from the parts not *Metalline* (which they call the *Cauſalty*) they Dry it in a *Furnace* on Iron-Plates, and then *Grind* it very Fine in a *Craſing-mill*. After this they *Re-waſh* it, then dry it a little, and Carry it laſt of all thus fitted to the *Furnace*, called by them a *Blowing-Houſe*, and there *melt* and *caſt* it.

There ſwims on the Metal, when it runs out of the *Furnace*, a Scum, which they call *Droſs*; much like to *Slag* or *Droſs* of *Iron*; which being *melted* down with *freſh Ore*, Runneth into Metal.

The *Cauſalty* they throw in Heaps upon Banks, which in 6 or 7 *Years* they fetch over again: But they Obſerve that in leſs time it will not afford Metal worth the Pains; and at the Preſent none at all.

CIV. 1. I am well Inform'd, that all *Mendip* in *Somerſetſhire* is Mountanous: Yet the Hills not Equal in Height. It is Barren and Cold, and Rocky in ſome places. The Ridges thereof run Confuſedly, but moſt *Eaſt* and *Weſt*, and not in any Parallel one with another. Upon the Surface thereof, it is *Heathy*, *Ferny* and *Furzy*; and the Cattle it Feeds, for the moſt part, are *Sheep*, which go there all the Year; and *young Beaſts*, *Horſes* and *Colts*, at Spring and Fall. The *Sheep* are not Fair but Big-bellied, and will grow to no Bigneſs, after they have been there Fed; but will grow Fat, if they are removed into better Soil; and ſo their *Beaſts* and *Horſes*.

Lead-Mines in Somerſetſhire; by *Mr.* Joſ. Glanvil. n. 28. p. 525.

The *Inhabitants* live Wealthy, ſaving ſuch as are Employed about *melting* of the *Lead* at the *Mines*; who, if they work in the *Smoak*, are ſubject to a Diſeaſe, that will kill them, and the Cattle likewiſe that feed thereabout. The *Smoak* that reſts upon the Ground, will Bane them: And therefore the

Inhabitants

Inhabitants have Keepers to keep them from it, for fear of the Infection. At the Foot of the Hills there are many Springs which are very Wholsome; And Produce Rivers, after they have run to some distance from thence. The *Air* is Moist, Cold, Foggy, Thick and Heavy.

The *Soil* is Red and Stony; and the Stones are either of the Nature of *Fire-stones* or *Lime stones*, but no way *Clayie*, *Marly*, or *Chalky*. The *Trees* have their Tops Burnt, and their Leaves and Outsides Discoloured, and scorched with the Wind, and grow to no Bigness. The *Stones* that are washt by the Brooks and Springs, are of a Reddish Colour, and Ponderous. *Snow*, Frost, and Dew, stay upon *Mendip* longer, than upon any of the Neighbouring Grounds. Thunder and Lightning, Storms, Nocturnal Lights, and Fiery Meteors, are more frequent than Ordinary.

When they have got the *Ore* they *Beat* it Small, then *Wash* it Clean in a RunningStream; then *Sift* it in *Iron-Rudders*; then they make of Clay, or Fire-Stone, an *Hearth*, or *Furnace* which they set in the Ground, and upon it Build their *Fire*, which is Lighted with *Charcoal*, and continued with Young *Oaken Gadds*, Blown with *Bellows* by Men's *Treading* on them: And after the *Fire* is Lighted, and the *Fire-place* Hot, they throw their *Lead-Ore* upon the Wood, which *Melts* down into the *Furnace*; and then with an *Iron-Ladle* they take it out, and upon Sand *Cast* it into what Form they please.

A further account by Mr. Glanvil. n. 39. p. 767

2. I am farther informed, by experienced *Mine-men*, that they have sometimes known the *Vein* to Run up into the Roots of Trees, and yet they have observed no Difference at the Top, with respect to the other *Trees* there, into whose Roots no such *Veins* Run. The *Snow* and *Frost* near the *Grooves* Melt Quickly, but continue Long at further Distance. Sometimes when a *Mine* hath been very near the Surface, the Grass hath been *Yellow* and *Discoloured*. They have no value for the *Virgula Divinatoria*; yet they say when the *Mine* is Open, they may Guess by it, how far the *Vein* Leads. *White*, *Yellow* and *Mixt Earth* are *Leaders* to the Country (as they call it;) *Changeable Colours* always incourage their Hopes. For *Stones*, they are sometimes 12. *Fathom* Deep, before they Meet any: Other while, when a *Stony-Reak* at Top, they meet *Ore* just under the *Sword* [Superficies] of the Grass, which *Ore* hath gone down about 40. *Fathom*. A *Black-Stone* is of Bad Signification, and *Leads* to a *Jam* [a Black Thick Stone, that Hinders their Work:] A *Grey Clear Dry* one, they account Best. They seldom encounter *Damps*. If in *Sinking* they come to *Wet Mooriſh Earth*, they expect a *Jam*, and to be Closed up with Rocks. The *Nearness* they Guess by Short Brittle Clay; for the Tough is not *Leading*.

The *Ore* sometimes is *Shole*, and again it is 14 or 20 *Fathom*, more or less before they *Hit* it: They follow a *Vein* Inclining to some Depth, when it Runs away in Flat *Binns*.

When the Stones part it then they find a *Vein* again. Their *Draughts* are 14 or 16 *Fathom*, till they come to a Stone, where they Cast aside a *Draught* call'd a *Cut*. Then they *Sink* Plum again 4. or 5. *Cuts*, one under another They find *Ore* at 50. *Fathom*. Their Best *Reaks* are *North* and *South*; *East* and

and *VVeſt* are Good, though not ſo Deep. The *Groove* is 4 *foot* Long, 2½ *foot* Broad, till they meet a Stone, when they carry it as they can. The *Groove* is Supported by Timber: A piece of an Arm's bigneſs will Support 10 *Tuns* of Earth. It Laſts long: that which was put in beyond the Memory of Man (nay which by the Difference in the Manner of *Working* their *Mines*, they know to have layn above 200 *Years*) will ſerve in New-Works. It is Tough and Black, and being Expoſed to the Sun and Wind for 2 or 3 *Days*, will ſcarce Yield to an *Ax*.

For the Supply of *Air* they have Boxes of *Elm* exactly Cloſed, of about 6 *inches* in the Cleer, by which they carry it Down above 20 *Fathom*. But when they come at *Ore* and need an *Air-ſhaft*, they ſink it 4 or 5 *fathom* Diſtant, of the ſame Faſhion with a *Groove*, to Draw as well *Ore*, as *Air*.

They make uſe of *Leathern Bags*, of 8 or 9 *Gallons* a piece, drawn up by Ropes, to *Free* the *VVater*. If they find a *Swallet*, they drive an *Adit*, upon a *Level*, till 'tis Dry.

If they cannot *Cut* the *Rock*, they uſe *Fire* to *Aneale it*, laying on Wood and Coal, and the *Fire* ſo Contrived, that they Leave the *Mine* before Operation Begins, and find it Dangerous to Enter again, before it be quite Clear'd of the *Smoak*; which hath Killed ſome.

Their *Beetles*, *Axes*, *VVedges*, &c. unleſs ſo Hardned as to make a Deep Impreſſion upon the head of an Anvil, are not fit for their Uſe: and yet they ſometimes Break them in an *hour*; others laſt 3 or 4 *days*, as it happens. They Work Cloathed in Frocks and Waſt-Coaſts, by *Candle-Light* of Tallow, 14 or 15 to the *Pound*, each whereof Laſts 3 *hours*, if they have *Air* enough: which if they want to keep in the *Candles*, the Workmen cannot Stay there A *Vein* being *Loſt*, they *Drive* 2 or 3 *fathom* in the *Breaſt*, as the nature of the Earth Directs them. They convey out their Materials in *Elm-Buckets* drawn by Ropes: The *Buckets* hold about a *Gallon*. Their *Ladders* are of Ropes.

The *Ore* runs ſometimes in a *Vein*, ſometimes diſperſed in *Banks*. It lies many times between Rocks: Some of it is Hard, ſome Milder. Many times they have *Branched Ore* in the *Sparr*. About the *Ore* there is *Spar* and *Chalk*, and another Subſtance, which they call the *Crootes*, which is a Mealy, White Stone, marted with *Ore*, and Soft. The *Sparr* is White, Tranſparent and Britle like Glaſs. The *Chalk* White and Heavy; Heavier than any Stone. The *Vein* lies between the *Coats*, and is of Different Breadths. It Breaks off ſometimes abruptly in an *Earth*, they call a *Deading Bed*, and after a *fathom* or 2 may come again, keeping the ſame *Point*. It *Terminates* ſometimes in a *Dead Earth*, Clayie, without *Croot* or *Spar*; ſometimes in a Rock call'd a *Fore-Stone*.

The Cleareſt and Heavieſt *Ore* is the Beſt: 36 *hundred* of *Ore* may yield a *Tun* of *Lead*.

The *Hearth* for *Melting* the *Ore* is about 5 *foot* High, ſet upon Timber, to be *Turned* as a *Wind-Mill*, to avoid the Inconvenience of *Smoak* upon a Shifting Wind. It contains *half* a *Buſhel* of *Ore* and *Coal*. There is a *Sink* upon

on the Side of the *Hearth*, into which the *Lead* Runs, that holds about 1½ *Hundred*. They have a Bar to ſtir the Fire; A ſhovel to Throw it up; and a *Ladle* Heated Red hot to Caſt out the *Melted Metal*. Once *Melting* is enough: and the Beſt (which is Diſtinguiſht by its Weight) *Melts* firſt.

There is a *Flight* in the *Smoak*, which falling upon the Graſs, *Poyſons* thoſe Cattel that Eat of it. They find the Taſte of it upon their Lips to be *Sweet*, and when the *Smoak* chances to Fly in their Faces. Brought home and laid in their Houſes, it Kills *Rats* and *Mice*. If this *Flight* mix with the Water, in which the *Ore* is *waſht*, and be carried away into a *Stream*, it hath *Poiſoned* ſuch Cattel as have drunk of it after a Current of 3 *miles*. What of this *Flight* falls upon the *Sand*, they gather up to *Melt* upon a *Flag-Hearth*, and make *Shot* and *Sheet Lead* of it.

They ſometimes find *Slags*, 3, 4, or 5 *foot* under ground; but ſuch as they judge were caſt aſide heretofore.

They have ſometimes Heard *Knockings* beyond their own *Works*, which when followed by them, have afforded Plenty of *Ore*. And one *King* of *Wells* about 2 *Years* ſince found in his *Groove* a Piece of *Ore*, in which they fancied the ſhape of a Man, Eyes, Arms, Leggs, Full Breaſt, *&c.* The whole was about 4 *Inches* in length; the *Mine* proved Rich.

In Germany; *by* [illegible] n. 1. p. 10.

3. There is a Peculiar *Lead Ore* found in the *Upper Palatinate*, at a place call'd *Freyung*; and there are two ſorts of it, whereof one is a kind of *Cryſtalline Stone*, and almoſt all good *Lead*; the other not ſo rich, and more Farinaceous. The *Mines* of that Place having lain long neglected, the People living thereabout take it from what their Fore Fathers had thrown away, and had lain long in the Open Air. It is of ſingular Uſe for *Eſſays* upon the *Coppel*, ſeeing that there is not any other *Metal* mixed with it.

The Poyſonous *Quality of* Lead Ore; *by Mr.* J. Beaumont. *Ph. Col.* n. 2. p. 6.

CV. Thoſe who live near where *Lead-Ore* is *Waſht*, cannot keep either *Dog* or *Cat*, or any ſort of *Fowl*, but they all Die in a ſhort time; and I have Known of a little Houſe wherein *Lead Ore* was kept ſome time, though afterward made very Clean and well Bedded with *Fern*, yet when *Calves* were put into it, they all died ſhortly after; and *Children* ſometimes, in theſe Houſes, have died *Suddenly*. If any ſort of *Cattle* Eat often of that *Graſs*, on which the *Steam*, which riſes from the *Smelting* of *Lead*, falls, they all die in a while after.

The Way of Making of Ceruſs; *by Sir* Philiberto Vernati *n.* 137. *p.* 935.

CVI. Pigs of Clean and Soft *Lead* are Caſt into Thin *Plates*, a *Yard* long, and 6 *Inches* Broad. Theſe are Rolled round, ſo as the Surfaces no where meet to Touch: For where they do no *Ceruſs* grows. Each of theſe is put into a *Pot*, juſt capable to hold One, upheld by a little Bar from the bottom, that it come not to touch the *Vinegar*, which is put into each *Pot*, to effect the Converſion. *Twenty* of theſe abreaſt, are put into a Square Bed of New *Horſe-Dung*; and each *Pot* is Covered with a *Plate* of *Lead*; and *laſtly*, all with Boards, as Cloſe as Conveniently can be. This repeated 4 Times, makes one *Heap*, ſo called, containing 1600 *Pots*.

After

After 3 *Weeks* the *Pots* are taken up, the *Plates* Unrolled, laid upon a Board, and Beaten with *Battle Doors* till all the *Flakes* come off; which, if good, prove Thick, Hard and Weighty. These *Flakes* are ground with Water, between *Millstones*, to almost an Impalpible Fineness. After which it is Moulded into smaller Parcels, and Exposed to the Sun to Dry, till it be Hard, and so fit for Use.

'Tis Observed, that some *Pots* will yield *Thick* and Good *Flakes*, whilst others, alike Ordered and set by them, without any possible Distinction of Advantage, yield few and small, or none at all. Sometimes the *Poles* are taken up all Dry, and so sometimes prove Best; sometimes again they are taken up Wet. The *Plates* that cover the *Pots* yield better and Thicker *Flakes*, than do the *Rolls* within. And the Outsides, next to the Planks, Bigger and Better than the Insides, next to the *Rolls*, and the *Spirits* that first arise out of the *Vinegar*.

The Accidents which happen to the Workmen, are 1. Immediate *Pain* in the *Stomach*, with exceeding *Contorsions* in the Guts, and *Costiveness* that yields not to *Cathartick*s, hardly to often repeated *Clysters*: Best to *Lenitives*, *Oil* of *Olives*, or strong New *Wort*. It brings them also to *Acute Fevers*, and Great *Asthma's* or *Shortness* of *Breath*. And these we find Effected principally by the *Mineral Steams* in the Casting of the *Plates* of *Lead*, and by the Dust of the *Flakes*. Also by the *Steams* coming from out of the *Heaps*, when the *Pots* are taking up.

Next a *Vertigo*, or *Dizziness* in the Head, with continual great Pain in the *Brows*, *Blindness*, *Stupidity*, and *Paralytick Affections*; *loss* of *Appetite*, *Sickness*, and frequent *Vomitings*, generally of sincere *Phlegm*, sometimes mixed with *Choler*, to the extreamest Weakness of the Body; and these chiefly in them that have the Charge of *Grinding*, and over the Drying Place.

CVII. 1. The *Mines* of *Mercury* in *Friuli*, a Territory belonging to the *Venetians*, are about a Days Journey and an half distant from *Goritia* Northwards, at a place call'd *Idria*, scituated on a Valley of the *Julian Alps*. They have been, as I am informed, these 160 Years in the Possession of the *Emperor*, and all the Inhabitants speak the *Sclavonian* Tongue. In going thither we Travelled several Hours in the Best *Woods* I ever saw; being very full of *Firrs*, *Oaks*, and Beeches of an Extraordinary Thickness, straitness, and Height. The Town is built as usually Towns in the *Alps* are, all of *Wood*, the *Church* only excepted, and another House wherein the Overseer liveth. When I was there in *August* 1664, the Valley and the Mountains too, out of which the *Mercury* was dug, were of as pleasant a *verdure*, as if it had been in the midst of *Spring*, which they there attribute to the *Moistness* of the *Mercury*. That *Mine* which we went into, the Best and Greatest of them all, was dedicated to *St. Barbara*, as the other *Mines* are to others *Saints*. The usual way down to it is at the Beginning not Difficult, the Descent not being much, the greatest Trouble is, that in several Places you cannot stand Upright: but this holds not long, before you come to Descend in Earnest by Perpendicular *Ladders*, yet being Imagined produced, they do not make one

The Quickfilver-Mines *in Friuli, by Dr.* Walt. Pope. n. 2. p. 21.

Ladder, but ſeveral Parallel ones. At the End of each *Ladder*, there are Boards acroſs, where we may Breath a little. All the way down, and the Bottom, where there are ſeveral Lanes cut out in the Mountain, is lined and propt with great pieces of *Firr-Trees* as Thick as they can be ſet. They dig the *Mineral* with Pick-Axes, following the *Veins*: 'Tis for the moſt part *Hard* as a Stone, but more Weighty; of a *Liver-Colour*, or that of *Crocus Metallorum*. There is alſo ſome Soft Earth in which you plainly ſee the *Mercury* in little Particles. Beſides this, there are oftentimes found in the *Mines* Round Stones like Flints, of ſeveral Bigneſſes, very like thoſe *Globes* of *Hair* which I have ſeen in *England*, taken out of *Ox*'s Bellies. There are alſo ſeveral *Marcaſites* and *Stones*, which ſeem to have Specks of *Gold* in them; but upon Tryal, they ſay, they find none in them. Theſe Round Stones are ſome of them very Ponderous, and well Impregnated with *Mercury*; others Light, having little or none in them.

The manner of getting the *Mercury* is this: They take of the *Earth*, brought up in Buckets, and put it into a *Sieve*, whoſe bottom is made of *Wires* at ſo great a Diſtance, that you may put your Finger between them; 'tis carried to a ſtream of Running Water, and *waſhed* as long as any thing will paſs through the *Sieve*. That *Earth* which paſſeth not, is laid aſide upon an Heap; that which paſſeth, is reſerved in a *Hole*, and is taken up again, and put into a *ſecond Sieve*; and ſo on to about ten or 12 *Sieves* proportionably leſs. It often happens in the *Firſt Hole*, that there is *Mercury* at the bottom; but towards the farther End, where the Intervals of the *Wire* are leſs, its found in very great Proportion. The Waſte Water is ſo much Impregnated with *Mercury*, that it cureth *Itches* and other *ſordid Ulcers*. The *Earth* laid aſide, is Pounded, and the ſame Operation repeated. The fine ſmall Earth, that remains after this, and out of which they can *waſh* no more *Mercury*, is put into *Iron Retorts*, and the *Fire* forces the *Mercury* into the *Receivers*: The Officer unluted ſeveral of them; and I obſerved in all that he firſt poured out *Perfect Mercury*, and after that came a *Black Duſt*, which being Wetted with Water, diſcovered it ſelf to be *Mercury*, as the other was. They take the *Caput Mortuum* and Pound it, and Renew the Operation. There are 16 *Furnaces* for this Uſe, each of them carrying 24 *Retorts*; in all 384 *Retorts*.

All the *Mercury* got without the uſe of *Fire*, whether by *Waſhing* or found in the *Mines* (for in the Digging ſome, the Particles get together, ſo that in ſome places you might take up two or three *Spoonfuls* of *pure Mercury*) is called by them *Virgin Mercury*, and eſteemed above the reſt. The Officer told me, that making an *Amalgama* of *Gold* and *Virgin Mercury*, and putting it to the Fire, that *Mercury* would carry away all the *Gold* with it, which *Common Mercury* would not do.

The *Engines* for drawing the Water, are all moved by Water, brought thither in no Chargeable *Aqueduct* from a Mountain 3 *Miles* diſtant. The Water *Pumpt* from the bottom of the *Mine*, by 52 *Pumps*, 26 on a ſide, is Contrived to Move other Wheels, for ſeveral other purpoſes.

The

The Labourers (being 280 always Employed) work for a *Julio* a Day, which is not above 6 or 7 pence, and Endure not long: For although None ſtay under-ground above 6 *Hours*; all of them in time (ſome later, ſome ſooner) become *Paralytick*, and Dye *Hectick*. We ſaw a Man who had not been in the *Mines* for above *half a Year* before, ſo full of *Mercury*, that putting a piece of *Braſs* in his *Mouth*, or Rubbing it in his *Fingers*, it immediately became as *White*, as if he had rubbed *Mercury* upon it. Thoſe alſo that Work upon the Back ſide of *Looking-Glaſſes*, are very Subject to the *Palſey*.

They Convey their Wood thus, about 4 *Miles* from the *Mines* on the ſides of Two Mountains, they Cut down the Trees, and draw them into the Interjacent Valley; Higher up in the ſame Valley they make a *Lock* or *Dam*; when the Water is ready to run over it, they open the *Flood Gates*, and the Water carries all the Trees impetuouſly to *Idria*, where the Bridge is Built very Strong, and at very Oblique Angles to the ſtream, on purpoſe to ſtop them, and throw them on ſhore near the *Mines*.

Thoſe *Mines* heretofore Coſt the Emperour 70000 or 80000 *Florens* Yearly; but now they Coſt him not above 28000. They produced

Anno 1661.	ll.	*Anno* 1662.	ll.	*Anno* 1663.	ll
Ordinary Mercury.	198481		225066		244119
Virgin Mercury.	6194		9612		11862
in all	204675		234678		255981

2. The Town of *Idria* in the County of *Goritia* and Province of *Friuli*, is ſeated low, and Encompaſſed with Hills on all ſides. A *River* of the ſame Name runs by it, and proves ſufficient upon Plentiful Rains to Convey down the *Firr-Trees* and other Wood required in the Service of the *Mines*: And to this End there is an Handſome Work of *Piles* made ſloaping athwart the *River* (after the ſame manner as I obſerved in *Newſol* in *Upper Hungary*, croſs the River *Gran*) to ſtop the Trees. *By Dr. Edw. Brown. n. 54. p. 1080.*

The Entrance into theſe *Mines* is not High, or upon an Hill, but in that Town it ſelf. The deepeſt part of the *Mine* from the Entrance, is between 120 and 130 *Fathoms*.

The *Virgin Quickſilver*, which they call *Jungfraw*, is that which diſcovers it ſelf without the help of *Fire*. Sometimes it is plainly ſeen in the *Ore*, or falls down in *Drops*, and ſometimes *Streams* out in good quantity; as about 7 *Years* ago it ran out of the Earth at firſt in a *Stream* as ſmall as a Thread, and afterwards as Big as a Packthread, but ceaſed in 3 or 4 *days*. That alſo is accounted *Virgin Quick Silver*, which is ſeperated only by *Water*.

Plain Quickſilver they obtain by *Fire* out of the *Ore*, or out of the *Cinnaber* of *Mercury*, which they dig out of this *Mine*. The *Ore* of this *Mine* is of a *Dark Colour*, mixed with *Red*.

The *Quick silver* Ore of this *Mine* ordinarily contains *Half*, and sometimes ⅔ of *Quicksilver*.

I went into the *Mine* by the Pit of St. *Agatha*, and came up again by that of St. *Barbara*, Descending and Ascending by *Ladders*. I Ascended at one of 639 Staves, or 89 *Fathoms*. It has been wrought 200 *Years*, about the same space of time with *Newsol-Mine*, but comes much short in time of the *Silver Mine* at *Schemnitz*; and much shorter yet of the notable *Lead Mines* in *Upper Carinthia*.

In a *Laboratory*, where the *Quicksilver* is seperated by *Fire*, I saw an Heap of 16000 *Retorts* of *Iron*; every one of which Costs a *Crown* at the Best Hand from the *Iron Furnaces* in *Carinthia*. There are 800 *Retorts*, and as many *Recipients*, Employed together, in drawing over the *Quicksilver* in 16 *Furnaces*; 50 in each *Furnace*, 25 of a side; 12 above, and 13 below of each side.

June 12. 1669, when I was there, they Carried out 40 *Saumes* of *Quicksilver* into Foreign Parts, each *Saume* containing 315 *pound* Weight, to the value of 4000 *Ducats* of *Gold*. Some of it is sent as far as *Cremnitz* in *Hungary*, for the Use of the *Gold Mines*: And very much carried away Southward; for they are not far from the *Sontius*, or *Lysonzo*, a considerable River, which Runs into the *Gulf* of *Trieste* in the *Adriatick Sea*.

In the Castle, I saw 3000 *Saumes* of *Quicksilver* together in Barrels; the *Quicksilver* being first made up in Double Leather: And in another House as much Ore as can be Distilled in 2 *Years*, except they have great Plenty of *Rain* to bring down the *Wood*.

The Country is well stored with stately *Firs*, *Larches*, *Pines*, *Pinasters*, *Picea*'s, and that Nobly Crisped and well Grain'd kind of *Acer*, whereof *Viols* and *Violins* are made: Whereof there is also Plenty in the Country of *Saltzburg* and *Carniola*.

Travelling sometimes in the Night, we had continually about us a great number of large *Glow-worms*, which put into Papers, gave a Dimm Light like Candles in Lanthorns; and the Air also was full of *Flaming Flies*, affording some delight unto us.

The way to this Place from *Croatia* I found Difficult; and coming from it to *Aidoschini* and *Croatia*, I passed over *Swartzenburg*, or the *Black Mountain*, from whence I descended 10 *Miles* in a Rocky Country, and far more Stony than the *Craw*, or *Campus lapidosus*, in *Provence*.

Mercury *found in* Plants; *by* S. Manfred Septalius. n. 27. p. 493.

CVIII. In the Valley of *Lancy*, which runs between the Mountains of *Turin*, grows a Plant like the *Doronicum*, (so also called by the Inhabitants and *Botanists*;) near the *Roots* whereof you may find *Pure Quicksilver*, running in small Grains like *Pearls*; the *Juice* of which Plant being Expressed, and exposed to the Air of a Clear Night, there will be found as much *Mercury*, as there is Lost of *Juice*.

The Incalescence *of* Mercury *with* Gold; *by* B. R. n. 122. p. 515.

CIX. Though I have many things to Object against the *Sympathy* of *Gold* with *Quicksilver*; yet perhaps there may be a *Quicksilver* more Subtle and

Ponderant

Ponderant than that which is Common, which may enable the *Chymiſts* to Argue very ſpecioufly for it.

It is hotly diſputed among the Curious in *Chymiſtry*, whether or no there be any ſuch thing as a *Mercury* which being barely *Mingled* with *Gold*, reduced to fine Parts, will produce any ſenſible *Heat*. The *Affirmative* is Aſſerted by ſome that pretend to the *Tranſmutation* of *Metals*, who Aſcribe this Virtue to the *Mercuries*, Extracted, as they ſuppoſe, from ſome *Compleat Metals*; which are therefore in their Phraſe ſtyl'd *Mercurii Corporum*, or the *Mercuries* of *Metalline* Bodies. But the *Negative* is more generally Maintain'd, not only by *Philoſophers* and *Phyſicians*, but the more Learned *Spagyriſts* themſelves, eſpecially the *Modern*

I the leſs wonder at this latter Opinion; becauſe having purpoſely enquired of ſeveral Prying *Alchymiſts*, they have a part ingenuouſly Confeſſed to me, that they never actually ſaw any *Incaleſcent Mercury*: though they had ſometimes heard it boaſted of.

But notwithſtanding all this, having for ſeveral Reaſons look'd upon *Mercury* as a Body which is not neceſſarily ſo *Homogeneous* as it is ſuppos'd, the Opinion I moſt liked of was, that of a Poſſibility of an *Incaleſcent Mercury*. For notwithſtanding the vulgarly ſuppoſed *Similar nature* of *Quickſilver*, which I willingly Confeſs to be great enough to be Admirable, yet having deviſed two ways (unpractiſed) that I know of by any *Chymiſt*,) the one to Diſcover whether a Clean and carefully *Diſtilled Mercury* might not be a *Compounded* Body, and have in it Parts that were not *Mercurial*; and the other out of ſuch a fine *Diſtilled Mercury* to ſeperate Parts, and that in no deſpicable number, that are Plainly *Heterogeneous*; I found upon Tryal, that both the Methods, I had thought on, would ſucceed: Which warranted me to think it poſſible, that a *Mercury* very fine and Clean, and even Purged by *Sublimations* and *Diſtillations*, may, by Art, have been made to Aſſume and Incorporate with it a multitude of *Heterogeneous* Corpuſcles, not to be Diſcovered, much leſs ſeparated, (as thoſe of *Tinn*, *Lead*, *&c.* may be) but by a Skilful Artiſt.

This was enough to Ingage me to make Trials, whether ſome of theſe *Heterogeneous* Particles, that I found Reducible with *Mercury* into a laſting *Mercurial Flux*, might not ſo Alter it as to Diſpoſe it to *Heat* with *Gold*: And that there were ſuch, through God's bleſſing, my Trials afforded me poſitive Proof, about the Year 1652.

For when I was alone (that I might not be impoſed upon by others) I took to *one part* of our *Mercury* ſometimes half the weight, and ſometimes an *equal* weight of *Refined Gold* reduced to a *Calx*, or ſubtle Powder. This I put into the Palm of my Left Hand, and putting the *Mercury* upon it, ſtirred it and Preſſed it a little with the Fingers of my Right Hand, by which the two Ingredients were eaſily Mingled, and Grew not only ſenſibly but conſiderably *Hot*, and that ſo Nimbly, that the *Incaleſcence* did ſometimes come to its Height in about a *Minute* of an *hour*, by a *Minute Clock*. I found the Experiment ſucceed, whether I took *Altogether*, or but *Half* as much *Gold* as *Mercury*; but

but the Effect ſeemed to be much Greater when they were Imployed in *Equal* Weight.

I tryed alſo the ſame *Mercury* with *Refined Silver* reduced to a very fine Powder; but I could not perceive any Heat or Warmth at all; tho' I am apt to think with a ſufficient Quantity of *Leaf Silver* it might have been ſenſible.

I made Tryal afterwards, oftner than Once, in the Hands of others, who were not a little ſurpriſed and Pleaſed at the Event; particularly having given the *Ingredients* to the Learned *Secretary* of the *Royal Society*, I deſired him to make the Experiment in and with his own Hand, in which it proved ſucceſsful within ſomewhat leſs than a *Minute* of an *Hour*. [And the *Lord Viſcount Brounker (Preſident* of *R. S.)* made the ſame Experiment with ſome of the ſame *Mercury*, in his own Hand with Good Succeſs.]

This *Incaleſcence* was the more Conſiderable, ſince being willing to Husband my *Mercury*, I made theſe Tryals but with a *Drachm* at a time, which ſcarce amounts in Quantity to the bigneſs of half a middle ſized *Bean*; and yet I have ſometimes had of this *Mercury* ſo Subtile, that the Heat made me willing to put it Haſtily out of my Hand.

However I will not hence Determine, whether thoſe that are *Mercurii Corporum*, and were made, as *Chymiſts* preſume, by *Extraction* only from *Metals* and *Minerals*, will each of them Grow *Hot* with *Gold*; as, if I much miſtake not, I found *Antimonial Mercury* to do. Nor will I Affirm, that every *Metalline Mercury* (though never ſo diſpoſed to *Incaleſcence)* or even that of *Silver* and *Gold* it ſelf, is the ſame with that which the *Chryſopœan* Writers mean by their *Philoſophick Mercury*, or is near ſo Noble as this. Nay, I will not ſo much as Affirm, that Every *Mercury*, obtained by *Extraction*, even from the *Perfect Metals* themſelves, muſt needs be more Noble and Fit (as *Alchymiſts* ſpeak) for the *Philoſophick Work*, than that which may with Skill and Pains, be at length Obtained from *Common Mercury*, Skilfully freed from its *Recrementitious* and *Heterogeneous* Parts, and Richly Impregnated with the Subtile and Active ones of Congruous *Metals* or *Minerals*. But if there be any Truth in what ſome of the moſt Approved *Spagyriſts* have delivered about a *Solvent* of *Gold*, that ſeems of Kin, and perhaps is not much Nobler than one that I had, it ſeems allowable to Expect, that even Ours ſhould be of more than Ordinary Uſe, both in *Phyſick* and *Alchymy*.

I had almoſt forgot to tell you, that whereas 'tis uſual to take 4, 5, or 6, nay 8 or 10 Parts of *Common Quickſilver* to make an *Amalgame* with one of *Gold*, even when both are Heated by the Fire; I found *Our Mercury* ſo Congruous to that *metal*, that it would preſently Imbody with no leſs than an Equal weight of it, and produce a pretty Hard *Amalgame* or Mixture, in which the *Mercury* was ſo diffuſed, that the *Gold* had quite loſt its *Colour*. *Secondly*, I ſhall add, what, for ought I know, has not been yet Obſerved, that this Power of *Penetrating Gold* and growing Hot with it, is ſo Inherent, not to ſay Radicated, in *Our Mercury*, that after it had been *Diſtilled* from *Gold*, again and again, I found it to retain that Property. And *Laſtly*, I found by Tryal, that a ſingle *Drachm* of *Mercury*, made after a certain manner, did the

the 3*d* or 4*th Year* after I had laid it by, grow ſo *Hot* with *Gold*, that I fear'd 'twould have Burnt my Hand.

It may be Doubted whether the Good that the *Preparations* of it (ſuch as *Precipitates* and *Turbiths* of diverſe kinds, *Mercurius dulcis*, *Cinnaber* made of the *Sulphur* of *Antimony*, and with *Gold*, *&c.)* may do in *Phyſick*, is likely much to Exceed the *Political* Inconveniences that may enſue, if it ſhould prove to be of the Beſt kind, and fall into ill hands. The knowledge of the Opinions of the Wiſe and Skillful about this Caſe, will be requiſite to aſſiſt me to take Right Meaſures in an Affair of this Nature. And till I receive this Information, I am Obliged to *ſilence*. In the mean while I ſhall make bold to Add this *Secret*, (which to ſome, I think, will ſeem a *Paradox*) namely, that a *Mercury* Qualifyed to *Heat* with *Gold*, and perhaps with other Powders, may be made by more ways than one or two; Experience having aſſured me, that ſuch a *Mercury* may be Prepared, not only by employing *Antimony* and *Solid Metals*, as *Mars*, but without any ſuch *Metal* at all, or ſo much as *Antimony* it ſelf.

I ſhall alſo Admoniſh thoſe Inquiſitive *Spagyriſts*, that may be Deſirous to Try, whether their *Purify'd Mercury* be *Incaleſcent*, that they be not too haſty to conclude it is not ſo; nor to Reject it, unleſs they have made the Trial with *Gold* duly Prepared. For the ſmalleſt *Filings* of *Gold* I could make, or even ſome *Calxes* of *Gold*, will not ſerve our Turn, as I have found by employing, without ſucceſs, a very fine and Spongy *Calx* made after an Uncommon way, the *Golden Particles* having, as it ſeemed, ſome extremely fine, tho' unobſerved Duſt of the Additament ſticking to them, which hindred the Adheſion of the *Mercurial Ones*. Now the *Calx* of *Gold* that I moſt uſed, as finding it ſtill to do well, was that made by *Quartation* (as *Alchymiſts* call it) That is, by Melting together one part of *Fine Gold*, and 3 or 4 parts of *Cuppell'd Silver*, and then putting the Maſs, wherein the *metals* are mixed almoſt *per minima*, into Purify'd *Aquafortis*, which diſſolving the *Silver* only, leaves the *Gold* in the form of a fine *Calx*. Alſo, by making an *Amalgama* with *Pure Gold* and *Vulgar Mercury*, and Diſſolving the *Mercury* in good *Aqua fortis*, there will remain a Powder, which being well waſht in fair Water, to *Dulcifie* it, and kept a while in a Moderate Fire, to dry it throughly without melting it, will become a *Calx*, which I have more than once uſed with *Our Mercury* with good Succeſs. I have alſo ſometimes taken, inſtead of a *Calx* of *Gold*, a competent number of *Leaves* of *Gold*, Reduced by beating only, without the help of *Salts*, to a ſufficient Thinneſs, (inſomuch that 70 odd *Leaves* did not weigh a *Scruple*) and putting two or three times the weight of Our *Mercury* to them, I have found (more than once) that a *ſmart Heat* was preſently produced in my Hand.

CX. There are diverſe *Silver-mines* at *Schemnitz* in *Hungary*, but the Chiefeſt and moſt Wrought, are thoſe of *Windſchacht* and *Trinity*.

The Silver-Mines *in* Hungary; *by Dr.* Edward Brown. n. 58. p. 186.

They have no River here, tho much Water in the *Mines*; ſo as they are conſtrained to ſend much of their *Ore* to *Hodrytz* and other Places, where are ſmall Rivers, by which their *Bellows* and *Hammers* may be Moved, (their

Ore

Ore Pounded Waſhed, and other Works requiſite, performed. To draw about the *Engines* to Pump out the Water, 12 Horſes at a time are employ'd to each Wheel: But in *Windſchacht-mine*, Deep in the Earth, is a large Wheel of 12 *Yards* Diameter, Turned about by the fall of *Subterraneous Water*; which, together with the other Water Pump'd from the deepeſt parts of the *Mine*, Runs out through a *Cuniculus* made on purpoſe) at the Foot of the Hill.

Trinity-Mine is 70 *Fathoms* Deep, built and kept open with under work at a great Expence. Much of this *Mine* being in Earthy Soil, the *Ore* of it is much eſteemed. Diverſe *Veins* lie *North*; and other rich *Veins* run to the *North-Eaſt*. When two *Veins* croſs one another, they eſteem it Fortunate. They uſe not the *Virgula Divina*, and have no certain way to know either which way the *Veins* run, or where they are, till by the Induſtrious perſevering in the Labour of the *Mines*, they are at laſt found out. They ſhewed me one Place, which they had digged ſtraight on 6 *Years*, when the *Ore* was but two *Fathoms* diſtant from the Place where they began; and in another Place they digged 12 *Years* outright, and at laſt found a *Vein*, which in a ſhort time paid their Charges.

The *Blackiſh Silver Ore* is eſteemed the Beſt; much of it hath a Mixture of a ſhining Yellow ſubſtance or *Marchaſite*, which if it be not in too great a quantity, is not unwelcome; by reaſon that it diſpoſeth the *Ore* to fluidity, or renders it more eaſie to be Melted: But if it be in too great a Proportion, they are of Opinion, that it Preys upon the *Silver* in the *Mine*, and in the *Furnace*, Carryeth it away while it Melteth, by Over-Volatizing it.

There is often found a *Red* Subſtance, which grows to the *Ore*, called *Cinnaber*, *Cinnaber* of *Silver*, *Cinnabaris nativa*, *Minium Nativum*, or *Berg-Cinober*. This Subſtance grinded with *Oil*, maketh a *Vermilion*, equal to, if not ſurpaſſing the *Cinnaber* made by *Sublimation*. I Diſcovered a *Sulphur* in it, by Caſting it upon a hot Iron Plate, on which it Burned *Blew*. The Miners ſay they met not with any *Quickſilver*; but they find *Cryſtals*, *Amethiſts*, or *Amethiſtine mixtures*, in the Clefts of the Rock, and ſometimes Nigh or Joined to the *Ore*, as alſo *Vitriol* naturally *Cryſtallized* in the Earth in diverſe of the *Mines*, and particularly in a *Mine* in *Paradiſe-Hill* near *Schemnitz*.

An *Hundred Pound* weight of *Ore* ſometimes yields but half an *Ounce*, or an *Ounce* of *Silver*; ſometimes 2 *Ounces*, 3, 4, 5, and unto 20 *Ounces*. What is Richer is very Rare: Yet ſome hath been found to hold *Half Silver*; and I have ſeen of it ſo Rich, as to be Cut with a Knife.

A *Specimen* of each ſort of *Ore*, which they dig out of the *Mines*, is carried to an Officer call'd the *Probierer*, who is to Prove and Judge of its Richneſs; which he doth in this manner: Of all ſorts of *Ores* he taketh the ſame Quantity: The *Ores* being firſt Dryed, Burned, and Powdred, he giveth an Equal proportion of *Lead* to all; Melteth and Purifieth them; then by Exact Scales takes notice of the Proportion between the *Ore* and the *Metal* contained in it; and Reports it to thoſe employed in the Great *Melting Furnaces*.

If the *Ore* be found to hold $2\frac{1}{2}$ *Ounces* or more of *Silver* in 100 *Pound* Weight, they Ordinarily *melt* it, without any foregoing Preparation, by the help of *Iron-Stone*, (which is not *Iron-Ore*, but a *Stone* found thereabout, of which the *Liver-Coloured* is the Beſt) *Kys*, (a ſort of *Pyrites*,) and *Slacken*, (a *Scum* or Lake taken off from the top of the Pan, into which the *melted Mineral* runs, and is a Subſtance made out of the Former mentioned by *Fuſion*;) which are thrown in with it into the *melting Furnace*.

If the *Ore* be Poorer, holding but 2 *Ounces* in an 100 *Pound* Weight, or leſs, it is firſt Pounded and Waſhed, till it becomes Richer, or hath a Greater Proportion of *metal* in reſpect of the *Ore*, much of the Earthy parts being Waſhed away. Then it is thrown into the *Furnace* with the Former *Materials*; and the *Marchaſite*, which remains ſtill with it, as ſinking always to the Bottom with the *Silver* in the *Waſh works*, helps to the quicker *Fuſion* of the *Ore*.

Whatſoever is Melted in the *melting Furnace*, is let out through an Hole at the bottom thereof into the Pan, which is placed in the Earth before it; and, thus expoſed, it immediately acquires an Hard Scum, Droſs, Loaf, or Cake, which being oft taken off from the Top, the *metal* Remaining in it becomes Purer; to which is added *Lead*, and after ſome Time the *melted Metal* is taken out. Then being again Melted in the *Driving Furnace*, the *Lead*, or what elſe Remains Mixt with the *Silver*, is Driven off by the Blowing Two Great *Bellows*, and Runs over in the form of *Litharge*. That which firſt comes over is the *White*, and that which is laſt, being longer in the *Fire*, is the *Red*; not that it is *Litharge* of *Gold*, both being driven off from the ſame *metal*.

Moſt of the *Schemnitz-Silver Ore* holds ſome *Gold*; which they ſeperate by Melting the *Silver*, then *Granulating* it, and afterwards by *Diſſolving* it in *Aquafortis*, whereby the *Gold* is left at the Bottom, and is afterwards Melted. The *Aquafortis* is Diſtilled from the *Silver*, and ſerveth again for Uſe.

The *Silver* then ſeperated from all its former Aſſociates, is ſent to *Cremnitz*, where they *Coin* it into Pieces of a *mixt Metal*, (which is the common *Money* of the Country) after this manner. They *Melt* it with about the ſame Quantity of *Copper*, and run it into Bars, which they Beat out; then ſoftening them in the Fire, Draw them out to an Exact Thinneſs between two Steel-wheels; then they cut them out into Round Pieces with an Inſtrument like a Shoe-maker's Punch; and then *Boil* them with *Tartar* and *Salt*, ſhake them in a Sack with Small Coal and Water, dry them in a Kettle Perforated, and afterwards they are drawn between two Wheels, in which they receive their *Stamp*.

CXI. Among the 7 *Mine-Towns* in *Hungary* (which are not far from one another, *viz. Chremnitz*, *Schemnitz*, *Newſol*, *Koningsberg*, *Bochantz*, *Libeten*, and *Tiln*) *Chremnitz* is the Richeſt in *Gold*. They have alſo, at preſent, *Gold Mines* at *Bochantz* and *Coningsberg*; and they report in that Country, that there hath been formerly a Rich *Gold Mine* at *Glaſs-Hitten*, but

The Gold Mines *in* Hungary, *by Dr.* Edward Brown. n. 58. p. 1193.

but loſt ſince that *Bethlem Gabor* over-ran Thoſe Parts, when the Undertakers ſtopped up the *Mine* and fled.

They have Worked in the *Gold Mine* at *Chremnitz* 900 *Years*. This *Mine* is diverſe *Engliſh Miles* in Length, and about 160 *Fathoms* Deep. Many *Veins* of the *Ore* run to the *North*, and to the *Eaſt*. They Work alſo towards *One*, *Two* and *Three* of the *Clock*, as they ſpeak; for the *Miners*, direct themſelves under Ground by a *Compaſs*, not of 32 *Points* (ſuch as is uſed at *Sea*) but by one of 24; which they Divide, as we do the *Hours* of the Day, into twice Twelve. Of the *Gold Ore*, ſome is *White*, and ſome *Black*, *Red*, or *Yellow*: That with *Black Spots* in *White* is eſteemed the Beſt, as alſo the *Ore* which lieth next) to the *Black Veins*. This *Ore* is not Rich enough to ſuffer any *Proof* in ſmall Parcels, like that in other *Mines*, whereby to know what Proportion of *Metal* is contained in it; but they Pound a very great Quantity thereof, and waſh it in a little River, which runs nigh the Town. The whole River being divided, and admitted into diverſe Cuts, runs over the *Ore* continually, and ſo waſheth away the Earthy parts from the Metalline: And from a Clear River above the Town, by its Running through ſo many Works, and over ſo much Pounded *Ore*, it becomes below the Town, a Dark-Yellow Stream, of the Colour of the Earth of thoſe Hills.

There have been Pieces of *Pure Gold* found in the *Mine*. Some of which I have ſeen in the *Emperor*'s *Treaſury*, and in the *Elector* of *Saxony*'s *Repoſitory*; one Piece as broad as the Palm of my Hand, and others leſs, and upon a White Stone many pieces of *Pure Gold*; but theſe are very Rare.

The common Yellow Earth of the Country near *Chremnitz*, although it be not Eſteem'd *Ore*, affords ſome *Gold*: And in one Place I ſaw a great part of an Hill digg'd away, which hath been Caſt into the Works, Waſhed and Wrought in the ſame manner, as pounded *Ore*, with Conſiderable Profit.

Some Paſſages in this *Mine*, Cut through the *Rock*, and long diſus'd, have grown up again, and I obſerved the ſides of ſome, which had been formerly wide enough to carry their *Ore* through, to approach each other, ſo as we paſſed with Difficulty. This happens in Moiſt Places. The Paſſages Unite not from the Top to the Bottom, but from one ſide to another.

There is *Vitriol* in this *Mine*, *White*, *Red*, *Blew* and *Green*; and alſo *Vitriol Waters*. There is a Subſtance found, which ſticks to the *Gold Ore*, of ſmall Pointed parts like *Needles*, call'd by them *Antimony* of *Gold*. Here are *Cryſtals* found here, and ſome Tinctur'd *Yellow*.

The *Miners* will not allow any *Quickſilver* or *Brimſtone* to have been found here; yet in the lately mention'd *Antimony* of *Gold*, there is evidently *Sulphur*, as I perceived by Burning. The *Quickſilver Mine*, mention'd in the Anſwer to *Kircher*'s *Inquiries*. *Mund. Subter.* is an *Hungarian Mile*, or ſeven *Engliſh* Miles diſtant from *Chremnitz*; and is not wrought in at Preſent.

There is a *Vitriol Mine* in theſe Hills near the *Gold-Mine*; the *Earth* or *Ore* of it is *Reddiſh*, and ſometimes *Greeniſh*. This Earth is Infuſed in Water, and after 3 *Days*, the Water is poured off, and Boyled 7 *Days* in a *Leaden Veſſel*, till it comes to a Thick Granulated Whitiſh Subſtance, which

is

is afterwards Reduced to a *Calx* in an *Oven*, and ſerveth in the making *Aqua-fortis*, or the *Separating Water*, uſed at *Schemnitz*.

They have Divers ways of taking the *Gold* out of its *Ore*; by *Burning* the *Ore*; by Melting; by Adding *Silver Ore* and other *Minerals*, *Sand*, and *Lead*, as they find the *Ore* Fluid or Fixt. But without *Lead* they Proceed thus.

They Break and Pound the *Ore* in Water very Fine; they Waſh it often, and lay it in Powder upon Cloaths, and by the gentle Oblique Deſcending of the *Water* over it, and their continual Stirring it, the Earthy, Clayiſh, and Lighter Parts, are Waſht away, while the Heavier and *Metalline* Remain in the Cloaths; theſe Cloaths are afterwards Waſht Clean in ſeveral *Tubs*, and the Water after ſome Settling, Poured off from its Sediment, which Sediment is again Waſht, and ſtirred up in ſeveral Veſſels and Troughs, till at length they ſprinkle *Quickſilver* upon it, and Knead it well together for an *hour*, and then Waſhing it again in a Wooden Veſſel, after the Separating of much of it which the *Quickſilver* touches not; by ſtriking this Veſſel againſt their Leg, they bring the *Gold* and *Quickſilver* together, in an *Amalgama*, to one Corner of it. From this *Amalgama* they Strain as much of the *Quickſilver* as they can through Coarſe Cloaths firſt, and then through Fine; then they put the Maſs Remaining upon a Perforated Plate, which they ſet over a deep Pan placed in the *Earth*, in the Bottom of which Pan they alſo put *Quickſilver*; This Pan they Cover, and *Lute* the Cover well, and then making a *Char-coal-Fire* Upon it, they Drive down the *Quickſilver*, yet Remaining in the *Gold*, to the reſt in the bottom of the *Pan*; then taking out the *Gold*, they Caſt it into the *Fire*, that it may become Purer.

Concerning *Cranach-Gold*, *I* cannot Learn, that there is any ſuch *Gold*, or Place where *Gold* is digg'd, in *Hungary*: but in *Germany I* think there is, for *Agricola* mentions ſuch a Place as *Golde-Cranacum*, and another call'd *Golde-Crona*.

CXII. It is evident from undoubted Experiment, that *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 *Earth's Center*; ſince the Impediment 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 piece of *Glaſs* of the ſame Magnitude (their *Specifick Gravities* being nearly as 7 to 1) and conſequently, that at leaſt 6 parts of 7 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.

The Extreme Ductility, *and Exceeding Minuteneſs of the Conſtituent Particles of* Gold; *By Mr.* Edmond Halley n. 194. p. 540.

In order to Examine the *Magnitude* of thoſe *Atoms*, I informed my ſelf among *Wire-drawers* that the very beſt *Double-Guilt Wire*, was made out of Cylindrick 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 2 *Yards* of the *Superfine Wire* weighs a *Grain*. Hence at first Sight it appeared, 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 $\frac{1}{5}$ 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*. And by means of the *Specifick Gravities* of the *metals*, viz. *Silver* $10\frac{1}{3}$ and *Gold* $18\frac{2}{3}$. I found the Diameter of such *Wire*, the $\frac{1}{1880}$ part of an *Inch*, and its Circumference the $\frac{1}{5920}$ part: but the *Gold* in *Thickness* not to Exceed the $\frac{1}{1345\,00}$ part of an *Inch*; whence it may be Concluded, that the *Cube* of an *hundred* part of an *Inch* would contain above 2433000000, (or the *Cube* of 1345) of such *Atoms*. And yet tho' the *Gold* be Stretcht to so great a Degree as is here Demonstrated, it shews it self of so Even and United a Texture, as not to let the *White Colour* of the *Silver* under it appear (even with a *Microscope*) 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.

A Mineral like Leaf-Gold *near* Mexico; *By an* English *Gentleman at* Seville n. 41. p. 817.

CXIII. 1. *An.* 1664 I travelled into the Kingdom of *Mexico*, under the Character of a *Biscaner*, and remained in that Country about 2 *Years*.

Some of the *Minemen* shewed me certain *Stones*, gathered in great abundance in the *Mines* of *Tasco*, which they would have to be *Amethysts*,

There is a famous Cave, some *Leagues* from *Mexico*, on the North-west side of the City, beyond the *Lake*. I found it situated somewhat High, in a place very convenient for *Generation* of *metals*. The Light of a Candle soon discovered to me on all sides, but especially above my Head, a Glistering Canopy Guilded with a kind of *Leaf Gold*. I heaped together a quantity of the *Mineral* mixt with Sand, and scraped also from the Superficies of the Earth, a Quantity of the same kind of *Mineral Leaves*; none of which exceed the breadth of a Man's Nail; and with the least Handling they divide themselves into many Lesser Spangles; with a little Rubbing they leave ones hand all Guilded over like *Gold*; and they equalize the Most *Refined Gold* upon the *Touch stone*.

It is reported that the Antient *Indians* knew how tomake use of this *Mineral*. But the *Spaniards* have never been able to Reduce it into a *Massy* Form by the Violence of the *Fire* or *Seperate* it from Heterogeneous Substances by the Mild Tryal of *Quicksilver*. Some indeed of the Choisest *Mines* of *Silver* and *Gold*, are almost of the like Nature, till the Impediments are removed, which are certain *Mineral Viscosities*, that sometimes by their *Oleaginous* Fatness, and at other times by a Fretting *Acrimony*, hinder the Ingress of the *Mercury*.

To find out therefore a *Cure* for this Disease *I* begin to make Experiment on the *Sand*, which had been the *Matrix* of the *Mineral* *I* try'd it in a Strong *Reverberating Fire*, but it did not afford any *Visible Fumes*. *I* then boiled some

of

of it in Water, and having Poured that off, *I* obſerved the *Alcali*, left after the Waters *Evaporation*: and thereby I diſcovered, that it abounded rather in *Sulphureous Unctuouſneſs*, than *Saline Acrimony*. Finding this, I applied firſt the *Quickſilver* Mingled with the Ordinary *Magiſtrals* (as they call them) uſed in that Country, to Curb and Break the force of the *Sulphureous* Impediments. But perceiving theſe to be of no Effect, I Encouraged the *Quickſilver* with the *Caput mortuum* of *Vitriol* or *Salt Peter*, (kept as a *Secret* among the *Chief-eſt-Minemen*) but with as little Signs of the *Mercuries* operation as before. Then I *boyled* my Mixture over the Fire; a way found out in *Peru* in ſuch Difficult Caſes: but all to no purpoſe. Then I deviſed a way to Torment it with a *Corroſive* of Ordinary *Separating Water*, Impregnated with *Common Salt*, and it made a Diſſolution exactly like that of *Gold*: But having Steamed away the *Aqua Fortis*, I found a Dirt ſomething *Yellow*, out of which with *Diſtilled Vinegar*, enforced with its own *Tartareous Salt*, I Extracted a *Tincture* more Curious than Uſeful.

An Experienc'd *Mineraliſt Cemented* it with the Powder of *Vulgar Sulphur*, *ſtratum ſuper ſtratum*, and this in a *Moderate Fire* for 3 *days* together; hoping the *Sulphur* would Conſume all the Impediments, which kept the *Mercury*, from entring: But (as I told him before hand) it only Served to Clog the matter with more *Sulphureous Unctuoſity* than it had before.

2. When *Silver* is Generated (as commonly 'tis) in certain Rocky *Stones*, abounding with *Bituminous Corroſive* mixtures, ſo as 'tis Impoſſible to free it totally from its Corrupt *Matrix* by the Violent way of *melting*, what ever Auxiliary Ingredients may be added, as *Lead* and *Artificial Salts*, and the like becauſe thoſe *Sulphureous* and *vitriolick* Compounds, (in the way of *Fuſion*) meeting together with the *Silver*, *Sublime* part of it away, in a Volatile Fume, by their Corroding *Acrimony*, *Calcinating* and *Vitrifying* the other part, and Robbing the Artificer of half his Gain: in this caſe the *Uſe* of *Quickſilver* is found moſt Advantageous. The Practice thus.

The uſe of Mercury *in Separating* Silver *from the* Ore; *By the ſame* Engliſh Gentleman *ib.* p. 820.

Having Reduced the *Ore* into ſmall ſtones, they Calcine it firſt in a *Reverberating Oven*, yet with a *Moderate Fire* for fear of *Fuſion*, and Driving away into the Air part of the Treaſure; the *Volatile* parts being by nature not perfectly mixt *per minima* with the Fixt, as they afterwards come to be by Induſtry and Art. And I have heard ſome of the more Intelligent *Mineraliſts* ſay, that they Judge their *Metallick* Labors and Operations to be many times not ſo much a Reaping of *Silver* ready made, as a kind of Artificial Compounding, and Bettering of that, which Nature had left Diſperſed and Imperfect.

This *Calcination* ſerves, chiefly to free the *Mineral* from many Infirmities, that Hinder the Operation of the *Quickſilver*; and it ſerves alſo to Diſcover by the *Colour* of the *Fumes* it yields, what *Corroſive* mixture chiefly abounds in it: beſides that, it renders the *Ore* more Tractable and Pliant under the *Mill Stone*, which is to Reduce it to Small Flower, before the Application of the *Mercury*. This is chiefly obſerved in thoſe *Silver Veins*, that are of a Hard and Dry Complexion; yet thoſe which are uſually more *Soft*, abounding in

in *Oleaginous Sulphurs*, before *Burning*, are first ground into powder in such *Mills* as *I* have often seen in *Glass houses*, and then they Receive a Gentle *Calcination*, the *Mineralist* mingling therewith Suitable Ingredients. As if (*e. g.*) the *metal* be *Sulphureous* and *Antimonial*, *Rust* and *Dross* of *Iron* is found to be an excellent Cure of this Distemper: If *Martial*, and abounding in *Iron*, then *Sulphur* and *Antimony* reduced to Powder. And *I* have found by Experiment that *Sulphur* has a particular Force to *Soften* and *Dissolve Iron*.

The *Ore* being Ground, Calcin'd and curiously Sifted, they Divide it in several Heaps, and then by Lesser *Essays*, they find out how much *Silver* is contained in every Heap: where 'tis very Ordinary to find only 6 *ounces* in 100 *pounds*; sometimes 12; but if it yield 18, 'tis esteemeed a very Rich *Vein*; yet sometimes there are great *Masses* found all of *Pure Silver*, which is called *Virgin metal*. Then Proportionable to the Quantity of *Silver* in each Heap they besprinkle them with *Quicksilver*, and that not all at once, but at several times Stirring the *Ore* up and down. If the *Mercury* gives Signs of being *Tocado* (as they call it) *i. e.* if it appear *Mortified*, not in Small and Clear spherical Figures (which is a good Prognostick) but in the form of Long Worms of a Wan, Pale, Dark and Leadish Colour, (which indicate that the *Ore* abounds with *Lead* and *Pewter*,) it is Cured by certain *Magistrals* which have for their *Basis* or Master Ingredient *Calcin'd Copper* Mingled with *Salt*.

The Heaps of *Ore* being thus Mingled with *Quicksilver*, they are often Stirred about, the better to Incorporate it with the *Silver*. *I* find, that they have none but Conjectural *Signs* to know, when the *Mercury* hath entirely performed its Office in *Seperating* All the *Silver* from those *Heterogeneal* Substances: the Uncertainty whereof occasions often very great Losses, especially when they Work about *Gold*; for in Passing the Right Time, the greatest part of the *Gold* Flyes away in a *Fume*. But when by the Colour of the *Mercury*, *Coagulated* by the *Silver* in Clear Masly lumps, they Conjecture the Work done, they Wash it by means of *Three Vessels*, standing in order the one under the Other, so that, the Matter in the *First* and Highest Vessel being Washed and Stirred about with a *Molinet*, all the Dust of the *Heterogeneous Minerals*, that Imbody not with the *Mercury*, is carried away together with the Water into the other Vessels, and from thence is quite thrown out by the Continual Current of the Water; whereas in the mean while the *Silver* in clotted Lumps, called *Pella's*, is by the weight of the *Mercury* Depressed down to the bottom of the Tubbs. Then the *Mercury* with the *Silver* is taken out of the Vessels, and diligently Squeezed in Course and Strong Linnen, and even with strokes of a Beetle, the *Quicksilver* is *Separated* as much as may be from the *Silver*. And this Mass is afterwards Reduced, in *Molds* of the shape of the *Indian Pine apple*, into a *Pyramidal* or *Conical* Figure, which they call *Pineas de Plata*, thus fashioned for the easier placing them round about the ridges of a great Earthen Vessel, of the Form of a *Blind Alembeck*; round about the Top of which a Fire being made, all the rest of the *Mercury* forthwith abandons the *Silver*, and Falls to the bottom, from whence it is Recovered, and kept for the like use.

Lastly,

Lastly, The *Silver* is *melted* down with the *Liga*, (as 'tis call'd) which the King of *Spain* allows, by which he returns to the People in *Copper* that *Fifth Part*, which they allow him of all the *Silver*.

Vegetable Silver. *ib.* 823.

I have observed, that there is a very strong Offensive *Smell*, Ranker than that of *Sepulchres*, in some *Mines*: the Workmen telling me, that that is one of the *Chief Signs* of a *Rich Mine*.

A Friend of mine shewed me a very pretty Experiment more Curious than Gainful; it was a continual *Budding* forth of *Silver* in the Form of a *Branch*, in a Glass, over an indifferent strong *Fire* of *Coals*; which *Sprouts* being Clipped off with Sciffers, and a small supply of *Crude Mercury* added to the Matter, in a small time there arose another *Branch* of *True Silver*, which had sucked and Converted into *Metallick Sprigs*, a considerable portion of the *Quicksilver*. This Motion, and the Increment of New *Silver Branches* Ceased not, as long as the Fire was continued, and Fresh *Mercury* applyed, for the due Nutriment of this *Mineral Vegetation*. This whole Complex of Ingredients is known to consist only of Vulgar *Aquafortis* (abstracted from two Parts of *Vitriol*, and *one* of *Salt Peter*) and *Quicksilver*, and a small Quantity of *Silver*, far less than you may Reap in a small time from these *Silver Sprigs*. Yet *Gain* there is none, there being more Expences Blown away into Smoak, by the Continuance of *Fire* in *One Month*, than can be recovered from this *Silver Harvest* in a longer time.

I am of Opinion that in all *Transmutation* of *Metals* the *Imperfect Metal* is not totally *Transformed* into the more *Perfect*, by the Substance mixed with it: But that the Mixture added to the *Melted* Metal, joins it self, (as *I* conceive) to those Parts, which being *Homogeneal*, Symbolize together with the Nature of the more *Perfect*, whereby the *Pure Metalline* parts are seperated from the other *Heterogeneal Impure Sulphurs*.

CXIV. The End of *Refining* is the *Separation* of all other Bodies from *Gold* and *Silver*, which is performed 4 ways, *viz.* by *Parting*; by the *Test*; by the *Almond Furnace* or the *Sweep*; and by *Mercury*. 1. *Parting* is done with the *Aquafortis*. Some *Refiners*, to make the *Aquafortis*, take *Salt Peter* 3 *pound*, and *Dantzick* (not *English*) *Vitriol* 2 *pound* (for the *English Vitriol* makes a weaker Water, and a Dirty Colour'd *Verditer*, and wholly spoils it.) After they are well Bruised and Mixed in a *Morter*, they *Distill* 100 *pound* of the Materials, put into a *Cast-Iron* Pot, after this mannor.

The Art of Refining; *by Dr.* Chr. Merret. n. 142. p. 1046.

Parting.

Build a *Furnace* 2 Yards high or more; and at the top place in your *Iron Pot*: To which fit a *Head* of Earth, like the *Head* of a large *Distillation* for *Chymical Oyls*, which must have a large Belly, branching it self out 8 *Inches* from the *Iron Pot*, into 3 *Branches*; one whereof in the midst, comes directly straight forwards, two other Lateral ones come Obliquely: All which Branches are 4 or 5 *Inches* hollow in Diameter, and 5 or 6 long. To these *Branches* are fitted *Glass Bodies*, Narrow and Hollow at both Ends, Large and Globous in the midst. These must be exceedingly well *Luted* on with *Colcothar*, *Rags*, *Flower* and *Whites* of *Eggs*. To this first *Glass Body* is *Luted* on another *Glass*, of the same Figure and Size, and in order 8. alike

in

in all, till they come to the *Receiver*, which is an Ordinary *Gallon Glaſs*. All theſe Rows of *Glaſſes* lie on Boards, ſhelving from the *Head* to the *Receiver*. The two Upper *Receivers* or *Glaſs Bodies* need Exceeding good *Luting*, for the reſt Ordinary *Lute* will ſerve.

The *Lute* is made of good *Lome*, ſome *Horſe dung*, and a little *Colcothar*; although the two former do well.

A little *Fire* and that of *Newcaſtle-Coals* does the Work. And you need never Break or *Unlute* any of the *Receivers*, but the Lowermoſt.

The *Aquafortis* being *Diſtilled* off, is put into a large Earthen Pot, and there is added of *Fine Silver*, *one* or *two Penny weight* (which is called *Fixes*) to every *Pound* of *Aquafortis*, which within 4 *hours*, will Purge it from all Dirt and Impurity, and make it fit for *Parting*, which is thus done.

If their *Silver Guilt* be *Fine* enough for *Wire*, they only *Melt* it in a *Wind Furnace*, and Caſt it, *Melted*, into a large Tub of Water, that they may have it in ſmall Pieces; but if it be but *Standard*, they firſt *Fine* it on the *Teſt*. Theſe ſmall Pieces taken from the Water, being well Dryed, are put into a Glaſs Taper-faſhion'd, a *Foot* High, and 7 *Inches* at the Bottom; and then the *Glaſſes* are Charged with *Aquafortis* about 2 *thirds* of it, and ſet in a *Range* of *Iron* Covered 2 *Inches* deep wth *Sand*, and a *Gentle Char-Coal Fire* is made under it.

Small *Bubbles* will ſoon ariſe, and the Water alſo Run over. If ſo they take off the *Glaſſes*, and hold them till it doth *Defervеſcere*, or elſe pour out ſome of it into a Veſſel which is at Hand.

If *Lead* be Mixed with it, they cannot keep it from Running over.

When the *Water* hath been once *Quieted*, from this *Ebullition*, it will Riſe no more.

The *Greenneſs* of the *Water*, manifeſteth the Quantity of *Copper* contained in it.

If the *Water* Boil over, 'twill *Penetrate* the *Bricks* and *Wood*.

They commonly let it ſtand a Night on the *Iron-Range*, with a *gentle Heat* under it, and in the Morning ſoftly Pour off the *Water* Impregnated with all the *Silver*; all the *Gold* lying like Black Dirt at the bottom; which being Waſhed out is put into ſmall *Parting-glaſſes*, and ſet over the *Sand* with their *Conduit Water* for an *hour*, and then the Water Poured off. This is repeated 5 or 6 times, to *Seperate* the *Salt* from the *Gold*, which is now fit to be *melted*, and *Caſt* into *Ingots*.

To Regain the *Silver*, they have large Round *Waſhing Bowls*, lined within with Melted Roſin and Pitch (for otherwiſe the *Water* would eat the Wood and penetrate the ſides of the *Bowl*) Covered with *Copper Plates* 10 *inches* long, 6 wide, and *Half* or more Thick. Into which *Bowls* they pour good ſtore of Water (the more, the better the *Verditer*) and then the *Silver-Water*; which Working on the ſofter Metal of *Copper*, leaves all the *Silver* in moſt fine Sand at the Bottom, and Sides of the *Bowl*, and *Plates* of *Copper*; which being taken out, is Waſhed, Dryed and Melted for any Uſe.

If any *Braſs* or *Shroffe Metal* be in the *Plates*, they gather very little of the *Silver*; the Latter Mixing with the Silver.

With

With the *Copper-water*, poured off from the *Silver*, and *Whiting*, *Verditer*, is made thus. They put into a Tub a *Hundred Pound* weight of *Whiting*, and thereon pour the *Copper-Water*, and ſtir them together every day, for ſome *Hours* together. And when the Water Grows Pale, they take it out, and ſet it by for farther Uſe, and pour on more of the *Green water*; and ſo continue till the *Verditer* be made; which being taken out, is laid on large pieces of *Chalk* in the *Sun*, till it be dry for the Market.

The Water mention'd to be taken from the *Verditer*, is put into a *Copper*, and Boiled till it comes to the Thickneſs of Water-Gruel, now principally conſiſting of *Salt Peter* Reduced, (moſt of the *Spirit* of *Vitriol* being gone with the *Copper* into the *Verditer.*) a Diſh full whereof being put into the other Materials, for *Aquafortis*, is Re diſtilled, and Makes a *Double-water*, almoſt Twice as good as that without it.

2. By the *Teſt*, all *Metals* are *ſeparated* from *Silver*, except *Gold*, becauſe they Swim over it, when they are all *melted* together. *The Teſt.*

The *Teſt* is thus made. They have an *Iron Mould*, Oval, and two *Inches* Deep. At the Bottom hereof are 3 *Arches* of *Iron*, ſet at Equal Diſtances, 2 Fingers wide, if the great Diameter of it be 14 *Inches* long; and ſo proportionably in Greater or Leſſer *Teſts*. This Cavity they fill with Fine Powder of *Bone-Aſhes*, moiſtened with *Lixivium*, made with *Soap-Aſhes*. Some uſe Cakes of *Pot-Aſhes*, or other *Aſhes* well Cleanſed, and ſo preſſed well together with a *Muller*, that it becomes very Cloſe and Smooth at the Top. There is left above, a *Cavity* in the Midſt of it, to Contain the *melted Silver*. This *Cavity* is made greateſt in the Middle; for the *Bone-Aſhes* come up Parallel to the Circumference of the *Mould*; only a ſmall *Channel* in that End, which is moſt remote from the *Blaſt*, for the Running off of the *Baſer Metals*, and ſo is made *Declive* to the Center of the *Teſt*, where 'tis not above half an *Inch* deep.

The *Teſt* thus made, is ſet *Annealing* 24 *Hours*, and then 'tis ſet in a *Chimney* a Yard High, Parallel almoſt to the Noſe of a Great Pair of *Bellows*; and then therein is put the *Silver*. Which being Covered all over with *Billets* of *Barked Oak*, the *Blaſt* Begins, and Continues all the while ſtrongly. The *Lead*, purify'd from all *Silver*, (which they call the *Soap* of *Metals*) firſt put in, *melts* down with the *Silver*, and then the *Lead* and *Copper* ſwim at the Top, and run over the *Teſt*. Whoſe Motion the *Refiner* helps with a long Rod of *Iron* drawn along the Surface of the *Silver* towards the fore-mention'd *Slit*; and often ſtirring all the Metal, that the *Impurer* may the better Riſe; and by continuing this Courſe, *Separation* is made in 2 or 3 *Hours*.

The greateſt part of the *Lead* flies away in *Smoak*.

If the *Lead* be gone before all the *Copper*, 'twill riſe in ſmall Red fiery Bubbles; and then they ſay the *Metal Drives*, and muſt add more *Lead*. The force of the *Blaſt* Drives the Higher *Metals* to the lower ſide of the *Teſt*, and helps its Running over.

When the *Silver* is fully *Fined*, it looks like moſt pure *Quickſilver*; and then they take off their *ſegs* and let it *Cool*. In the *Cooling*, the

Silver will frequently from the middle, Spring up in ſmall *Rays*, and fall down again. If *moiſt Silver* be put into that which is *melted*, 'twill ſpring into the Fire.

A good *Teſt* will ſerve two or three *Firings*.

So ſoon as the *Silver* will hold together, they take it out of the *Teſt*, and Beat it on an *Anvil* into a Round Figure, for the *Melting-Pot*; which being ſet in a *Wind-Furnace*, ſurrounded with *Coal*, and Covered with an *Iron-Cap* that no *Charcoal* fall into it, is then *melted*.

If any *Droſs* or *Filth* be in the *Melting-Pot*, they throw in ſome *Tincal*, which gathers the *Droſs* together, that it may be ſeperated from it.

Theſe *Melting-Pots* are never *Burned*, but only *Dryed*, and laſt a whole *Day*, if they be not ſuffered to *Cool*; but if they once *Cool*, they infallibly *Crack*.

The Almond Furnace.

3. In the *Almond-Furnace* or *ſweep*, all ſorts of *Metals* are *ſeperated* from *Cinders*, parts of *melting Pots*, *Teſts*, *Brick*, and all other Harder Bodies; which muſt be firſt Beaten into ſmall Pieces with a *Hammer* on an *Iron-Plate*.

Thoſe which ſtick but ſuperficially to the *Silver*, they *Waſh* off thus; they have a Wooden Round Inſtrument 2 *Foot* wide, ſomewhat Hollow in the Middle, with a Handle on each ſide. On this they put the Materials, and hold them in a Tub of Water below the Surface, and ſo Waving it to and fro, all the *lighter* and *looſer* matter is *ſeperated* from the *Metal*.

The *Furnace* is 6 *feet* High, 4 *feet* Wide, and 2 *feet* Thick, made of Brick; having a Hole in the midſt, at the top 8 *Inches* over, growing Narrower towards the Bottom of it, where on the fore-part, it Ends in a ſmall Hole, environed with a Semicircle of *Iron*, to keep the *Molten Metal*. About the Middle of the Back, there is another Hole to Receive the Noſe of a Great pair of *Bellows*.

When the *Furnace* is *Annealed* with Charcoal and Hot, they throw two or three Shovels of Coal, to one of the fore-mention'd Stuff, and ſo Proceed during the whole Work, which continues three *Days* and *Nights*, without Intermiſſion. After Eight or Ten *Hours* the *Metal* begins to Run; and when the Receiver below is pretty full, they lade it out with an Iron Ladle, and Caſt it into *Sows* in Cavities, or Forms, made with *Aſhes*.

They frequently ſtop the *Paſſage-hole* with *Cinders* to keep in the Heat; and when they think a Quantity of *Metal* is *melted*, they Unſtop the *Hole* to paſs it off.

If the Stuff be hard to *Flux*, they throw in ſome *Slag* (which is the *Recrement* of *Iron*) to give it *Fuſion*.

A ſtinking Blew *Smoak* proceeds from the *Furnace*, and all By-ſtanders put on the *Colour* of *Dead men*.

By Quickſilver.

To get the *Silver* from thoſe *Metals*, and to *Refine* their *Copper* from the *Litharge*, they now uſe no other Art than that of the *Teſt*.

4 By

4. By *Quickſilver* the *Filings* of *Gold* and *Silver* are *ſeparated* from *Duſt &c.* This *Duſt* is put into a Hand-Mill with *Quickſilver*, and being continually Turned upon that and the Metals, an *Amalgama* is made of them, and Fair Water Poured in, carries off the *Duſt* as it runs out again by a ſmall Quill. *By* Quickſilver.

This *Amalgama* is put into an Iron, with a *Bolt-head* ſet into the *Fire*, having a long Iron *Neck* 3 *Feet* long, to which is fitted a *Receiver*. The Fire *Diſtills* off the *Mercury* into the *Receiver*, and the *Gold* and *Silver* remain in the *Bolt Head*.

CXV. 1. There was taken of *Crown-Gold* (which is as they call it, of 22 *Kerats* Fine, or $\frac{11}{12}$; and the *Alloy* is part *Silver*, part *Copper*, more of the *Copper* for the moſt part) to the Quantity of 178 *Grains*. This was melted down with 2 *Ounces* and 2 *Drachms* of *Antimony* (about 6 times as much as the *Gold.*) And becauſe the *Gold* was put in *Plates*, for the more certain *Melting* and *Mixture*; the *Firſt Regulus* of *Gold* being ſeperated from the *Antimony*, both were Powdered apart, and the *Regulus* in the *Melting-Pot* laid upon the *ſame Antimony*, and ſo both *Melted* down again. In both which *Meltings*, ſuch an *Heat* was given, as made all of a clear Light, even Red Hot, and Boiling. Then the *Pot* was taken out of the *Fire*, and all permitted to *Seperate*, *Settle*, and *Cool in it*. Upon the Breaking the *Pot* the *Regulus* of *Gold* (being very Diſtinct in the bottom, and Eaſily *ſeperated* from the *Antimony*) weighed 163 *grains*. *Experiments of* Refining Gold *with* Antimony; *by Dr.* Jonath: Goddard. n. 138. p. 953. *With freſh Antimony.*

N. B. That this Way of *Cooling* All *in the Pots* was Obſerved in all the following Experiments, for the more certain *Seperation* and *Settlement* of the *Regulus*, without *Effuſion* into the *Antimony-Horn* (as they call it) or Hollow *Iron Cone*. Which *Effuſion* by *Confounding* and *Cooling* the Mixture may be ſome hindrance to a more perfect *Separation*. And to be ſure, in the bottom of the *Cone*, there is always a Thin Cruſt of the *Crude Antimony*, troubleſome to be *Seperated*, without taking off ſome part of the *Regulus*.

Note alſo, That *Borax* was uſed in every *Pot*, for prevention of the ſticking of the *Regulus* to the Bottom, and the *Antimony* to the ſides of it; ſo that both were gotten off Clean, and in full Quantity.

Of the *Regulus* a piece was broken off, which weighed $38\frac{1}{2}$ *grains*, and was kept to be *Refined* upon the *Coppel* apart; the Weight of the Remainder therefore was $124\frac{1}{2}$ *grains*, which being Powdered and put upon $2\frac{1}{4}$ *Ounces* of *freſh Antimony* and *melted* down, the *Regulus* Weighed 74 *grains*.

The other Piece of $38\frac{1}{2}$ *grains* being *Refined* on a *Coppel*, from the *Antimonial* Subſtance mixed with it, (by *Exhalation*, promoted ſome time with a *Blaſt* upon it, eſpecially toward the latter end, as in all the following Experiments of *Refining* upon the *Coppel*) $30\frac{1}{2}$ *gr.* and upon *melting* with *Borax* in a *Crucible*, loſt not above *half* a *grain*. So that the Weight of the whole to the *Gold* it held, was as $38\frac{1}{2}$ to $30\frac{1}{2}$, or the *Gold* almoſt $\frac{5}{6}$ of the whole. The Latter *Regulus* Weighing 74 *gr.* being *Refined* in the ſame manner,

Weighed 63 *gr.* the *Gold* holding Proportion to the whole, as 63 to 74; that is, near upon $\frac{6}{7}$ of the whole. So that the ſame *Regulus* of *Gold* and *Antimony*, in paſſing through *New Antimony*, though it loſe in Weight, yet it is Richer in *Gold*; and appears ſo to Senſe, being of a *Redder* Complexion, more Tough and Harder to Powder.

Both the parcels of *Antimony* were ſeverally Mixed, with equal weight both of *Tartar* and *Nitre*, and then *Fired*, and ſo reduced to a *Regulus*. Then the *Regulus* of each, *Exhaled*, and Blown off upon *Coppels*. Of the *Firſt* Parcel of *Antimony* wherewith the *Gold* was firſt Melted, the *Regulus* being *Exhaled*, there remained in *Gold* 36 *gr.* Which upon *melting* in a *Crucible*, loſt ſomewhat, but ſcarce $\frac{1}{2}$ *gr.*

Of the *ſecond* Parcel of *Antimony*, wherewith the *Firſt Regulus* of *Gold* and *Antimony*, weighing $124\frac{1}{2}$ *gr.* was Melted, there remained in *Gold* 27 *grains.*

All the other Parcels were *fine Gold* to Senſe, upon the *Touch.* Only that out of the *Firſt Antimony*, was apparently *Unfine* and *Pale*, from the *Silver* in the *Original Alloy* Mixed with it, as appeared by Comparing on the *Touch-ſtone*, with *Sovereign Gold Allayed* with *Silver*; holding (to the judgment of Senſe) about a *fourth Part* of *Silver*, as the *Sovereign Gold* doth a *ſixth.* Neither was it altogether free from *Copper*; becauſe upon *Nealing*, it always turned *Black* on the Surface. But for more exact Diſcovery, it was taken and firſt *Refined* with *Lead* upon a *Coppel*, for *Seperation* of any *Copper* that might be in it. Upon which Operation it came forth $33\frac{1}{2}$ *grains*, which was $2\frac{1}{2}$ *grains* leſs than it was before. Afterwards this Laſt was *melted* with betwixt *two* and *three* parts of *Silver*, and ſo wrought in *Aqua fortis*, for *Seperation* of the *Silver:* And there Remained in *Gold* but $28\frac{1}{2}$ *grains*, and yet it appeared upon the *Touch*, not *Fine*, but Paler than *Fine Gold*, and deeper than *Crown Gold* allayed with *Silver.* So that what remained in it, was neceſſarily of *Silver*; and it might be eſtimated about twenty three *Keratts Fine*; or to hold in *Fine Gold* about twenty ſeven *grains.* What Loſs of *Gold* was upon this *Refining* with *Antimony*, may be eaſily Computed. Firſt, $14\frac{5}{6}$ *grains* for *Alloy*, being Deducted from the Firſt Quantity of *Crown Gold*, Weighing 178 *grains*, the Remainder is $163\frac{1}{6}$ *grains.* Then the ſeveral Parcels of *Fine Gold* was Recovered and *ſeperated* from the *Regulus* of *Antimony* and *Gold*, and alſo from the Parcels of *Crude Antimony*, Reduced to *Regulus*, are to be added together; that is, 30 *grains*, 63 *grains*, 27 *grains*, and 27 *Grains*, all which Amount to 147 *grains*, which being Deducted from the Firſt Quantity of $163\frac{1}{6}$, the Difference is $16\frac{1}{6}$ *grains*, which is more than $\frac{99}{1000}$, or very near a *Tenth.*

Where and how this Loſs of *Gold* ariſeth, it appears thus. The *Firſt* parcel of the *Antimony*, was Charged with $163\frac{1}{6}$ *grains* of *Fine Gold*; of which the *Firſt Regulus* Weighing 163 *grains* (in proportion to that piece of it Weighing $38\frac{1}{2}$, and producing upon *Refining* on the *Coppel* 30 *grains*) muſt hold 127 *grains* of *Fine Gold.* Then 27 *grains*

of

of *Fine-Gold*, Eſtimated to be Contained in the 36 *gr.* Separated from this *Firſt* Parcel of *Antimony*, being added to the 127 *gr.* makes 154 *gr.* which is ſhort of 163½ *gr.* by 9½ *gr.* and ſo much was Irrecoverably Loſt in this Parcel of *Antimony*.

Then the Piece of *Regulus* Weighing 124½ *gr.* *Melted* with the *Second* Parcel of *Antimony* (in Proportion to the former piece broke off, Weighing 38 *grains*, and upon *Refining* yielding 30 *grains* of *Pure Gold*) muſt contain 98 *gr* of the *Like Gold*; and ſo much this *Second* parcel of *Antimony* muſt be Charged with. Towards which the *Regulus* Weightng 74 *gr.* being *Refined* produced 63 *gr.* and that *Gold*, Separated from this 2*d.* Parcel of *Antimony*, Weighing 27 *gr.* being added, make 90 *gr.* ſhort of the Firſt quantity Charged upon this part of the *Firſt Regulus* by 7 *gr.*

Some loſs of *Gold* may be upon Powdering of the *Regulus*, as alſo by the papers neceſſarily uſed: but the greateſt Loſs was by ſmall Sparks, which continually Fly up, while the *Antimony* is in a Boiling Heat with the *Gold*, many whereof Fly over the *Pot* into the Fire. That theſe ſparks were *Gold* appeared thus, when many of them Stuck to an Earthen Cover, and had Coloured it of a Deep Red, *Aquafortis* did not Fetch off or Diſſolve any thing, but *Aqua Regis* run off it *Yellow*, like a *Solution* of *Gold* in the ſame *Water*.

Some Loſs of *Gold* may alſo be upon the *Firing* of the *Antimony* with *Tartar* and *Nitre*, which make a Vehement *Conflagration* with abundant Sparkling.

It hath been Suſpected that ſomewhat of the *Gold* may be Diſſipated by the *Blaſts* upon the *Coppels* in *Refining* it from the *Antimony* remaining in it. But this is not ſo Probable, becauſe when *Refiners* to give their *Fine-Gold* a Higher Colour for *Gilding*, put to it a *Third* or *Fourth* part of *Crude Antimony*, or of *Regulus* of *Antimony* (which is a Conſtant practice among ſome of them) and with a great Heat and Strong *Blaſt* work it off; in which Operation, in ſome *Ounces* of *Gold*, they Loſe not *one Grain*.

2. There was taken of *Crown-Gold* 141½ *gr.* which was *Melted* with 1¾ *ounce* of *Antimony* and the *Regulus* Weighed 123 *gr.* from this a piece Weighing 30 *gr.* was broken off, and Reſerved for *Refining* by it ſelf; the Remainder, being 93 *grains*, was *Melted* down again with the *Same Antimony*, being powdered and put on the Top: and thereupon the *Regulus* came forth, weighing 91 *gr.* So that here was no Conſiderable Loſs. And there is Ground to Suſpect, that it might be upon ſome Accidental Difference in the Managing, that the *Regulus* did not ſo perfectly *Separate* and *Settle*: for in all other Experiments of *Melting* the *Same Regulus* again with the *Same Antimony*, the *Regulus* Gained Weight. *With the ſame Antimony ib.* p. 958.

From this 2*d. Regulus*, a piece was broken off and reſerved for *Refining* a part, weighing 36 *gr.* the Remainder being 55 *gr.* was *Melted* down, as the Former, and in the *Same Antimony*. Whereupon the *Regulus* came forth in weight 72 *gr.* 17 *gr.* being here Gained.

The

The *First* Piece of 30 *gr.* being *Refined* upon the *Coppel*, produced of *Fine-Gold* 24 *gr.* and the 2*d.* Piece of 36 *gr.* produced 28 *gr.* and the *Regulus* (upon the 3*d Melting*) of 27 *gr.* Produced 55 *gr.* So that each of the Pieces contained abut 4 *fifths* of *Gold*, and but *one* 5*th* of *Antimonial* Substance in it, yet Losing something of that Proportion at each *Melting*, tho the *Regulus Gained* weight; Both which are contrary, in Repeating the *Melting* of the *Regulus* with *Fresh Antimony*, as in the Former Experiments.

The Remaining *Antimony* being Reduced to a *Regulus* by *Firing* with *Nitre* and *Tartar*, as before, and that *Regulus* Exhaled upon the *Coppel* there remained of *Gold* 19 *gr.* This was Less *Fine* than that Fetched out of the *First Antimony* in the former Experiment. But this *Impurity* was wholly from the *Alloy*: and upon *Refining* it, First with *Lead* upon the *Coppel* for Fetching out the *Copper*, it weighed $17\frac{1}{2}$ *gr.* having lost $1\frac{1}{2}$ *gr.* and then with the *Aquafortis*, after the *Melting* down with more than the Double Weight of *Silver*, upon which operation there Remained 15 *gr.* and that not *Perfect Fine*, but retaining somewhat of *Silver*; but *Finer* than *Crown-Gold* Allayed with *Silver*; upon the *Touch*, about 23 *Kernals*.

The Loss of *Gold* is thus Computed. From the First Quantity of $141\frac{1}{2}$ *gr.* a 12*th.* part or about $11\frac{5}{6}$ *gr.* being Deducted for *Alloy*, the Remainder is $129\frac{4}{6}$ *gr.* And the several Parcels of *Fine Gold* produced of the *Regulus*, according to the account given in particular, being 24 *gr.* 28 *gr.* 55 *gr.* $14\frac{1}{2}$ *gr.* all together make $121\frac{1}{2}$ *gr.* short of the First Quantity by $8\frac{1}{6}$ *gr.* or very near one *Sixteenth*.

By Exhaling *the Whole Antimony ib.* p. 960

3. A parcel of *Crown-Gold*, weighing $82\frac{1}{2}$ *gr.* was *Melted* down with an *Ounce* of *Antimony*, and the *Antimony* was *Exhaled* in the *Crucible* to a *Regulus*. Then the *Antimonial* part of that *Regulus* was *Exhaled* on a *Coppel*: Whereupon there Remained 84 *gr.* or $1\frac{1}{2}$ *gr.* more than the First Quantity. This must Happen, for want of a Heat Strong enough at last to Force off All the *Antimonial* Substance. Whence afterward, upon *Melting* in a *Crucible* it came forth 80 *gr.* the $2\frac{1}{2}$. Wanting, being Less than the Least part of the Proportion of *Copper*, that must be in it, according to the Usual *Alloy* of *Crown-Gold*. And that there Remained *Copper* in this *Gold* appeared by the *Black* Complexion of it upon *Nealing*; As also by the Loss upon Working it with *Lead* on a *Coppel*: whereupon it came forth only 76 *gr.*

So that *Antimony* in a far Greater Proportion, doth not so much, as *Lead*, in *Exhaling* or *Separating Copper* from *Gold*; if the work be done meerly by *Exhalation*: but doth only Retain it with it self, whilst the *Gold* Separates and *Settles* in a *Regulus* at the bottom. Neither is it so Destroyed but that it may, in part at least, be United to the *Gold* again.

CXVI. Papers *of leſs general Uſe*, Omitted.

1. Articles of Inquiries concerning *Mines*; by Mr. *Rob. Boyle.* n. 19. p. 330.

2. Some Uſes of *Vaul s* and *Cold Conſervatories* in diſcovering *Minerals*, intimated; by Dr. *Jo. Beale.* n. 56. p. 1136.

3. Several *Coal-Boreings* near *Leeds* in *Yorkſhire*, in the Year 1659, for the Concerns of a private Family; Communicated by Dr. *M. Liſter.* n. 250. p. 73.

4. Enquiries concerning *Quarries* and *Stones*, and the Ancient way of *Tempering Tools*, for *Cutting Porphyry* and other Hard *Marbles.* n. 93. p. 6012.

5. Several *Curioſities* relating to *Amber*, lately ſent to the *R. Society* from *Philippus Jacobus Hartmannus:* and which are now in their *Repoſitory* at *Greſham College.* n. 249. p. 49.

6. Enquiries about the *Salt-Springs* in *Worceſterſhire* and *Cheſhire*; by Dr. *Beale.* n. 28. p. 359.

7. Queries concerning *Salt-Petre.* n. 193. p. 503.

8. The way uſed in the *Mogul*'s Dominions, to make *Salt Petre.* Extracted from Mr. *Thevenot*'s *Voyages.* n. 6. p. 103.

9. Some *Natural Curioſities* ſent the *Royal Society* from *Sicily*; by Dr. *Pet. Silveſter.* n. 265. p. 632.

CXVII. Accounts *of Books* Omitted.

1. The *Mundus Subterraneus* of *Athanaſius Kircher.* n. 6. p. 109.

2. *Admirandorum* Foſſilium, *que in Tractu* Hildeſheimenſi *reperiuntur, Deſcriptio; Iconibus Illuſtrata; a D.* Frederico Lachmund Hildeſheimi, 1669; in 4*to.* n. 77. p. 3016.

3. *Lezzioni alla Natura delle* Moffette, *&c.* Diſcourſes concerning the Nature of *Damps*; by *Leonardus Capuanus*; a Member of the *Academy* of the *Inveſtigantes. Naples*, 1683. In 4*to.* n. 207. p. 38.

4. *Diſſertationes Medico Phyſicæ de* Antris Lethiteris; *de Montis* Veſuvii Incendio; *de ſtupendo* Oſſium Coalitu; *de Immani* Hypogaſtrii *ſarcomate*; *à* Bernardo Connor, *M. D.* Oxon. 1695. in 8*vo.* n. 219. p. 215.

5. Franc. Travagini, *ſuper Obſervationibus à ſe factis tempore Ultimorum* Terræ-Motuum, *ac potiſſimum* Raguſiani, *Phyſica Diſquiſitio*; *ſeu, Gyri Terræ Diurni Indicium.* Lugduni Bat 1669 in 4*to.* n. 60. p. 1084.

6. *Hiſtoria & Meteorologia* Incendii Ætnæi, *Anni* 1669. Joh. Alph. Borelli. Regio Julio. 1670 in 4*to.* n. 75. p. 2264.

7. *Epiſtola ad* Regiam Societatem Londinenſem; *qua de Nuperis* Terræ-Motibus *diſſeritur, & veræ eorum cauſæ eruuntur.* Lond. 1693 *in* 4*to.* n. 203. p. 893.

8. A Philoſophical Eſſay declaring the probable Cauſes of *Stones* in the greater World, in order to find out the Cauſes and *Cure* of the *Stone* in the *Kidneys* and *Bladder* of *Men*; by Dr. *Tho. Sherly. Lond.* in 8*vo.* n. 81. p. 4030.

9 Hiſtoire

n. 23. p. 419. 9. Hiſtoire des *Joyaux* & des Principales Richeſſes de l'*Orient* & de *l'Occident* ; par le Sieur *Chapuzeau.*

n. 84. p. 4095. 10. An Eſſay about the Origine and Vertues of *Gemms* ; by the Honourable *R. Boyle*, Eſq. *Lond.* 1672, in 8*vo.* The ſame in *Latin.*

n. 87. p. 5082.

n. 67. p. 2039. 11. *Eraſmi Bartholini* Experimenta *Criſtalli Iſlandici Diſ-Diaclaſtici* ; quibus Mira & Inſolita *Refractio* detegitur. *Hafniæ.* 1669.

n. 28. p. 538. 12. Hiſtoria *Ambræ-Griſeæ* ; Auth. *Juſto Klobio.*

n. 263. p. 573. 13. Deſcription de la piece de *Ambergris* que la Chambre d'*Amſterdam* a recue des *Indes Orientales*, peſant 182. *Livres* : Avec un petit Traite de ſon Origine & de ſa Vertue ; par *Nicolas Chevalier.* a *Amſter.* 1700. in 4*to.*

n. 58. p. 1202. 14. *Jo. Ludov, Ganſii* M.D *Coralliorum* Hiſtoria. *Francofurti.* 1669. in 12°.

n. 61. p. 2008. 15. The Natural Hiſtory of *Nitre*, or a Philoſophical Diſcourſe of the Nature, Generation, Place, and Artificial Extraction of *Nitre*, with its Vertues and Uſes; by *Will. Clark. Lond.* 1670. in 8*vo.*

n. 40. p. 810. 16. Scrutinium Chymicum *Vitrioli.* Auth. *Joh. Georgio Trumphio. Fenæ.* 1667. in 4*to.*

n. 71. p. 2162. 17. *Theod. Kerkringii* M. D. Commentarius in *Currum Triumphalem Antimonii Baſil. Valentini* ; à ſe Latinitate donatum. *Amſtelodami.* 1671. in 12°.

n. 176. p. 1208. 18. *Frederici Hoffmanni* Fred. Fil. M. D. Exercitatio Medico-Chymica de *Cinnabari Antimonii. Lugd. Bat.* 1685. in 8*vo.*

n. 60. p. 1086. 19. De *Lacte Lunæ* diſſertatio Medica, *Joannis Danielis Majoris*, Ph. & M D. *Kiloni.* 1667. in 4*to.*

n. 66. p. 2034 20. *Metallographia*; or an Hiſtory of *Metals* ; by *Jo. Webſter*, Practitioner in Phyſick and Chyrurgery. *Lond.* 1670. in 4*to.*

n. 108. p. 187 21. 1. The *Firſt* Book of the *Art of Metals* ; written in *Spaniſh* by *Alonſo Barba, &c.* and *Engliſht* by the Right Honourable *Edward* Earl of *Sandwich*, *Lond.* 1674. in 8*vo.*

n. 109. p. 211. 2. The *Second* Book of the *Art of Metals* ; wherein is taught the common way of *Refining Silver* by *Quickſilver* ; with ſome new Rules added for the better performance of the ſame ; Written in *Spaniſh* by *Alonſo Barba* ; and *Engliſhd* by the Right Honourable *Edward* Earl of *Sandwich*, *Lond.* 1674. in 8*vo.*

Ph. Col. n. 3. p. 80. 22. Prattica Minerale del Marcheſe *Marco Antonio* della *Fratta*, in *Bologna*, 1678. in 4*to.*

n. 147. p. 189. 23 *Fleta Minor*, or the Laws of Art and Nature in Knowing, Judging, and Aſſaying, Fining, Refining, and Inlarging the Body of Confined *Metals, &c.* By Sir *Jo. Pettus.*

n. 132. p. 814. 24. A Touchſtone for *Gold* and *Silver Wares* ; or a Manual for *Goldſmiths*, and all other Perſons, whether Buyers or Sellers, or Wearers of any manner of *Goldſmiths* work, *&c.* By *W. B.* of *London*, Goldſmith. in 8*vo.*

n. 74. p. 2232. 25 *Joh. Joachimi Becheri Spirenſis* Med. Doct. Experimentum Chymicum Novum, quo Artificialis & Inſtantanea *Metallorum generatio* & *Tranſmutatio* ad Oculum Demonſtratur. *Francofurti.* 1671. in 8*vo.*.

CHAP.

CHAP. IV.

Magneticks.

I. 1. A conſiderable *Load Stone* was digg'd out of the ground in *Devonſhire*, which weighed 60 *l.* It takes up no great weight, yet it Moves a *Needle* about 9 *Foot* diſtant. Some Part of it was broken off, which being put in its proper place, adds much ſtrength; for without that, it Moves not much more than 7 *foot*.

Loadſtone *found in* Devonſhire; *by Dr.* Edw. Cotton. n. 23. p. 423.

2. I can aſſure you, that thoſe *Courſes*, *Veins* or *Loads*, where *Loadſtones* are found in the Lower parts of *Devonſhire* (either as they lye ſparingly here and there amongſt *Iron Ore*, or as they lie in conſiderable Bodies with it) do all generally run *Eaſt* and *Weſt*; which is contrary to the Imagination of thoſe who have thought that the *Loadſtone* gave a *Northerly Direction*, becauſe its Natural Poſition in its *Mine* was (as they fancied) *North* and *South*.

By Mr. J. Beaumont. *Ph. Col.* n. 1. p. 8.

II. 1. A Noble Perſon did affirm, That a *Needle* of a *Sea-Compaſs*, put in a good *Iron Mine* (which, he ſaid, yielded 23 *Pounds* of Metal, out of 120 *pounds* of Ore) was not ſenſibly Moved thereby.

Magnetical *Obſervations*; *by* —— n. 23. p. 423.

2. Intelligent Perſons ſay, That all the *Perfection* of our *Sea-Compaſſes*, as yet, conſiſted in this, That the *Needle* be touched by good *Loadſtones*, and well *Librated*, and that the *Variation* be truly Placed.

3. I have often made Tryal with many *Needles*, *Touching* them in each *Hemiſphere* of the *Stone*, with all Variety of ways I could imagine, to find if it were poſſible by that means, to cauſe any of theſe *Needles* to Vary in its *Direction*; but all of them Conform'd to the *Magnetical Meridian*, ſtanding *North* and *South*, as other *Needles*, that were *Toucht* upon the very *Pole* of the *Stone*.

By Mr. Sellers. n. 23. p. 423. n. 26. p. 478.

All *Needles* Toucht upon Different *Loadſtones*, of ſeveral Bigneſſes and Different Virtue, in all Parts of the World, Agree in this *Magnetical* Harmony, that they all give the *ſame Directions*.

Having ſometimes drawn a *Needle* only over the *Pole* of the *Stone*, within the *Sphere* of its *Vertue*, without at all *Touching* the *Stone*; it hath received the *ſame Directive* Quality, though not altogether ſo ſtrong as if it had been really *Toucht* upon the *Stone* it ſelf. I have alſo *Toucht Needles* with faint Strokes, and other *Needles* with ſtronger; all theſe *Needles* received the ſame Effect upon the *Stone*, both for *Strength* and *Direction*. But the nature of the *Steel*, whereof the *Needle* is made, and the *Temper* that is given thereunto, cauſeth different Effects, as to the *ſtrength* it receiveth from the *Stone*. So that I can infuſe ſuch *Vertue* into a piece of *Steel*, that it ſhall take up a piece of *Iron* of 2 *Ounces* Weight or more; and give alſo to a *Needle*, the vertue of Conforming to the *Magnetical Meridian*, without the help of a *Loadſtone*, or any thing elſe, that hath received Vertue therefrom.

By Mr. Sam. Colepreſs, n. 27. p. 500.

4. I took a *Loadſtone* Unpoliſhed, which *Attracted* but meanly; and *I Heated* a *Lath-Nail* Glowing Hot, nimbly applying the *North-Pole* of the ſaid *Magnet* to it, which quickly took it up, and Held it ſuſpended. Then I caſt the *Stone* into the Fire, and when it was *Red Hot*, I applyed the *North Pole* to another *Lath Nail* Cold and Untouch'd before, which it took up but *faintly*, yet held it ſuſpended. Two or three *Days* after, *I* found that the *Loadſtone* Attracted then as ſtrongly, as before it was caſt into the *Fire*.

The Reſpect of the Needle *to a piece of* Iron. *held* Perpendicular, *in ſeveral* Climates; *by* ----- n. 177. p. 1213.

III. All the way from *England* to 10 *deg. North Latitude*, the *North* Point of the *Needle* reſpected the *Upper* end of the *Iron*, and the *South* point the *Lower* end, very ſtrongly.

Lat. 90. 42'. *N°.* and *Meridian diſtance* from the *Lizard* 9°. 32'. *W.* The *S.* point of the *Needle* did ſtrongly reſpect the *Lower* end of the *Iron*, but the *N.* point did not ſo ſtrongly reſpect the *Upper* end, as before. *Lat.* 4° 33', *N.* and the *Meridian Diſt.* 5°. 18. *W.* from the *Lizzard*, the *North* point of the *Needle* begun to decline from the *Upper* end of the *Iron*, and the *South* point to Encline more ſtrongly to the Lower end. *Lat.* 0°. 52' *S.* and the *Meridian Diſt.* 11°. 52'. *W.* from the *Lizard*, the *North* point of the *Needle* would not reſpect the *Upper* end of the *Iron*, nor the *Lower* end neither; but the *South* point did ſtill incline to the *Lower* end, though not ſo ſtrongly.

Lat. 5°. 17'. *S.* and *Meridian Diſt.* 15°. 9'. *W.* from the *Lizard*, the *South* point of the *Needle* would Turn to the *Lower* end of the Iron, about 2 *Points*, but remove the *Iron* any farther, and it would fly away from it, and reſpect the *Poles* again; but it would not reſpect the *Upper* end at all; neither would the *North* point Reſpect either, but lay the *Iron Horizontal*, and let the Ends of the Iron reſpect the *Poles* of the World, and the *North* point of the *Needle* would turn to the *South* End of the Iron, and contrarily the *South* point of the *Needle* would turn to the *North* End of the Iron; and alter its reſpect to the *Poles* 5 or 6 *Points*, and no farther; but hold the Iron *Perpendicular*, and put the *Middle* thereof to the *Needle*, it would ſtill reſpect the *Poles*.

Lat. 8°. 17'. *S.* and *Meridian Diſt.* from the *Lizard* 17°. 35'. *W.* the *North* point of the *Needle* would not reſpect the *Upper* end of the Iron, but rather forſake it, but the *South* point would ſtill ſomething reſpect the *Lower* End, and alter its true Poſition about 2 *Points*; but take the Iron and lay it *Aſlope* over the *Compaſs*, ſo that the *Upper* end be towards the *South Pole*, and the *Lower* end to the *North*, and then the *North* point would reſpect the *Lower* end, and follow it; but if you Point the *Upper* end to the *North*, and the *Lower* end to the *South*, the *North* point will forſake it. But if you lay it *Horizontal*, it would do as in the foregoing Obſervations.

Lat. 15°. 00'. *S.* and 20°. 00'. *W.* from the *Lizard*, the *South* point of the *Needle* began to Reſpect the *Upper* end of the *Iron*, and the *North* point the *Lower* end, and followed it about *One* point; but lay the Iron *Horizontal*, and the *North* point reſpected the *South* end of the Iron, and contrary wiſe, *&c.*

Lat. 20.

Lat. 20° 20 *S.* and 19°. 20'. *W.* from the *Lizard*, the *South* point of the *Needle* respected the *Upper* end of the Iron, and the *North* point the Lower end pretty strongly, and followed it 3 or 4 *Points*; but lay it *Horizontal*, and it would do as before.

Lat. 29° 25', and 13°. 10'. *W.* from the *Meridian* of the *Lizard*, the *South* point of the *Needle* respected the *Upper* end of the Iron, and the *North* point the *Lower* end strongly.

IV. 1. It's known that a Rod of Iron, held *Perpendicular* to the *Horizon*, or *Inclining*, the *Lower* end is its *North Pole*, or attracts the *South* end of a *Magnetick Needle*; and that the same end held *Upwards*, becomes a *South Pole*, *&c.* Attracts the *North* end of the *Needle*, and Repels the *South* end. *The* Polarity *of* Iron, *by Mr.* J.C. n. 214. p. 257.

I call that a *Mutable Pole*, which may be *North* or *South*, as you Hold it; and a *Fixt Pole* that which does not Change however you hold it.

2. The *Species* of the *Pole*, whether *North* or *South*, may be found by passing the Iron Rod through Cork or Wood, and then leaving it to swim on Water, it will turn to its Proper *Pole*: But this way is slow and not nice. A better way to try, for Instance a *North Pole*, is to hold the Iron *Perpendicular* to the *Horizon*, and to try whether being held under the *North* end of the *Needle*, it Attracts it. But a yet better way is to try whether the *Upper* end of the Rod Attracts the *South* end of the *Needle*: for *Attraction* is more sensible than *Expulsion*.

3. *A Fixt North Pole* may be made with all the Ways and Rods that you can make a *Fixt South Pole*; but not *vice versa*; for there are many Cases wherein you can make a *Fixt North Pole*, but not a *Fixt South Pole*: And whatever way you get a *Fixt South Pole*, 'tis weaker than a *Fixt North Pole* made the same way. Applying a *Needle* to an Erect Bar, beginning at the Top, and so Down, the *Needle* Turns not at the *Middle*, but *nearer*. Of some Rods you cannot make a *Fixt South* primarily, yet you may consequentially; so you may make one End a *Fixt North Pole*, and then the other end of those Rods may, without more to do, become a *Fixt South Pole*. But this does not always hold, for the One may be a *Fixt North Pole*, and the other may be a *Mutable Pole*.

4. *Fire* destroys all *Fixt Poles*, *&c.* whether made by the *Magnet*, or otherways; but it increases, or rather less hinders that *Magnetism*, which proceeds from the *Earth*; *&c.* a Wire or Rod of Iron *Heated* at one end, that end is a *Mutable Pole*, but more vigorous while *Hot* than *Cold*. The Vigour of *Mutable Poles* is more in Great than Little *Rods*; but 'tis otherwise in *Fixt Poles*.

5. *Heat* the End of a Rod of Iron *Red Hot* (or *Heat* All the Rod) and *Cool* that *Ignited* end *Northward*, it will be a *Fixt North Pole*; if *Cooled South* it becomes a *Fixt South Pole*. This say *Gilbert* and others from Experience: But I say this holds but in some cases; *&c.* if the Rod is short, you cannot make a *Fixt Pole* that way. Take a Round Wire whose Diameter is $\frac{1}{5}$ *inch*, and Length 10 *inches*, you cannot produce a *Fixt Pole* by *Ignition*; but if this Wire were longer, as suppose 30 *Inches* long, or never so much longer,

'tis capable of a *Fixt Pole* by *Ignition*. Again, take a round Rod 30 *Inches* long, and 1 *Inch* Diameter, this Rod is not capable of a *Fixt Pole* at that length, though the leſſer was capable at that Length. And ſo my Experiments give me reaſon to think, that there is no Rod nor Bar of Iron ever ſo thick, but which if it had length enough, would be capable of a *Fixt Pole* by bare *Ignition*; for of that I only ſpeak in this Paragraph: And there is no Rod ever ſo ſhort, but which if you make it ſufficiently Thin, is capable of a *Fixt Pole*. So when in a Rod I could not obtain a *Fixt Pole* at 21 *Inches* Length in that Thickneſs, I could, by making the Rod Thinner, produce a *Fixt Pole*, even in the Length of *one Inch* and Leſs, and the *Pole* ſhould be of what kind I Pleaſed. The *Terminus*, or neceſſary Length, for every Thickneſs increaſes more than you would be apt to think.

6. *Heat* a Rod, or its End *Red Hot*, and throughly *Cool* this end *Downwards* or *Towards* the *Nadir*, it will have ſomewhat more *Magnetiſm* than if *Cooled Horizontally* towards the *North*. But the better way is to *Cool* it a little inclining towards the *North*. I cannot find that multiplicity of *Ignitions* does produce more *Magnetiſm* than One good *Igmition*; but it muſt be throughly *Ignited*. Nor can I find by many Experiments, that *Quenching* in Water ſignifies to the Producing or Hindring *Magnetiſm*; but many *Ignitions* may accidentally Promote it by Purifying the Iron.

7. Dr. *Power* ſays, that if we hold a Rod *Northward*, and *Hammer* in that Poſition the *North* end, that will become a *North Pole*, *i. e.* a *Fixt North Pole*: contrarily if you *Hammer* the *South* end. But this is True (as I ſaid before of *Ignitions*) only in Rods of a Certain Length and Thickneſs.

8. What is ſaid of *Hammering* is to be underſtood of *Filing*, *Grinding*, *Drilling*, *Sawing*: Yea, a *ſoft Rubbing*, provided it is long, will produce *Fixt Poles*. The more Heavy the Blows are, *cæteris paribus*, the *Magnetiſm* is more. I ſay *cæteris paribus*, as when the Blows be not ſo Heavy in either Caſe as to flat; for flatting the Iron produces more *Magnetiſm*, though other things don't vary. A few Hard Blows will Produce as much *Magnetiſm* as many, yet a ſoft Blow, may produce but little *Magnetiſm*. The utmoſt *Magnetiſm* that I could Produce in Ordinary Rods this way, did not exceed that which an Ordinary *Loadſtone* would have Infuſed.

9 *Beating* many Rods *Northward*, whoſe Lengths I knew ſufficient, *I* never failed of producing a *Fixt North Pole*; but *Hammering* the ſame or like Rods *Southward*, *I* found that I could not produce a *Fixt South Pole*, only a *Mutable Pole*; nay *Hammering* one full *South*, *I* produced a *Fixed North Pole*. Then *I* thought the Reaſon might be, that the *Hammer'd South* end on the Anvil was a little *lower* than the End which *I* held in my Hand: Then I held the End Higher, and ſo *Hammering* it *South* Upwards, I never failed Producing *Fixt South Poles* in proper Rods.

10. Old *Drills* and *Punches* are *Fixt North Poles*, becauſe almoſt conſtantly uſed downwards: But new *Drills* are either *Mutable Poles*, or *weak North Poles*. When I ſay a *New Drill*, I don't mean one made on the Spot, for that is probably a *North Pole*, becauſe Quencht downwards in Water; but then ſuch *Polarity* made by bare *Ignition* is a *Weak Pole*,

and

and soon Decays and turns to a *Mutable Pole:* But I mean a *Drill*, which though never or Little Used, yet has been made some *Days* or *Weeks*. *Drill* with this *Southward Horizontally*, and 'tis a Chance if you Produce a *Fixt South Pole*; but much Less if you *Drill South* Downwards: But if you *Drill South* Upwards, you may make it a *Fixt South Pole*.

11. The Stronger the *Polarity* is, the Longer it will Last. A Weak *Fixt Pole* may Degenerate into a *Mutable Pole* in a Day's time; yea I have known it in a few *Minutes*, while exposed to the Air, and held in a Position contrary to its *Pole:* On the Contrary we find *Needles Touched* with good *Loadstones* hold that Vertue a great while, if kept from *Air*, and in a *Meridian* Site.

12. The *Loadstone* it self will not make a *Fixt Pole* of any *Iron*; it must have a Proper Length if 'tis Thick: or if 'tis Short, it must have a sufficient Thinness. So Ordinary or Weak *Loadstones* cannot *Fix* a *Pole* in a Thick Short Key, which yet they will do in a little Key. So in a Short Thick Iron Tapering, a *Loadstone* may *Fix* a *Pole* in the Little End, when it Cannot in the Great End.

13. When *Ignition*, *Hammering*, or a *Loadstone* cannot make *Fixt Poles*, it must not be thought that it can do absolutely Nothing on such Rods: for even then it may be found that there's an Effect of *Magnetism* in them Discernable enough otherways, though not enough to make *Fixt Poles*.

14. When you have the due Length for making of a *Fixt Pole*, you will find the making One a *Fixt North* will consequently render the other a *Fixt South Pole:* but if keeping the same Diameter of this Rod, you increase it's Length enough, the making One End a *Fixt North Pole*, will not necessarily make the Other a *Fixt South Pole*, but leave it a *Mutable Pole*. So if you by a like Primary Operation make the Second end a *Fixt Pole*, the First end will Lose its *Fixity*, and become *Mutable*.

I say there's a *Certain Length* suited to every *Thickness* of Iron, to leave one end *Mutable*, while the other is *Fixt*, and the Thicker the Iron is, the Greater is the *Length*.

15. If you Farther Increase the Length of the Same Rod, you will Attain such Length, that when you have *Fixed* a *Pole* on One end, and then go to *Fix* the Other end, the *Fixity* of the First will not be Destroyed, and that end become *Mutable* as before: but the *Fixity* of the *First* end will Remain, and so you make Both ends Two *Fixt North Poles*, or Two *Fixt South Poles*. I say the Shortest Length (for there's no *Terminus* of the Greatest Length) for this is more in Thick than in Thin Iron.

16. The aforesaid Lengths are Less, according to the Strength of *Magnetism*; *sc. Ignition* requires a Greater Length than when a Rod is Actuated by a *Loadstone*; and a Rod *Touched* with a Strong *Loadstone* requires Less Length than one *Toucht* with a Weak one.

By Mr. Ballard n. 246. p. 417.

2. 1. I caused 6 or 7 several *Drills* to be made before my Face, and the *Bit* or Point of every one became a *North Pole*, only by *Hardening*, before they ever came to be workt, either in Iron or any other Matter; so that I cannot suppose

those

thoſe found in a Shop to have gotten their *Polarity* ſo much from their After-uſe as from their Firſt make.

2. That Pieces of Plain Iron, in ſhape like *Drills*, (that is ſomething Long and Small) do always *Change* their *Poles* as they are Inverted, the End Downwards being ever the *N. Pole*, I find not Always True: For though it hold Generally in ſuch ſmall Pieces, and Always (as far as I can yet find) in Pieces of any Bulk, as Large Hammers, Anvils, Andirons, Bars of Windows, *&c.* Yet I found ſeveral Small pieces of Steel, ſuch as the *Drills* are made of, to have *Fixed Poles*, one End *North*, the other *South* in whatever Poſtures I held them. Some of theſe were very *Vigorous* in ſuch their *Polarity*, others ſhew'd plainly a Tendency to ſuch a *Pole*, rather than the other, yet ſo faintly that it applyed contrary to their Inclination; (that is, at the *Upper* end, if it Affected to draw the *South*; or the *Lower* End, if the *North*;) They cauſed the *Needle* to ſtand in *Æquilibrio*, *Eaſt* and *Weſt*; the Particular Inclination of one End ſeeming, in ſome pieces, quite to Conquer; in others, quite to Hinder that more General *Polarity* they both acquire, by being either *Upward* or *Downward*. Yet this ſeems only to be found in ſmall Stems of Iron; the being either *Upward* or *Downward* always prevailing in Pieces of Greater Bulk,

3. I took my Knife, which had been *Toucht* a *Quarter* of a Year or more before, and profering it to the *Needle*, it Drew the *North Pole*; which happened right for my Purpoſe. I Whetted it briskly on a Dry Dirty Threſhold, and being Thin it became very Hot towards the Point, the Edge being Whet away to a *Wire*, as they Term it, I ſtruck the very Top, and Back towards the Top againſt the Ground, as I had done the Sides, to Deſtroy and Rub off, if I could all its former *Polarity*, which was *Southward*; then offering it again to the *Needle*, it Drew the *South End*, and was quite Changed. To confirm the thing, I *Toucht* the ſame Knife again with the *North Pole* of my *Loadſtone* and it Drew vigorouſly the *North End* of the *Needle*. I Whet it again ſtrongly in the ſame manner, and it *Changed* again. This I repeated 5 or 6 Times, and it ſtill *Changed* by Whetting, eſpecially on the Sides towards the Top of the Knife; the very Top and Back, which could not be Whet to ſo great an Heat, retaining ſtill ſome Affection for that *Pole* the *Loadſtone* had Inclined them to. This I tryed with a Knife of a Thicker Blade; but I could not with my Hand whet it to that Heat, as to have the ſame Effect wrought upon, as my own; though I uſed ſuch Force as at laſt to break it in Two.

4. I ſuppoſe that bare *Drilling* might be able to give a *Polarity* to a *Drill* if it could be made Indifferent, as well as *Filing* does, if the *Drill* be uſed ſo briskly as to be made as Hot as the *File* makes the Iron. And though a *South Pole* given by the *Magnet* cannot be taken off by the Heat of a Brisk Motion (as that of *Drilling*;) which yet by the Experiment of my Knife ſeems to be Contradicted; yet perhaps the Heat may be great enough to produce a *Polarity* in an Indifferent Piece of Iron, as may be done in little Indifferent *Drill-like* Pieces of Steel, by *Filing*.

5. Two

V. Two *Degrees* to the Northward of the *Line*, the North Point of the *Needle* did *Incline* 8 *degrees* downward: but as we went to the Southward it was *Inclined* above 48 *Degrees* Upward.

The Declination of the Needle *Obſerv'd; by Mr.* Ja. Cunningham n. 264. p. 577.

VI. 1 *An.* 1666. *Jun.* 13. In *Rownham* Meadows near *Briſtol* by the Water ſide, Capt. *Sturmy* took the following Obſervations.

Magnetical Variations, *near* Briſtol; *by Capt.* Sam. Sturmy n. 37. p. 726.

⊙ *Alt.*		*Magnetick Azimuth.*		⊙ *Azim.*		*Variation Weſterly.*	
44°.	20′	72°.	00′	70°.	38′	1°.	22′
39.	30	80.	00	78.	24	1.	36
31.	50	90.	00	88.	26	1.	34
27	2	95.	00	93.	36	1.	24
23.	20	103.	00	101.	23	1.	23

In this Table He notes the greateſt Difference to be 14′. and taking the Mean for the True *Variation*, he Concludes it then and there, to be juſt 1°. 27′. He obſerved again in the ſame Day of the next Year, *viz. Jun.* 13. 1667. and then he found the *Variation* encreaſed about 6′. *Weſterly*.

2. *An.* 1630. I traced 3 different *Meridian* Lines in ſeveral places of *Paris*, and found, that the *Needle* Declined $4\frac{1}{2}$ *deg. North-Eaſt*: which having Publiſht, and made known here to the Curious, and to Artiſts, ſome of whom counted 9 or 10 *deg.* according to the Tradition and Writings of *Orontius Fineus*, and *Caſtle Franc*; others, $11\frac{1}{2}$ *deg.* following *Sennertus* and *Offuſius*: all at firſt Rejected my Obſervation; and as commonly New things meet with Obſtacles and Contradictions, before they are Eſtabliſht, thoſe that could not Contradict what they Saw, pretended that this Variety did perhaps proceed from the greater or leſſer Vigour in the *Loadſtones* employed to touch with; or from thence, that the *Needles* had been Toucht nearer to or farther from their *Poles*.

At Paris; *by M.* Petit n. 28. p. 527.

To remove the Objections and to try another Quality which *Gilbert* had aſſigned to *Terrella's*, I cauſed a *Magnet* to be Turned with the Powder of *Emery* till it became Spherical $\frac{1}{2}$ *Inch* in Diameter, its 3 Centers of *Magnitude Gravity* and *Strength* being the ſame with ſo much Juſtneſs, that after I had exactly found the two *Poles* of this Stone, I cauſed 2 Small Holes to be made therein, to ſupport it by two points of *Needles*, as by two Pivots: which having put in a *Meridian* of Braſs, and Suſpended the Ball betwixt them like

a little *Globe*, it was so easily moveable that I made it Turn every way with a Blast only of my Mouth, and it Stopped Indifferently, now in one, then in another place, not any side of it Prevailing.

This *Stone*, being thus prepared without any Defect in Vertue or Figure, Uniform, Homogeneous, Equilibrated, was adjusted on its *Meridian* and an *Horizon*, and so Placed on its *Meridian* Line that the *Poles* thereof answered to the *Poles* of the *Heavens*. The Success was that it had not any Motion at all; whence I thought the Proposition of *Gilbert*, that such a *Stone* so Posited would *Turn* round in 24 *hours*, was sufficiently Refuted.

This *Stone* together with others (whereof the *Poles* were well mark'd) served me also to find out, whether the *Needles Touched* in Different Places, nearer to or farther from the *Poles*, had different *Declinations*. Which having tryed frequently, I found no Difference at all in the *Declination* of the *Needles* but all of them *Declined* then from the *Meridian* $4\frac{1}{2}$ *deg.* from the *North-Eastward*, I also found it to be the Same in Many Places, from *Brest* in *Brittany* to the *Valtoline* amongst the *Alps*. I believed at First, that the Ancients had Ill Observed the *Variation*: but I was soon undeceived of this Error, by the Observations in *England* of Mr. *Burrows*, *An.* 1580. of Mr. *Gunter*, *An.* 1612. and of Mr. *Gellibrand*, *An.* 1633, which did assure me, that those *Declinations* were not Constant.

And that I might be Convinc'd by my self, in *June An.* 1660 after I had very exactly Traced a *Meridian* by many *Azimuths*, before and after Noon, with a Brass *Quadrant* of 6 *Foot* Diameter, and applyed good *Needles* upon it; the one of 7. the other of 10. *Inches* long, I found that they *Declined* but *One Degree*, or thereabout: And the Last year (1666) I found no more but 10 *minutes* on the same *Meridian*. And methinks that the *Declination* this year 1667 is Still less: but yet some *Minutes* towards the *East*, at least at *Paris*. But I doubt not, but in 12 or 15 *Years* the *Declination* will be $1\frac{1}{2}$ *degree North-west*: As I have Prognosticated by my *Hypothesis*, which maketh the *Declination* to *Vary* a *degree* every 7 or 8 *years*.

At Rome; by M. Adrian Auzout n. 58. p. 1184.

3. *An.* 1670, M. *Adrian Auzout* made the following Observation here at *Rome* on many *Meridian Lines*, with a *Needle* about 6 *Inches* long; and on all the *Lines* it was seen to *Decline* somewhat more than 2 *degrees Westward* and on some near $2\frac{1}{2}$ *degrees*. But by the Observations here made formerly, it appears, that the *Needle* hath *Declined Eastward* to 8 *Degrees*, and hath afterwards been Diminishing, until it's come to the other Part, where we find it at present.

It seems not, that this Difference of 10 *Degrees* and more, can be attributed to the Change of the *Pole* of the *Earth*; or to the *Magnet*, or to the *Iron*, that are found in certain Places, because there is but Little *Loadstone*: and M. *Auzout* affirms, that the *Mines* which he hath seen, make no Impression at all on the *Needle*. So that 'tis difficult to Hit the true Cause of such a *Variation*: Yet however, if the Direction of the *Magnet*, and of the *Needle Touched* by it, depends from the Flux of a certain Matter, passing through the Whole Earth, or the Exteriour Parts of it, strait along the *Axis*; it may be said, that it proceeds from Changes made in the said *Flux*: which supposing the Inequalities

lities of the Earth, and the Alterations made continually therein, as well Artificial, by Excavations, and such like other works, as Natural, by Corrosions, caused by Fire and Water, or by the Generation of *Metals* and *Stones* (besides the various Changes, we cannot think of, by reason of the little Knowledge we have of so vast a Body as the Earth) cannot but in progress of time, Change its scituation The Inequalities of the Earth may in time occasion some Bending in the Current of this *Magnetick* matter, and make it Change its Bed and Channel: Whence it comes to pass, that the *Needle* Changeth its *Direction* according as the Current Changeth, which directs it. And if it should be so, there would be no Hopes of finding a Regular *Hypothesis* for that Change; for as much as it would depend from Causes that have no Regularity at all in them; as most of the Mutations of Nature are.

4. *An* 1642. I observed the *Declination* of the *Magnet* here, at *Dantzick*, as did M. *Linnemannus* about the same time at *Koningsberg*: And we both found the *Magnetick Needle* at that time to *Decline* from the *North* 3° 5′ *Westward*. But now (*Jun.* 22. 1670, *St. n.*) it is far otherwise; for it *Declines* at present, as I have very carefully Observed, 7°. 20′. to the same Quarter; so that in the space of 28 *Years*, that *Declination* is increased 4°. 15′. In the *Year* 1628, if *I* remember aright, *I* found it near *one Degree Westward*: Which *Declination* was affirmed by the Learned *Petrus Crugerus* (once my worthy *Præceptor*) to have been, about the Beginning of this Age, or the end of the next foregoing, 8°. 30′ *Eastward*. Hence it appears, that this *Declination* of the *Loadstone* doth here, at *Dantzick*, Encrease each *year* to 9′. 6″. Which is sufficiently Confirmed by the Observations made at *Lime-House* near *London*, by those 3 famous *English-men*, *Burrows*, *Gunter*, and *Gellibrand*: Of whom the *First* found the *Declination A.* 1580. to be 11°. 16′; the *Second* 5°. 36′. 30″. *An.* 1622; the *Third*, 4°. 3′. 30″. *A.* 1634

At Dantzick; *by Mr.* Hevelius. n. 64. p. 2059.

—I cannot yet devise any Cause of those Appearances, except we impute them to a kind of Libration in the Motion of the *Earth*, and the *variation* of the *Meridian*.

5. The Last Summer 1680. *I* was present with Dr. *Geo. Volcamer*, at *Nuremberg*, while he was making some Observations and Tryals, with his *Magnetical Needle*. He Repeated the Tryals several Days one after another, and with various ways of Examination; but still in every of them, with the same success, he most certainly found, that the *North* End of the *Magnetical Needle*, (which the former *Age* always reported to us, to vary from the *North*, and to Direct or Point more towards the *East*, by several *Degrees*) did now *Decline* towards the *West* near 5 *Degrees*.

At Nuremberg *in* Germany; *by* Joh. Chr. Sturmius. *Ph. Col.* n. 2. p. 8.

An. 1685 Sub initium Mensis *Augusti*, de certitudine *Meridianarum* omni qua fieri potuit Cura ex Circumspectione Securi redditi, applicatis variis *Pyxidibus Magneticis*, tam iis Vetustioribus, quæ ante *Quinquennium* huic Usui adhibebantur, quam aliis Recentioribus plurimis, mediocris quidem Longitudinis, quarum maximæ *Semissem Pedis* non excedebant, sed Gracilioribus & Vivacibus, animadvertebamus, quod mirum, *Declinationem Acus* à Pristina nec in *uno minuto* Discrepare, sed in quavis *Meridiana* exacte cum Priori convenire, ad *Occas. Scil.* 5°. 5′. An autem interea temporis

M. G. C. Eimmart. n. 178. p. 1253.

alterius proceſſerit, aut nunc in Situ *Retrogrado* ejus Deviatio deprehenſa fuerit, quod certe caſu eveniſſe potuiſſet, non Liquet, cum nec temere iſtud ſtatuere, quin in eam Sententiam, quod *Stationarius* (procul dubio *Circularis Motus*) in eodem puncto permanſerit, pronius abire velimus.

On the Coaſt of Guinea; *by Mr.* Heathcot n. 158 p. 578.

7. *An.* 1683. The *Magnetical Variation* here at *Cabo Corſe Caſtle* was 3°. 49′. from the *North* to the *Weſtward.*

Magnetical Variations Predicted; *by Mr.* Hen. Bond n. 40. p. 789.

VII. Mr. *Hen. Bond*, having entertained an *Hypotheſis* of the *Variations* of the *Needle* hath (for the Examination of it) Calculated the Following Table.

Years.	*Variation Weſt.*	*Years.*	*Variation Weſt.*	*Years.*	*Variation Weſt.*	*Years.*	*Variation Weſt.*
1663	1°.—56′	1701	7°.—19′	1706	8°.—1′	1711	8°.—41′
1670	2—18	1702	7—28	1707	8—9	1712	8—49
1680	4—00	1703	7—36	1708	8—17	1713	8—56
1690	5—39	1704	7—45	1709	8—25	1714	9—4
1700	7—10	1705	7—53	1710	8—33	1715	9—11

A Theory of the Magnetical Variation; *by Mr.* Edm. Halley n. 148. p. 208.

VIII. Before I proceed to the *Theory* of the *Variation* of the *Magnetical Compaſs*, it is neceſſary to lay down the Grounds upon which I raiſe my Concluſions: and at once to give a Synopſis of thoſe *Variations* which I have reaſon to look upon as ſure, being moſtly the Obſervations of Perſons of Good Skill and Integrity.

Names of Places.	*Long. from* London.	*Latitude.*	*An. Dom.*	*Variation Obſerved.*
London	0° 0′	51° 32′ N.	1580	11° 15′ E
			1622	6 0 E
			1634	4 5 E
			1672	2 30 W
			1683	4 30 W
Paris	2 25 E	48 51 N	1640	3 00 E
			1666	0 00
			1681	2 30 W
Uraniburg	13 00 E	55 54 N	1672	2 35 W
Copenhagen	12 53 E	55 41 N	1649	1 30 E
			1672	3 35 W
Dantzick	19 00 E.	54 23 N	1679	7 00 W
Mompelier	4 00 E.	43 37 N	1674	1 10 W
Breſt	4 25 W	48 23 N	1680	1 45 W

Rome

Rome	13	00	*E*	41	50	N	1681	5	00	W
Bayonne	1	20	W	43	30	N	1680	1	20	W
Hudſon's Bay	79	40	W	51	00	N	1668	19	15	W
In *Hudſon's Streights*	57	00	W	61	00	N	1668	29	30	W
In *Baffin's Bay* at Sir *Th. Smith's*	80	00	W	78	00	N	1616	57	00	W
At Sea (*Sound*	57	00	W	38	40	N	1682	7	30	W
At Sea	31	30	W	43	50	N	1682	5	30	W
At Sea	42	00	W	21	00	N	1678	0	40	E
Cape St. *Auguſtine* off *Brazile*	35	30	W	8	00	S	1670	5	30	E
Cape *Frio*	41	10	W	22	40	S	1670	12	10	E
At Sea off of the Mourh of the *River of Plate.*	53	00	W	39	30	S	1670	20	30	E
At the *Eaſt* Entrance of *Magellan Streights.*	68	00	W	52	30	S	1670	17	00	E
At the *Weſt* Entrance of the *Magellan Streights.*	75	00	W	53	00	S	1670	14	10	E
Baldivia	73	00	W	40	00	S	1670	8	10	E
At Cape d'*Agulkas*	16	30	E	34	50	S	1622	2	00	W
							1675	8	00	W
At Sea	1	00	E	34	30	S	1675	0	00	
At Sea	20	00	W	34	00	S	1675	10	30	E
At Sea	32	00	W	24	00	S	1675	10	30	E
At St. *Helena*	6	30	W	16	00	S	1677	0	40	E
At *Aſcenſion*	14	30	W	7	50	S	1678	1	00	E
At *Johanna*	44	00	E	12	15	S	1675	19	30	W
At *Mombaſa*	40	00	E	4	00	S	1675	16	00	W
At *Zocatra*	56	00	E	12	30	N	1674	17	00	W
At *Aden*, at the M. of the *R. Sea.*	47	30	E	13	00	N	1674	15	00	W
At *Diego Roiz.*	61	00	E	20	00	S	1676	20	30	W
At Sea	64	30	E	0	00	S	1676	15	30	W
At Sea	55	00	E	27	00	S	1676	24	00	W
At *Bombay*	72°	30′	E	19°	00′	N	1676	12°	00′	W
At Cape *Comorin*	76	00	E	8	15	N	1680	8	48	W
At *Ballaſore*	87	00	E	21	30	N	1680	8	20	W
At *Fort St. George.*	80	00	E	13	15	N	1680	8	10	W
At the *Weſt* Point of *Java*	104	00	E	6	40	S	1676	3	10	W
At Sea	58	00	E	39	00	S	1677	27	30	W
At the Iſle of *St. Paul*	72	00	E	38	00	S	1677	23	30	W
At *Van Diemens Land*	142	00	E	42	25	S	1642	0	00	
At *New Zealand*	170	00	E	40	50	S	1642	9	00	E
At *Three Kings* Iſle in *New Zeal.*	169	30	E	34	35	S	1642	8	40	E
At the Iſle *Rotterdam* in the *S. Sea.*	84	00	E	20	15	S	1642	6	20	E
On the Coaſt of *New Guinea.*	149	00	E	4	30	S	1643	8	45	E
At the *Weſt* point of *New Guin.*	126	00	E	0	26	S.	1643	5	30	E

By this *Table* it appears,

1. That in all *Europe* the *Variation* at this Time is *Weſt*, and more in the *Eaſtern* parts thereof than the *Weſtern*; as likewiſe that it ſeems throughout to be upon the *Increaſe* that way.

2. That on the Coaſt of *America*, about *Virginia*, *New England*, and *Newfoundland*, the *variation* is likewiſe *Weſterly*; and that it *Increaſes* all the way as you go *Northerly* along the Coaſt, ſo as to be above 20 *Degrees* at *Newfoundland*, nearly 30 *deg.* in *Hudſon*'s *Streights*, and not leſs than 57 *deg.* in *Baffin*'s *Bay*; alſo that as you ſail *Eaſtward* from this *Coaſt* the *Variation diminiſhes*. From theſe two it is a *Legitimate Corollary*, That ſomewhere between *Europe*, and the *North-part* of *America*, there ought to be an *Eaſterly Variation*, or at leaſt no *Weſterly*; and ſo *I* conjecture its about the *Eaſtermoſt* of the *Tercera* Iſlands.

3. That on the Coaſt of *Braſil* there is *Eaſt-Variation*, which Increaſes very Notably as you go to the *Southward*, ſo as to be 12 *deg.* at Cape *Frio*, and over againſt the *River* of *Plate* 20½ *deg.* and from thence, ſailing *Southweſterly* to the *Straits* of *Magellan*, it Decreaſes to 17 *deg.* and at the *Weſt* Entrance it is but 14 *Degrees*.

4. That to the *Eaſtward* of *Braſil* properly ſo Called, this *Eaſterly Variation* Decreaſes, ſo as to be very little at St. *Helena* and *Aſcenſion*; and to be quite gone, and the Compaſs to Point True about 18 *deg.* of *Longitude*, *Weſt* from the *Cape of good Hope*.

5. That to the *Eaſtward* of the aforeſaid Places a *Weſtward Variation* begins, which Reigns in the whole *Indian Sea*, and ariſes to no leſs than 18 *deg.* under the *Æquator* it ſelf about the *Meridian* of the *Northern* part of *Madagaſcar*, and near the ſame *Meridian* but in 39 *deg. South Latitude*, it is found full 27½ *deg.* from thence *Eaſterly* the *Weſt Variation* Decreaſes, ſo as to be but little more than 8 *deg.* at Cape *Comorin*; and than 3 *deg.* upon the Coaſt of *Java*; and to be quite Extinct about the *Molucca* Iſlands, as alſo a little to the *Weſtwards* of *Van Diemens Land* found out by the *Dutch* in 1642.

6. That to the *Eaſtward* of the *Molucca*'s and *Van Diemens Land* in *South Lat.* There ariſes another *Eaſterly Variation*, which ſeems not ſo great as the former, nor of ſo Large Extent; for that at the Iſland *Rotterdam* it is ſenſibly leſs than upon the *Eaſt-Coaſt* of *New Guinea*; and at the Rate it Decreaſes, it may well be ſuppoſed, that about 20 *deg.* farther *Eaſt*, or 225 *deg. Eaſt Long.* from *London*, in the *Latitude* of 20 *deg. South*, a *Weſterly Variation* begins.

7. That the *Variations* obſerved by the Honourable Sir *John Narborough* at *Baldivia*, and at the *Weſt Entrance* of the *Straights* of *Magellan*, do plainly ſhew, that that *Eaſt Variation* noted in our 3d *Remark* is Decreaſing apace; and that it cannot reaſonably Extend many *Degrees* into the *South Sea*, from the Coaſt of *Peru* and *Chili*, leaving room for a ſmall *Weſterly Variation*, in that Tract of the Unknown World that lies in the Midway between *Chili* and *New-Zealand*, and between *Hounds Iſland* and *Peru*.

8. That in ſailing *North weſt* from St. *Helena* by *Aſcenſion*, as far as the *Æquator*, the *Variation* continues very ſmall *Eaſt*, and as it were conſtantly

the

the ſame: So that in this part of the World, the Courſe wherein there is no *variation*, is evidently no *Meridian*, but rather *Northweſt*.

9. That the Entrance of *Hudſon*'s *Streights* and the Mouth of the *River of Plate*, being nearly under the ſame *Meridian*, at the One place the *Needle Varies* 29½ *deg.* to the *Weſt*, at the other 20½ *deg.* to the *Eaſt*. This plainly demonſtrates the Impoſſibility of reconciling theſe *Variations* by the Theory of *Bond:* which is by *Two Magnetical Poles and an Axis, Inclined to the Axis of the Earth*; from whence it would follow that under the ſame *Meridian*, the *Variation* ſhould be in all Places, the ſame way.

Theſe things being premiſed, may ſerve as a ſure Foundation for this *Theory*, That *the whole Globe of the Earth is one great* Magnet, *having* 4 Magnetical Poles, *or Points of Attraction, near Each* Pole *of the* Æquator 2, and that *in thoſe Parts of the World which lye near adjacent to any one of thoſe* Magnetical Poles, *the* Needle *is governed thereby*; *the neareſt* Pole *being always Predominant over the more* Remote. The parts of the Earth wherein theſe *Magnetical Poles* lye, cannot as yet be exactly determined for want of ſufficient *Data* to proceed *Geometrically*: But, as near as Conjecture can reach, I reckon that the *Pole* which is at preſent Neareſt to us, lies in or near the *Meridian* of the *Lands End* of *England*, and not above 7 *Deg.* from the *Pole Artick*. By this *Pole* the *Variations* in all *Europe*, and *Tartary*, and the *North Sea*, are principally Governed; tho' with regard to the other *Northern Pole*, whoſe Situation is in a *Meridian* paſſing about the middle of *California*, and about 15 *gr.* from the *North Pole* of the World. To this the *Needle* has chiefly reſpect in all the *North America*, and in the *Two Oceans* on either ſide thereof, from the *Azores* Weſtwards to *Japan*, and farther. The *Two Southern Poles* are rather farther diſtant from the *South Pole* of the World. The one about 16 *deg.* therefrom, is in a *Merid.* ſome 20 *deg.* to the Weſtward of *Magellan's Streights*, or 95 *deg. Weſt* from *London*; this Commands the *Needle* in all the *South America*, in the *Pacifick Sea*, and the greateſt part of the *Æthiopick Ocean*. The 4*th* and laſt *Pole* ſeems to have the Greateſt Power and largeſt Dominions of all, as it is the moſt remote from the *Pole* of the *World*, being little leſs than 20 *deg.* diſtant therefrom, in the *Meridian*, which paſſes through *Hollandia nova*, and the Iſland *Celebes* about 120 *deg. Eaſt* from *London*. This *Pole* is Predominant in the *South* part of *Africa*, in *Arabia*, and the *Red Sea*, in *Perſia*, *India*, and its Iſlands, and all over the *Indian Sea* from the Cape of *Good Hope* Eaſtwards to the middle of the Great *South Sea* that divides *Aſia* from *America*. This ſeems to be the preſent Diſpoſition of the *Magnetical Vertue* throughout the whole Globe of the Earth.

By this *Hypotheſis* it is Plain that (our *European North Pole*, being in the *Meridian* of the *Lands End* of *England*) all Places more *Eaſterly* than that will have it on the *Weſt* ſide of the *Meridian*; and conſequently the *Needle*, reſpecting it with its Northern Point, will have a *Weſterly Variation*, which will ſtill be greater as you go to the *Eaſtwards*, till you come to ſome *Meridian* of *Ruſſia*, where 'twill be greateſt, and from thence Decreaſe again. Thus at *Breſt* the *Variation* is but 1¾ *deg.* at *London*. 4½ *Deg.* but at *Dantzick*, 7 *deg. Weſt*. To the *Weſtward* of the Meridian of the *Lands End*, the *Needle* ought

to

to have an *Easterly Variation*, were it not that (by Approaching the *American Northern Pole*, which lies on the *West* side of the *Meridian*, and seems to be of greater Force than this other) the *Needle* is drawn thereby *Westwards*, so as to Counterballance the Direction given by the *European Pole*, and to make a small *West Variation* in the Meridian of the *Lands End* it self. Yet *I* suppose that about the Meridian of the Isle *Tercera*, our Neareſt *Pole* may so far prevail as to give the *Needle* a little turn to the *East*, though but for a very small space, the Counterballance of those two *Poles*, permitting no considerable *Variation* in all the *Eastern* Parts of the *Atlantick Ocean*; nor upon the *West* Coasts of *England* and *Ireland*, *France*, *Spain*, and *Barbary*. But to the *Westwards* of the *Azores*, the Power of the *American Pole* overcoming that of the *European*, the *Needle* has chiefly respect thereto; and Turns still more and more towards it as you approach it. Whence it comes to pass, that on the Coast of *Virginia*, *New-Engl.* *New found-land*, and in *Hudson's Streights* the *Variation* is *Westwards*; that it Decreases as you go from thence towards *Europe*; and that it is less in *Virginia* and *New-England* than in *New-foundland*, and *Hudson's Streights*. This *Westerly Variation* again Decreases, as you pass over the *North America*; and about the Meridian of the middle of *California*, the *Needle* again Points due *North*; and from thence *Westwards* to *Yedzo*, and *Japan*, *I* make no doubt but the *Variation* is *Easterly*; and Half Sea over not less than 15 *deg.* This *East Variation* Extends over *Japan*, *Yedzo*, *East Tartary*, and part of *China*; till it meet with the *Westerly*, which is governed by the *European North Pole*, and which *I* said was greatest somewhere in *Russia*.

Towards the *Southern Pole* the Effect is much the same, only that here the *South* point of the *Needle* is Attracted. Hence it will follow, that the *Variation* on the Coast of *Brazil*, at the *River of Plate*, and so on to the *Streights* of *Magellan*, should be *Easterly* as in the 3*d.* *remark*. And this *Easterly Variation* doth extend Eastward, over the greatest part of the *Ethiopick Sea*, till it be Counterpoised by the Vertue of the other *Southern Pole*; as it is about mid-way between the Cape of *Good Hope*, and the Isles of *Tristan d'Alcunha*. From thence Eastwards, the *Asian South Pole* (as *I* must take the liberty to call it) becoming Prevalent, and the *South* Point of the *Needle* being Attracted thereby, there arises a *West Variation* very great in Quantity and Extent, because of the great Distance of this *Magnetical Pole*, from the *Pole* of the *World*. Hence it is, that in all the *Indian Sea* as far as *Hollandia Nova*, and farther, there is constantly *West Variation*: And that under the *Equator* it self, it arises to no less than 18 *deg.* where 'tis most- About the *Meridian* of the Island *Celebes*, being likewise that of this *Pole*, this *Westerly Variation* Ceases, and an *Easterly* begins; which reaches, according to my *Hypothesis*, to the middle of the *South Sea* between *Zelandia Nova* and *Chili*, leaving room for a small *West Variation* Governed by the *American South Pole*; which I shewed to be in the *Pacifick Sea*, in the 6*th* and 7*th* *Remarks*.

In the *Torrid Zone*, and particularly under the *Æquinoctial*, respect must be had to all 4 *Poles*, and their Positions well considered, otherwise it will not be easie to determine what the *Variations* shall be; the Neareſt *Pole* being always the strongest; yet not so, as not to be Counterballanced sometimes by the

the United Forces of Two more Remote. A Notable inſtance hereof is in our 8*th* Remark, where I took notice, that in Sailing from St. *Helena*, by the Iſle of *Aſcenſion* to the *Equator* on a N. W. Courſe, the *Variation* is very little *Eaſterly*, and in that whole Tract *Unalterable*: For which *I* give this Reaſon, that the *South American Pole* (which is conſiderably the neareſt in the aforeſaid Places) requiring a great *Eaſterly Variation* is Counterpoiſed by the Contrary Attraction of the *North American* and the *Aſian South Poles*; each whereof ſingly is in theſe Parts, Weaker than the *American South Pole*; and upon the N. W. Courſe, the Diſtance from this Latter is very little Varied; and as you Recede from the *Aſian South Pole*, the Ballance is ſtill preſerved by the Acceſs towards the *North American Pole*. I mention not in this Caſe, the *European North Pole*, its *Meridian* being little removed from thoſe of theſe Places; and of it ſelf requiring the ſame *Variations* we here find:

What *I* have here ſaid does plainly ſhew, the ſufficiency of this *Hypotheſis* for ſolving the *Variations* that are at *This Time* obſerved. n. 195. p. 564.

But there are two Difficulties not eaſie to ſurmount. The *One* is, that no *Magnet I* have ever ſeen or heard of, hath more than *Two* Oppoſite *Poles*: Whereas the Earth hath viſibly 4, and perhaps more. *Secondly*, It is plain by the *Change* of the *Variation*, not only at *London* (where this Diſcovery was firſt made) but alſo almoſt all over the *Earth*, that theſe *Poles* are not at leaſt all of them *fixt* in the Earth, but ſhift from Place to Place, whereas it is not known that the *Poles* of the *Load-ſtone* ever ſhifted their Place in the *Stone*, nor (conſidering the Compact Hardneſs of that Subſtance,) can it eaſily be ſuppoſed. Theſe Difficulties for a Long Time made me Deſpond, when in Accidental Diſcourſe, and leaſt expecting it, *I* ſtumbled on the following *Hypotheſis*.

It is ſufficiently known and allow'd, that the *Needles Variation Changes*; and that this *Change* is Gradual and Univerſal, will appear by the following Examples.

At *London*, *An.* 1580. The *Variation* was obſerved by Mr. *Burrows*, to be 11°. 15'. *Eaſt*. In *An.* 1622, the ſame was found by Mr. *Gunter*, to be but 6°. 0. *Eaſt*. In the *Year* 1634, Mr. *Gellibrand* found it 4°. 5' *Eaſt*. In 1657. Mr. *Bond* obſerved that there was *No Variation* at *London*. *An.* 1672. my ſelf Obſerved it 2°. 30'. to the *Weſt*; and this preſent year 1692. I again found it 6°. 00' *Weſt*. So that in 112 *Years* the Direction of the *Needle* has *Changed* no leſs than 17 *Degrees*.

At *Paris*, *Orontius Finæus* about the Year 1550, did account it about 8 or 9 *Deg. Eaſt Variation*. *An.* 1640. it was found 3 *deg. Eaſt*. *An.* 1666. there was *No Variation* there, and *An.* 1681. I found it to be 2°. 30'. to the *Weſt*.

At Cape *d'Agulhas*, the moſt Southerly Promontory of *Africa*, about the Year 1600. the *Needle* pointed *due North* and *South* without *Variation*, whence the *Portugueze* gave its Name. *An.* 1622. There was 2 *deg. Weſt Variation*. *An.* 1675. It was 8°. 00'. *Weſt*, and this Year 1692, it was curiouſly obſerved not leſs than 11 *deg. Weſt*.

At St. *Helena*, about the Year 16 0. the *Needle declined* 8. *deg.* to the *Eaſt*. *An.* 1623. It was but 6°. 00'. *Eaſt*. *An.* 1677. when I was there, I obſerved

obſerved it accurately on ſhore to be 0°. 40′ *Eaſt*; and now this Year it was found 1°. to the *Weſtward* of the North.

At Cape *Comorin* in *India*, in the year 1620, there was 14° 2′. *Weſt Variation*; in the year 1680, there was 8° 48′. but in the year 1688. it was no more than 7° 30. ſo that here the *Needle* has returned to the *Eaſt*, about 7°. in 70 *Years*.

From theſe and many other Obſervations, it is 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 *Ægypt*. 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 Encreaſed; 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 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. And by Analogy we may Infer (though we have not Experience enough to Aſcertain it) that both the *Eaſt* and *Weſt Variation* in the *Pacifick Sea*, do gradually Increaſe and Decreaſe after the ſame Rule.

Theſe *Phœnomena* being well underſtood, and duly conſider'd, do ſufficiently evince, That the whole *Magnetical Syſtem* is by one, or perhaps more Motions Tranſlated: 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 by a *Gradual* and Regular Motion.

Now conſidering the ſtructure of our Terraqueous Globe, the only way to render this Motion Intelligible and Poſſible, is, to ſuppoſe it poſſible to *Turn about the Center of the Globe, having its Center of Gravity Fixt and Immoveable in the ſame common Center 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. 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 Center 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. So that if this *Exterior* Shell of Earth be a *Magnet*, having its *Poles* at a diſtance from the *Poles* of *Diurnal Rotation*;

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 4 *Magnetical Poles*, as likewеſe 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, 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 Defect, 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 $10\frac{1}{2}$ more *Eaſterly* at *Paris* than at *London*, tho' it be certain 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 of the *Needle* were wholly govern'd 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.

If then Two of the *Poles* be *Fixt*, and Two *Moveable*, I think we may ſafely determine that the *European Pole* 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' the *Pole* be much farther removed from the *Axis*. And that the *Aſian*, of the two *South Poles* is *Fixt*, and conſequently the *American* moveable; from the like obſervation of the ſlow Decreaſe of the *Variation* on the Coaſt of *Java*, and near the *Meridian* of the *Aſian Pole*.

If this be allowed me, 'tis plain 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 Impreſt on the Earth, being given to the *External* Parts, and from thence in Time Communicated to the *Internal*.

The *Period* of this Motion appears, by all Circumſtances, to be of many Centuries of *Years*; and conſidering the Change of the Place, where there was *no Variation*, by reaſon of the Æquilibre of the *Two Southern Magnetical Poles*, *viz.* from Cape d'*Agulhas* to the Meridian of St. *Helena*, (which is about 23°. in about 90 *Years*;) and of the Place where the *Weſterly Variation* is in its ἀκμὴ 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* was Moved *Weſtwards* 46°. in that Time; and that the whole *Period* thereof is performed in ſeven Hundred *Years*, or thereabouts: So that the Nice Determination of this, and of ſeveral other Particulars in the *Magnetick* Syſtem, is reſerved for Remote Poſterity.

I doubt not but this *Hypotheſis* of an *Internal Nucleus* will find Oppoſers enough: But the Globe of *Saturn* being environ'd with his *Ring*, is a Notable Inſtance of this kind, as having the ſame common Center, and moving along with it, without ſenſibly approaching one ſide of it more than another: 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 Center of *Saturn* in its own, it follows that ſuch a *Concave Sphere* may move with another Included in it, having the ſame common Center. Nor can it well be ſuppoſed otherwiſe, conſidering the Nature of *Gravity*: For ſhould theſe *Globes* be adjuſted once to the ſame Common Center, the *Gravity* of the Parts of the *Concave*, would preſs equally towards the Center of the *Internal* 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 Center of the *Exterior*, muſt neceſſarily Aſcend, whatſoever way it move; that is, it muſt overcome the Force of *Gravity* preſſing towards the Common Center, 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 Center, muſt always there remain.

It may be Objected, that the Water of the Sea would perpetually Leak through this *Shell*, unleſs we ſuppoſe the Cavity full of Water: But when we conſider how tightly great Beds of Chalk or Clay, and much more Stone, do hold Water, and even Caves Arched with Sand, no Man can doubt but the Wiſdom of the Creator has provided for the *Macrocoſm*, by many other ways than I can either Imagine or Expreſs. We cannot think it a hard ſuppoſition that the internal Parts of this Bubble of Earth ſhould be Replete with ſuch

Saline

Saline and *Vitriolick* Particles as may contribute to *Petrifaction*, and diſpoſe the tranſuding 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. *quam proxime. Eſt igitur Corpus* Lunæ *Denſius, ac magis* Terreſtre *quam* Terra noſtra. Now if the *Moon* be more Solid than the *Earth* as 9 to 5, why may not we 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 4 *Ninths* thereof to be *Cavity*, within and between the *Internal* Spheres, which I would render not Improbable.

It muſt be allowed indeed, that theſe *Included* Globes 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 we ſee all the Parts of the Creation abounds with *Animate Beings*, why ſhould we think it ſtrange that the Prodigious Maſs of Matter, whereof this Globe does conſiſt, ſhould be capable of ſome other Improvements, than barely to ſerve to ſupport its ſurface? Why may we not rather ſuppoſe that the exceeding ſmall quantity of ſolid Matter in reſpect of the fluid Æther, 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.

And tho' without *Light*, there can be no *Living*, yet there are many ways of producing *Light* which we are wholly Ignorant of: The Medium it ſelf may be always *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 the *Sun*; nor can we without a Boldneſs unbecoming a Philoſopher, ad-

adventure to aſſert the Impoſſibility of *Peculiar Luminaries* Below, of which we have no ſort of *Idea*.

Thus I have ſhewed a Poſſibility of a much more ample Creation, than has hitherto been Imagined: 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.

But there may be a farther uſe of this *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 *Æther* 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 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*.

An Invariable Compaſs; *by M.* de la Hire. n. 188. p. 344.

IX. 1. Having determined, as well a *I* could the *South Pole* of a *Terrella* or *Spherical Loadſtone*, of 3 *Inches* Diameter which accidentally had fallen into my hands, I was much ſurpriſed to find it 18°. diſtant from a Croſs, deep engraven on the Stone, which according to all appearance had heretofore been the *Pole* of this Stone, as it had been obſerved by him that Cut it. This Change having revived ſome Thoughts I had formerly entertained concerning the *Variation* of the *Needle*, I believed that if it were True that the *Poles* of the *Magnetical* Vertue *Changed* in the *Loadſtone*, as we ſee they *Change* in the *Earth*, one might derive great Advantages there from: For if this *Change* of theſe *Poles* in the *Loadſtone* were Certain, and that it was Analogous to the *Change* of the *Poles* of the *Magnetick* Vertue in the *Earth*, it is not to be Doubted but a *Terrella*, being ſuſpended at Liberty, would remain Immoveable, and that One Point thereof would regard the *Pole* of the World, which might be called the *True Pole* of the *Stone*, whilſt the *Poles* of its *Vertue* would paſs ſucceſſively from one part to another, after the ſame manner as they *Change* in the *Earth*.

After having well conſidered this *Hypotheſis*, and having Cleared up ſome doubts which *I* had, concerning the Poſition of the *Stone* at the Time when its *Pole* had formerly been Determined, *I* concluded that this Former *Pole* was Diſtant from the Point *I* call the *True Pole*, 13 *Degrees* towards the *Eaſt*, in the Place where it had been Marked, (and which is Unknown to me,) ſince that at this time in this Country the *Needle Varies* about 5 *Deg. Weſtward*.

Upon this *Hypotheſis*, which *I* know not that any one elſe has yet thought upon, *I* have invented a new ſort of *Needle* for the *Compaſs*, which may have the ſame Alterations as a *Spherical Loadſtone*, and at the ſame time the ſame Conveniencies as the Ordinary *Needle* hath.

I cauſed a *Ring* of 3 *Inches* Diameter to be made of *Steel-Wire*; from which there went 3 *Radii* of very Fine *Braſs-Wire* meeting at the Center in

a *Cap* perfectly like that of an Ordinary *Compass*, that so this Circle might rest on a Pin in its Center, and be at full Liberty to turn round, its Center being Fixt. This done *I* gave the *Magnetical Touch* to this *Steel Ring*, by applying indifferently to a Point thereof one of the *Poles* of a strong *Loadstone*, and the other *Pole* of the *Stone* to the Opposite Point, to give the greater Vertue to the *Ring*. Then *I* observed that the *Ring* was strongly *Magnetical*; and that the Point called the *South-Pole* did readily turn it self towards the *North*, and after several Vibrations stopped there; and that it had also the same *Inclination* towards the *Pole* which is found in *Needles* after they have been *Touched*; Lastly *I* fix'd upon the *Ring* a small *Fleur de Lis* of Brass, in the Point which exactly respected the *North*, the *Ring* being first well settled.

To inform my self, if this *Steel Ring* had the same Effects as a *Terrella*, *I* made the following Experiment. Having *Touched* a *Steel Ring*, and having laid it on a Paper, *I* strewed the *Filings* of *Steel* upon it, and then gently shaking the Paper, *I* saw that the *Direction* of the *Magnetical Matter* passed directly cross the *Ring* from one *Pole* to the other, and that there were two *Vortices* on the sides, as it is observed in the *Spherical Magnet*; which seems very surprising: For according to the Ordinary *Hypothesis* of the *Magnet*, the *Magnetical* Vertue passing more easily in the *Steel* than in the *Air* should run on both sides of the *Pole* round the *Ring*, and only Form a *Pole* Opposite to the First. But *I* was further confirmed in this Opinion, by applying a Flat and Pointed piece of Iron like the blade of a Knife, to a *Loadstone*, so as the Point of the Iron reached beyond the *Stone*: And having afterwards presented this Point to the *Magnetical Ring*, *I* observed that different Points of the *Ring* did apply to the Point of the Iron, according as the several Points thereof had been applyed to the *Stone*; which happens not in the *Magnetical Needle*, for that always presents one of its *Ends* to the Point of the Iron, being not disposed, by reason of its Length, to receive the *Magnetical* matter in all the Parts thereof Analogous to those of the *Stone*. It must only be noted that in an Irregular *Stone*, the *Magnetical* Vertue appears stronger towards the Angles than in the other Parts, which may cause some Irregularity in this Experiment, if it be tryed with a *Stone* that is very Uneven.

Those Experiments gave me the Curiosity of making another, by Touching two *Semicircles* of *Steel*. Having Joyned the Two Ends *Touched* by the same *Poles*, *I* observed by the *Steel Dust* the same effect as in the *Ring*: But having joyned the Ends Differently *Touched*, *I* found that immediately the two *Half Rings* run together, and stuck to each other; and by the *Steel Dust* strowed on Paper *I* observed, that there were 4 *Vortices*, one in the middle of each *Semicircle*, and one at each of the places where they were Joyned, and that the two Latter were Less than the others, and much stronger. *I* saw likewise, that there were 4 *Poles*, each of which was within a *Vortex*, and that each retained in its *Semicircle* the Vertue of the Ends of the *Half Rings*.

I Tried, after having *Touched* a *Steel-Wire* that was Straight, to make a Ring thereof. But *I* found, that it had quite lost its *Vertue*: Which cannot be

be attributed to the Junction of the *Poles*, ſince they ought to ſtick together, according to the other Experiments which have been made, but only to this, that hath been already noted, that when a *Magnetical Virgula* is a little bent, it looſes its Vertue, which cannot happen, but from the Alteration of the *Pores* of the *Steel*.

I farther Remarked, that a *Ring* of *Steel* having been Touched, does for a Long Time retain its Vertue, although it be put in a Poſition contrary to its *Poles*. And this Experiment is confirmed by another much more Conſiderable, Which is, that a *Ring* of *Steel* having been Touched with a ſtrong *Loadſtone*, cannot without Difficulty receive a contrary Touch from a *Magnet* Leſs Strong than the firſt: But that in Time, by little and little, it reſumes its Former Vertue; much as we ſee *Magnets* do, which being Applyed to another ſtone, by the *Poles* of the ſame Denomination, loſe their Firſt Vertue and take a Contrary, which they afterwards Loſe by Degrees to Reaſſume their Firſt.

After I had preſented this New Syſtem of the *Magnet* to the *Academy*, there were made ſome Experiments upon a *Terrella* of much the ſame Diameter with Mine, but whoſe *Poles* were not diametrically Oppoſite; and upon a *Half Globe* very much bigger than the *Terrella:* But we could find in them no conſiderable Difference or *Alteration* of *Poles*. Becauſe of ſome Circumſtances, the Company thought fit that ſome Experiments ſhould be made with this ſort of *Compaſs*.

Theſe *Circular Needles* may be Toucht a new after this manner; Apply the *Poles* of the *Stone* to the *Ring*, and the *Ring* which is ſuſpended upon its *Pivot*, will turn ſo, as the Point anſwering to the *Pole* of the Vertue of the *Stone* which is applyed to it, will come as near to it as poſſible: In ſo much, that without Touching the one or the other, the *King* will not fail to receive very much Force. The ſame may be done at the Oppoſite Point.

The Principle Examined; by ---- ib. p. 350.

2. This account having been read before the *Royal Society*, it was ordered that the *Terrella*, which has been in their *Repoſitory* theſe 25 *Years*, ſhould be Examined: And it was found, that the Points which are Marked thereon with croſſes, were as near as could be diſcerned, the *True Poles* of the *Stone*; notwithſtanding that the *Variation* has *Changed* at *London* full 4 *deg.* ſince this *Terrella* has been in the *Society's* Cuſtody, and perhaps many more ſince it was Marked; and had there been a *Change* in the *Poles* of the *Loadſtone* Analogus thereto, it muſt needs have been Perceived in this, whoſe Diameter is about $4\frac{1}{2}$ *Inches*. However to put this matter paſt Diſpute, care was taken to find out exactly and Mark the *Poles* of the *Societies Great-Loadſtone*, the Sphere of whoſe Activity is above 9 *foot* Radius, and whoſe *Poles* are 13 *inches* aſunder: whereby if this *Tranſlation* of the *Poles* be real, it cannot fail of being made very Senſible hereafter. In the mean time ſome of the Company well skill'd in *Magneticks* were of Opinion, that ſuch a *Circular Needle* would libraté on its Center, ſo as to reſpect the *Magnetical Meridian* with the Points that had at Firſt received the *Touch*, rather than that the *Ring* remaining immoveable, the *Directive* vertue ſhould be *Transferred* therein from Place to

Place,

Place, either by Length of time, or by Tranſporting this *Compaſs* into thoſe Parts where the *Variation* of the *Needle* is conſiderably Different.

X. An Account *of a Book*, Omitted.

Epiſtola Invitatoria, ad Obſervationes *Magneticæ Variationis*, communi Studio junctiſque Laboribus, inſtituendas, *Altorfi.* 1682. n. 143. p. 23.

CHAP. V.

Botany. Agriculture.

I. PRepare two Plates of Iron as large as you deſire to preſerve the *Specimens*. Theſe Plates muſt be too Thick to Bend, very ſmooth on one ſide, and Holes for Screws on each Corner, to Screw them cloſe. Then take your *Flowers*, *Leaves*, *&c.* when perfectly Ripe, and in their True Colours; Spread them on a Brown-paper, with the *Leaves* as Diſtinct as you can; and if the *Flowers* be Large, there muſt more Paper lye under it; and if it be Thick, you may pare away the one half thereof, as alſo of the Stalk, ſo as to make it lye almoſt Flat, and ſome Diſtinct *Leaves* may be ſeparated and taken out, as a by ſtore, to be afterwards Stuck in, and compleat the *Flower*. Then lay, over all more Brown-Paper, and put theſe between the Iron Plates, Screw 'em cloſe, put the ſame into an *Oven* for two Hours, juſt as the Bread is drawn; After which take out the *Flowers*; then take *Aqua Fortis*, and *Aquavitæ*, or *Brandy*, in equal Quantity, mixed together, and with a Bruſh paſs over the *Leaves* of the *Flowers*. Then lay them on Freſh Brown-Paper and Preſs them a little with a Handkerchief, or with your Fingers, to grow Dry. Then take the bigneſs of a *Walnut* of *Gum Dragon*, which in leſs than 24 *Hours*, will be Diſſolved in a Pint of Fair Water; and with a fine Bruſh, rub the backſides of your *Flowers* and *Leaves*, to make them Stick, and then lay them into your Paper Book, where they will lye Faſt, and always look Freſh.

To Preſerve the Specimens of Plants; *by Sir.* Rob. Southwel. n. 237. p. 42.

There muſt be a little Skill after the *Oven*, to turn the *Leaves* into Shape, and a ſort of *Perſpective*, in caſe the *Flower* be too Thick. And if you would add any *Smell* to theſe *Flowers*, which will have none, touch them with ſuch *Eſſence* as you think fit.

II. 1. As I paſſed through *Marton* Woods under *Pinno Moor* in *Craven*. *Aug.* 18. 1672. I found an infinite Number of *Muſhroms*, ſome Withered, and others new Sprung and Flouriſhing. They were of a Large Size, ſomething bigger than the Ordinary *Red gilled Eatable Muſhrom*, or *Champignon* and very much of their Shape; that is with a perfectly Round Cap, or Strool (as we vulgarly call it,) Thick in Fleſh, and with open *Gills* underneath; having a Thick, Fleſhy not Hollow, and Round *Foot-Stalk*, of about 6 Fingers-

An Odd kind of Muſhrom; *by Dr.* Liſter. n. 89. p. 5116.

gers breadth High above Ground, and ordinarily as Thick as my Thumb. If you Cut any part of this *Muſhroom*, it will Bleed exceeding freely a *Milk-White Juice*, which Taſts much Hotter upon the Tongue than *Pepper*; it is not Clammy to the Touch; and the Air does not much Diſcolour it, or the Blade of a Knife, as is uſual with moſt *Vegetable Juices*. It became in the Glaſs Viol I drew it into, ſuddenly Concrete and Stiff, and did in ſome Days Dry into a Firm Cake; Which alſo when well Dryed, retained its Fierce Biting Taſt and White Colour.

Further: I Obſerved theſe *Muſhroms*, full of *Juice* not to be endured upon our Tongues, to abound with *Fly Maggots*. Alſo the youngeſt and Tendereſt of them, that is ſuch as are moſt *Juicy*, to have been very much Eaten by the *Grey Meadow Naked Snail*, lodging themſelves within the ſide of the *Plant*.

By Mr. Wray. *ib. p.* 5117.

2. I doubt not but this *Muſhrom* is that Deſcrib'd in *Joh. Bauhin.* l. 40. c. 6. under the Title of *Fungus Piperatus Albus, Lacteo Succo turgens*: For in almoſt all Points the Deſcriptions agree exactly.

Another ſort of Muſhrom; *by Dr.* Liſter. n. 110. p. 225.

3. The *Fungus poroſus craſſus magnus. J. B.* when Freſh gathered is of a *Buff Colour* Inſide and Out ſide; and, yet Cut through the middle, it will in a Moment Change from a Pale Yellow to a *Deep Purple* or *Blew*, and ſtain Linnen accordingly. A drop of the *Juice*, leiſurely Squeezed out, will Change, holding it betwixt your Eye and the Light, through all the Colours of the *Rainbow*, in the very time of its Falling, and Fix in a *Purple*, as it doth in the Springing out of its Veins.

The Flowers *and* Seed *of* Muſhroms; *by Dr.* Liſter. n. 110. p. 225.

III. I am of Opinion that *Muſhroms* are *Plants* of their *Own Kind*, and have more than a *Chance Original*. We will Inſtance in that Species, call'd *Fungus Poroſus Craſſus Magnus*. J. B. The Texture of the *Gills* is like a Paper prick'd full of *Pin-holes*. In *Auguſt* this is very frequent under Hedges, and in the middle of the *Moors* in many places of *Yorkſhire*. It ſeems to me (and, no doubt, it will to any Perſon that ſhall well examine it,) that the *Gills* of this *Muſhrom* are the very *Flower* and *Seed* of this *Plant*. When it is Ripe, the *Gills* here are eaſily Separable from the reſt of the *Head:* Each *Seed* is Diſtinct from other, and hath its Impreſſion in the Head of the *Muſhrom*, juſt as the *Seeds* of an *Artichoak* hath in the Bottom of it. The Bigger End of the *Seed* is full and Round; and they are Diſpoſed in a Spiral Order, juſt as thoſe of the *Artichoak*. The like we do think of all other *Muſhroms*, however differently Figured.

And if it ſhall Happen to him that ſhall *Sow* them, that theſe will not Produce their Kind, but be *Sterile*, it is no ſtrange thing amongſt *Plants*, there being whole *Genus*'s of *Plants* that come up, and *Flower*, and *Seed*, yet their *Seed* was never Known to produce *Plants* of their Kind: Being naturally *Sterile*, and a *Volatile Duſt*, as all the *Orchides* or *Bee-Flowers*.

Truffles; *by Dr.* Tanc. Robinſon. n. 202 p. 814. 824. n. 204. p. 935.

IV. The *Tubera Terræ* obſerved lately at *Ruſhton* in *Northamptonſhire*, by Dr. *Hatton* of *Harborough* in *Leiceſterſhire*, are the true *French Truffles*, the

Italian

Italian Tartuffi or *Tartuffole*, and the *Spaniſh Turmas de Tiera*, which are not noted by Mr. *Ray* to be found in our *Britiſh* Soil. 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 Fryed in Slices with Butter or Oil, Salt and Pepper; or elſe out of Pickle, and often Boyled in their Soup. 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 Unſavory; ſtreaked with many white Veins or Threds, as in ſome Animals *Teſticles:* The whole is of a *Globoſe* Figure, though unequal and Chinky. 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* and *Thunder* may diſpoſe them to ſend forth their particular Scent ſo Alluring to the *Swine*; For ſome of the Ancients call'd them *Ceraunia*. *Fig.* 157. *Fig.* 158.

Dr. *Hatton* Obſerved *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 ſulcated *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 *Arachydna'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 Earthnut*, Digg'd up and Eaten by the Poor People,) non niſi Altâ Foſſione inveniendæ, ſays *John Bauhine*. The *Roots* of our *Bulbocaſtanum* (of the *Umbelliferous* Tribe) commonly call'd *Kepper-Nuts*, *Pignuts*, and *Gernuts*, in the North, lie very Deep, and Fatten *Hogs*, which are very Greedy of them. *Fig.* 159.

V. Some years ſince M. *Perrault* related to the *Royal Academy* of *Paris*, that travelling through *Sologne*, he had been informed by ſome Phyſicians and Chyrurgions of that Country, that the *Rey* there was ſometimes ſo *Corrupted*, that thoſe who did Eat of the Bread which had much of this *Corrupted* Grain in it, were ſeized on by a *Gangrene*. We have viewed ſome of theſe Grains of *Rey* thus Degenerated; they are Black without, and pretty White within, and when they are Dry, they are Harder and cloſer than the Natural *Good* Grain. They have no ill Taſte. I have found ſome of them that had Hanging at their *Baſis* a ſubſtance of a *Honey* taſte and Conſiſtence. They become much Longer in the *Ear*, than the other. There are ſome of them that are 13 or 14 *Lines* long, and 2 *Lines* large, and at times you will find 7 or 8 of them in One *Ear*. It may be ſeen, in Examining theſe *Ears*, that they are not Bodies of *Another Kind*, Generated among the Grains of *Rey*, as ſome pretend: But that they are true Grains of *Rey*, having their Coats like the reſt, wherein may be Diſtinguiſht the place of the *Germen* and of the *Furrow*. *A Strange ſort of* Rey *in* France; *by* ---- n. 130. p. 758.

There happened many like Accidents in 1674 at *Montargis* from the ſame Cauſe. M. *Dodart* cauſed to be brought to him ſome Ears of this *Rey*,

and the Company found the Grains of them altogether like those they had seen formerly.

M. *Tuillier* hath imparted a Letter of M. *Chatton*, an Old and Expert Chyrurgion at *Montargis*; whence he saith he hath learned the Particulars following; *viz*, *Rey* doth in this Manner *Degenerate* in *Sologne*, *Berry*, the Country of *Blaise* and *Gastinois*, and almost every where, especially in Light and Sandy Land. There are Few Years but some little of this *Ill Grain* grows. When there is but little, the Ill Effects of it are not Perceived. It Grows Plenteously in Wet Years, and most of all when after a Rainy Spring there follow Excessive Heats. The Constitution of the Air or of the Rains, which impress this *Malignity* in the *Rey*, is Rare: there having been found none at *Montargis* but Thrice in 38 *Years*; and there having been but Few Distempers of it the second time, because there was but little of that *Corrupted Grain*. The *Bread* made of the *Rey* which holds some of this *Corrupted* Corn, Tasts neither worse nor better than other. The *Rey* thus *Corrupted* hath its Effects chiefly when 'tis New, yet not till it hath been Used a considerable Time,

These Effects are, to Dry up the *Milk* in *Women*; to cause sometimes *Malign Fevers*, accompanied with *Drowsiness* and *Raving*; to Breed the *Gangrene* in *Arms*, but most in *Legs*, which ordinarily are *Corrupted* first, and to which this Distemper fastens it self, as the *Scorbute* doth. This *Corruption* is preceeded by a certain *Stupefaction* in the *Legs*; upon which follows a Little *Pain*, and some *Swelling* without Inflammation, and the Skin becomes Cold and Livid. The *Gangrene* begins at the Center of the Part, and appears not at the Skin but a long while after, so that People are often obliged to Open the Skin to find only the *Gangrene* Lurking under it.

The only *Remedy* for this *Gangrene* is to *Cut off* the Part Affected: If it be not *Cut off*, it becomes Dry and Lean, as if the Skin were Glued over the Bones, and 'tis of a Dreadful *Blackness* without *Rottenness*.

Whilst the *Legs* are Drying up, the *Gangrene* Ascends to the *Shoulders*: and one knows not, which way it Communicates it self.

We have not as yet Lighted upon a *Specifick Remedy* against this Evil. There is some Hope of Preventing it by *Hot Spirits* and *Volatile Salts*. The *Orvietan* and *Ptisan* of *Lupins* do considerable Good to the Person Distempered. Poor People are almost Only subject to these Evils.

M. *Tuillier* also writes word, that in 1675 he saw much of this *Cornuted Grain* among the *Rey* of the Country of *Gastinois*; and that the Country People told him, that there was much more of it this Year 1676. than the Last Year; and that it caused great Disorders: And yet 'tis certain, that this Summer hath been rather *Cold* than *Hot*; and that there hath not been any considerably Intemperate Weather this Year, but Excess of *Wet*.

However, it may be Doubted, whether these *Gangrenes* are the Effect of this *Corn* Eaten; or whether the *Corruption* of the *Rey* and that of the *Parts* in the Bodies of Men, are not Accidents equally derivable from the same Constitution of the Air, and independent the one from the other. Yet M. *Tuillier* has assured M. *Dodard* that in the *Year* 1630. which was Fatal to the Poor of the Countries subject to these Evils, he being at *Sully*, and having understood by a Physician

and

and Chirurgion, that the *Cornuted Rey* was the Cauſe of the *Gangrenes* that were then very Frequent, being deſirous to ſatisfy himſelf, whether this *Grain* was indeed the Cauſe thereof, he gave of it to ſeveral *Animals*, which *Dy'd* of it.

VI. Malt is made in *Scotland* of no other Grain, but *Barly*: Whereof there are two Kinds; 1, which hath 4. Rows of Grains on the Ear; the *other* 2. Rows. The *firſt* is the more commonly uſed: but the *other* makes the beſt *Malt*.

To make Malt; *by Sir* Rob. Murray. n. 142. p. 1069.

The more recently *Barly* hath been Threſhed, it makes the Better *Malt*. But if it hath been Threſhed 6 *Weeks* or upwards, it proves not good *Malt*, unleſs it be kept in one Equal Temper; whereof it eaſily fails, eſpecially if it be kept up againſt a Wall: For that which lies in the Middle of the Heap is Freſheſt; that which lies on the Outſides and at Top is over dry'd; that which is next the Wall, Shoots forth; and that which is at the Bottom Rots. So that ſome Grains do not *Come Well* (as they call it) that is, never gets that right Mellow Temper *Malt* ought to have, and ſo ſpoils all the reſt. For thus ſome Grains *Come* Well, ſome not at all, ſome Half, and ſome too Much.

The beſt way to Preſerve Threſhed *Barly* long in good Temper, is not to Separate the Chaff from it, But as long as it is Unthreſhed, it is always Good. Brewers Uſe to keep their *Barley* in Large Rooms on Boarded Floors, laid about a Foot in Depth, and ſo Turned over now and then with Scoops,

Barly that hath been Overheated in the Stacks or Barnes, before it be ſeperated from the Straw, will never Prove Good for *Malt*, nor any other Uſe. But though it Heat a little, after it is Threſhed, and kept in the Chaff, it will not be the Worſe, but rather the Better for it: for then it will *Come* the ſooner, and more Equally. A Mixture of *Barly* that grow on ſeveral Grounds, never proves Good *Malt*, becauſe it *Comes* not Equally. So that the beſt *Barly* to make *Malt* of, is that which grows in One Field, and is kept and Threſh'd together.

Take then Good *Barly*, newly Threſhed, and well purged from the Chaff and put hereof 8 *Bolls*, that is about 6. *Engliſh Quarters*, in a ſtone-Trough. Where let it infuſe, till the Water be of a bright Reddiſh Colour; which will be in about 3 *Days*, more or leſs, according to the Moiſtneſs or Dryneſs, Smalneſs or Bigneſs of the Grain, Seaſon of the Year, or Temper of the Weather. In Summer *Malt* never makes Well; in *Winter* it will need Longer Infuſion, than in the *Spring* or *Autumn*.

It may be known when *Steeped* Enough, by other Marks beſides the Colour of the Water, as the Exceſſive Swelling of the Grain: or if, *Over ſteeped*, by too much Softneſs; being, when in the Right Temper, like that *Barly* which is prepared to make Broth of.

When the *Barly* is ſufficiently *Steeped* take it out of the Trough, and lay it on *Heaps*: ſo let the Water Drein from it. Then after 2 or 3 *Hours*, Turn it over with a *Scoop*, and lay it in a New *Heap* about 20 or 24 *Inches* Deep.

This *Heap* they call the *Coming Heap*: And in the managing of this *Heap* aright, lies the greateſt Skill. In this *Heap* it will lie 40 *Hours*, more or leſs, according to the forementioned Qualities of the Grain, *&c.* before it come to the right Temper of *Malt*; which that it may do *Equally*, is moſt to be Deſired.

Whilſt it lies in this *Heap*, it is to be carefully looked to, after the firſt 15 or 16 *Hours*: For about that time, the Grains will begin to put forth the *Root*, which when they have Equally and Fully done, the *Malt* muſt within an *Hour* after, be Turned over with a *Scoop*; otherwiſe the Grains will begin to put forth the *Blade* or *Spire* alſo, which by all means muſt be prevented: for hereby the *Malt* will be utterly Spoil'd, both as to the Pleaſantneſs of Taſt, and Strength.

If all the *Malt Come* not Equally, becauſe that which lies in the Middle being Warmeſt will uſually *Come* firſt, *Turn* it over, ſo as the Utmoſt may lie Inmoſt, and ſo leave it till all be *Come* alike.

So ſoon as the *Malt* is ſufficiently *Come*, Turn it over, and ſpread it to a Depth not exceeding 5 or 6 *Inches*. And by that time it is all ſpread out, begin and Turn it over and over again, three or four times. Afterwards Turn it over in like manner, once in 4 or 5 *Hours*, making the *Heap* Thicker by Degrees, and continuing ſo to do conſtantly, for the ſpace of 48 *Hours* at leaſt. This Frequent *Turning* it over, Cooles, Dryes and Deads the Grain, whereby it becomes Mellow, Melts eaſily in *Brewing*, and then ſeparates entirely from the *Husk*.

Then Throw up the *Malt* into a *Heap*, as High as you can. Where let it lye, till it Grows as Hot as your Hand can endure it: which uſually comes to paſs, in ſome 30 *Hours* ſpace. This perfects the ſweetneſs, and Mellowneſs of the *Malt*.

After the *Malt* is ſufficiently Heated, throw it abroad to Cool, and Turn it over again about 6 or 8 *Hours* after, and then Dry it upon the *Kiln*. Where after One Fire, which muſt ſerve for 24 *Hours*, give it another more Slow, and if need be a third. For if the *Malt* be not throughly Dryed, it cannot be well Ground, neither will it Diſſolve well in the *Brewing*, and the *Ale* it makes will be Red, Bitter, and will not Keep.

The beſt *Fewel* is *Peat*; The next, *Charcoale*, made of *Pit Coal* or *Cinders*. *Heath*, *Broom*, and *Furzes*, are nought. If there be not enough of one Kind, Burn the Beſt Firſt, for that gives the ſtrongeſt Impreſſion, as to the Taſte.

The Granaries in London; by Dr. Merret. n. 25. p. 464.

VII. 1. All the 12 *Companies* of *London*, and ſome other *Companies* and Private Perſons, have their *Granaries* at the *Bridge-Houſe* in *Southwark*; (where are a *Juſtice of the Peace*, a *Steward*, and two *Maſters*.) Theſe *Granaries* are built on two ſides of an Oblong Square; one whereof ſtands North and South, and is near 100 *Yards* long; whoſe *Lettice*-Windows reſpect *North-Eaſt*: the other ſide may be about 50 *Yards* long; the Windows look to the *North*; and the Oppoſite ſides have no Apertures. All the Windows

are

are about a *Yard* High, without any *Shutters*, and run on in a continued *Series*, with very ſmall Partitions, ſufficient only to nail the *Lettices* to. Each of them is 3 or 4 *Stories* High. The Ground or lowermoſt *Story*, 12 *Foot* from the Ground, is uſed only for a *Ware-Houſe*, &c. To ſettle the Firſt *Story* upon ſtrong Pillars, fortify'd with Spikes of Iron, that no *Vermin* might get up, would make that *Story* fitter for drying of Corn, and more *Perflatile*. In ſome places they put, in all the Inſide of their Rooms, Iron *Wire*, of ſo narrow *Meſhes*, that neither *Rats* nor *Mice* can get through them, 2 or 3 *Foot* deep. Others erect, on all the ſides, *Boards* of Timber, and faſten others to the top of the Perpendicular one, lying either Parallel to the *Horizon*, or ſo that they make an Acute Angle with the former, to the ſame purpoſe: For, beſides the devouring of the Grain, the Excrements and Urine of that *Vermine*, Moiſtning the *Wheat*, or *Rye*, make them apt to Corrupt and Breed *Weivels*.

The two main Conſiderables, in Building theſe *Granaries*, are, To make them *ſtrong*, and to expoſe them to the *Moſt Drying Winds*.

The *Ordering* of their *Corn* is this, in *Kent*, to ſeperate the Duſt and other Impurities in it; when 'tis Thraſh'd, they throw it in Shovels from one ſide to the other, which the longer it is, the better; by which means all ſuch Impurities remain in the Middle, betwixt the two *Heaps* of *Corn*; which they *Skreen* to Part the Corn that is good, from the ſaid Impurities. Then, when they firſt bring the Grain into the *Granaries*, they lay it about *half* a *Foot* Thick, and Turn it twice a *Week*, and once in that time *Skreen* it; and this for 2 *Months* ſpace. After that, they lay it a *Foot* Thick for 2 *Months* more, Turning it once or twice a *Week*, and *Skreen* it proportionably, according as the *Drying* Seaſon is, ſeldomer or oftner. After 5 or 6 *Months*, they raiſe it to 2 *Foot* in Height, and Turn it once a *Fortnight*, and *Skreen* it once a *Month*, as Occaſion is. After a *Year*, they lay it *two and a half* or 3 *Foot* Deep, and Turn it once in 3 *Weeks* or a *Month*, and *Skreen* it proportionably.

When it hath lain 2 *Years* or more, they Turn it once in 2 *Months*, and *Skreen* it once a *Quarter*, and ſo on, as they find it in Brightneſs, Hardneſs and Dryneſs. The oftner theſe two things are done, the better the Grain proves. They leave an empty ſpace about a *Yard* wide on all ſides of the Room, and at 6 *Foot* diſtance, through the whole *Area*, empty of Corn; into which empty Places, they Turn the Corn as often as 'tis Needful.

In *Kent* they make two ſquare Holes in both the Ends of the Floor, and one Round in the Middle; by which they throw the Corn from the Upper into the lower Rooms, *& contra*, to Air and Dry it the better.

The *Skreens* are made with two Partitions, to ſeparate the *Duſt* from the Corn; which falls into a Bag, and when ſufficiently full, is caſt away, the good Corn remaining behind.

Corn has been kept in *London Granaries* 32 *Years*: and the longer 'tis kept the more *Flower* it yields, in Proportion to the Quantity of Corn, and makes the Purer and Whiter Bread; the ſuperfluous Humidity only Evaporating.

2. Dr.

At Zurich: *by Dr.* Pell. ib.

2. Dr. *Pell* mentioned at a *Meeting* of the *R. Society*, that they keep Corn at *Zurich* in *Helvetia* 80 *Years*.

In Dantzick *and Muſcovy*; *by* ---- *ib.* p. 466.

3. Obſerving Merchants and Travellers tell us, that the *Granaries* of *Dantzick* are generally 7 *Stories* High, and ſome 9 *Stories*; having each of them a *Funnel*, to let the Corn Run down from one Floor to another; thereby chiefly ſaving the Labour and Charges of carrying it down. And then, that they in that Town, are built altogether ſurrounded with Water, whereby the Ships have the Conveniency of lying cloſe to them, to take in their Lading. No Houſes are ſuffer'd to be Built near them, to be thereby ſecured from the Caſualties of *Fire*.

Thoſe of *Muſcovy* are made *Under-ground* by digging a Deep Pit, of almoſt the Figure of a *Sugar-Loaf*; Broad Below, and Narrow at the Top; the Sides well *Plaiſtered* round about; and the Top very cloſely Covered with Stone

The People of that Country are ſo very careful, to have the Corn well *Dried*, before they put it into thoſe *Subterraneous Granaries*, that when the Weather of that *Northern Climate* ſerves not to *Dry* it ſufficiently, they Heat their Barns by the means of great Ovens, and thereby well *Drying* their Corn, ſupply the Deficiency of their ſhort *Summer*.

Turnep and Potato Bread; *by Dr.* Beal, n. 90. p. 5142.

VIII. 1. In the *Year* 1629, and 1630. there was a Dearth in *England*; And much talk they had then, that in *London* they had a way to Knead and ferment Boyl'd *Turneps* with a ſmall quantity of *Meal*; and that it made Better *Bread* for Whiteneſs, Pleaſantneſs, Laſting and Wholſomneſs, than is made of the fineſt Flower of *Wheat*. *Turneps*, *Rapes*, *Carrets*, *Parſneps*, *Potatoes*, and other Roots, lie ſafe Under Ground from ſcorching Heat, and are ſaid to Thrive beſt in the greateſt Rain. *Potatoes* were a Relief to *Ireland* in their laſt *Famine*. They yield *Meat* and *Drink*.

Turnep Bread; *by Mr.* Sam. Dale. n. 205. p. 970.

2. The Dearneſs of all ſorts of Corn in 1693, occaſion'd many Poor People in *Eſſex* to make *Bread* of *Turneps*. The way of making it is this, They take Pilled *Turneps*, and Boil them in Water until they are ſoft or Tender; then preſſing ſtrongly out the *Juyce*, they Mix them with their Weight of *Wheat-Meal*; then adding Salt and Yeaſt, of each *q. s.* and Warm Water, they Knead it up as other Dough, or Paſte; which having lain a little while to Ferment, they Order and Bake it as Common *Bread*. This *Turnep Bread*, to the Eye, is 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.

The Culture of Maize; *by Mr. Winthorp*: n. 142 p. 1065.

IX. The Corn uſed in *New England* before the *Engliſh* Planted there, is call'd by the Native *Weachin*, and is known by the Name of *Maiis* in ſome *Southern* Parts of *America*. The *Ear* is for the moſt part, about a *Span* long, compoſed of ſeveral, commonly 8 *Rows* of Grains, or more according to the Goodneſs of the Ground: And in each *Row*, uſually above 30 Grains. It is of various Colours, as Red, White, Yellow, Blue, Olive, Greeniſh

Greeniſh, Black, Speckled, Striped, *&c.* Sometimes in the ſame Field, and the ſame *Ear*. But the White and Yellow are the moſt common.

The *Ear* is clothed and Armed with ſeveral ſtrong thick *Husks*: Not only defending it from the Cold of the Night (being the latter End of *September*, in ſome Parts, before it be full Ripe,) and from Unſeaſonable Rains; but alſo from the *Crows*, *Starlings* and other Birds; which being allured by the ſweetneſs of the Corn before it hardeneth, come then in great Flights into the Fields, and pecking through the top of the Cover, devour as far as they can Reach.

The *Stalk* groweth to the height of 6 or 8 *Feet*; more or leſs, according to the Condition of the Ground, or Kind of *Seed*. The *Virginian* groweth Taller than that of *New England*: And there is another ſort uſed by the *Northern Indians* far up in the Country, that groweth much ſhorter than that of *New England*. 'Tis always jointed like a *Cane*: And is full of ſweet Juice, like the *Sugar-Cane*: And a Syrup as *ſweet* as *Sugar* may be made of it; as hath been often try'd. And Meats *ſweetned* with it, hath not been diſtinguiſhed from the like *ſweetned* with *Sugar*. At every *Joint* there are long *Leaves* almoſt like *Flags*, and at the Top a Bunch of *Flowers*, like the Bloſſoms of *Rye*.

It is *Planted* between the Middle of *March* and the Beginning of *June*: But moſt commonly from the Middle of *April* to the Middle of *May*.

In the more *Northerly* Parts, they have a peculiar kind call'd *Mohauks-Corn*, which though Planted in *June*, will be Ripe in Seaſon. The *Stalks* of this kind are ſhorter, and the *Ears* grow near the bottom of the *Stalks*, and are generally of diverſe Colours.

The manner of *Planting* is in Rows, at Equal diſtance every way, about 5 or 6 *Feet*.

They open the Earth with an *Howe*, taking away the ſurface 3 or 4 *Inches* deep, and the breadth of the *Howe*; and ſo throw in 4 or 5 Grains, a little diſtant one from another, and cover them with Earth. If two or three grow, it may do well: For ſome of them are uſually deſtroyed by *Birds*, or *Mouſe Squirrels*.

The Corn grown up an Hand's length, they cut up the Weeds, and looſen the Earth about it, with a broad *Howe*: Repeating this Labour, as the Weeds grow. When the *Stalk* begins to grow high, they draw a little Earth about it, and upon the putting forth of the *Ear*, ſo much as to make a little Hill, like a *Hop-Hill*; after this, they have no other Buſineſs about it, till Harveſt.

After 'tis gathered, it muſt, except laid very Thin, be preſently Stripped from the *Husks*, otherwiſe it will Heat, grow Mouldy, and ſometimes Sprout. The common way (which they call *Tracing*) is to weave the *Ears* together in long *Traces* by ſome parts of the *Husk* left thereon. Theſe *Traces* they Hang upon *Stages*, or other Bearers within doors, or without: For, Hung in that manner, they will keep good and ſweet all the Winter after, though expoſed to all Weathers.

The

The Natives commonly *Threſh* it as they Gather it, Dry it well on Matts in the Sun, and then beſtow it in *Holes* in the Ground (which are their Barns) well Lined with Withered Graſs and Mats, and then covered with the like; and over all, with Earth; and ſo it's kept very well, till they Uſe it.

The *Engliſh* have now taken to a better way of *Planting* by the help of the *Plough*, in this manner: In the *Planting-time* they *Plough* ſingle Furrows through the whole Field, about 6 *Feet* diſtant, more or leſs as they ſee convenient. To theſe they *Plough* others acroſs at the ſame Diſtance Where theſe Meet they throw in the Corn, and cover it either with the *Howe*, or by running another Furrow with the *Plough*. When the *Weeds* begin to overtop the Corn, then they *Plough* over the reſt of the Field between the *Planted Furrows*, and ſo Turn in the *Weeds*. This is repeated where they begin to *Hill* the Corn with the *Howe*; and ſo the Ground is better looſened then with the *Howe*, and the Roots of the Corn have more Liberty to ſpread. Where any *Weeds* eſcape the *Plough*, they uſe the *Howe*.

Where the Ground is Bad or Worn out, the *Indians* us'd to put 2 or 3 of the Fiſhes call'd *Aloofes*, under or adjacent to each *Corn-Hill*, where they had many times a Crop double to what the Ground would have otherwiſe produced. The *Engliſh* alſo have learned the like Husbandry, where theſe *Aloofes* come up in great Plenty, or where they are near the *Fiſhing ſtages*; having there the Heads and Garbage of *Cod-Fiſh* in abundance, at no charge but the fetching,

The Fields thus Ploughed for this Corn, after the Crop is off, are almoſt as well fitted for *Engliſh* Corn, eſpecially *Summer.Grain*, as *Peaſon* or *Summer-Wheat*; as if lying *Fallow*, they had a very good *Summer-Tilth*.

The *Indians*, and ſome *Engliſh* (eſpecially in good Ground, and well *Fiſhed*) at every *Corn-Hill*, plant with the Corn, a kind of *French* or *Turkey Beans*: The *Stalks* of the Corn ſerving inſtead of *Poles* for the *Beans* to climb up with. And in the vacant places between the *Hills* they will plant *Squaſhes* and *Pompions*; loading the Ground with as much as it will bear. And many after the laſt Weeding, ſprinkle *Turnep-Seed* between the *Hills*, and ſo, after Harveſt, have a good Crop of *Turneps*. The *Stalks* of this Corn, cut up before too much dried, and ſo laid up, are good Winter *Fodder* for Cattle. But they uſually leave them on the Ground for the Cattle to feed on. The *Husks* about the *Ear* are Good *Fodder*, given for Change ſometimes after Hay. The *Indian* Women Slit them into narrow parts, and ſo Weave them artificially into Baskets of ſeveral Faſhions.

This Corn the *Indians* dreſſed ſeveral ways for their Food; ſometimes Boiling it whole till it ſwelled and became Tender, and ſo either eating it alone, or with their Fiſh or Veniſon inſtead of *Bread*; ſometimes Bruiſing it in Mortars, and ſo Boiling it: But commonly this way, *viz.* by Parching it in Aſhes or Embers, ſo artificially ſtirring it, as without Burning to be very Tender, and Turned almoſt Inſide Outward, and alſo White and Flowry. This they ſift very well from the Aſhes, and beat it in their Wooden Mortars with a long Stone for a Peſtle, into Fine Meal. This is a conſtant

Food

Food at Home, and especially when they Travel, being put up in a Bag, and so at all times ready for Eating either Dry or Mix'd with Water. They find it very wholsome Diet: And the *English* sometimes for Novelty, will procure some of this to be made by the *Indian Women*, adding Milk or Sugar and Water to it, as they please.

The *Indians* have another sort of Provision out of this Corn, which they call *Sweet Corn*. When the Corn in the Ear is full, while it is yet Green, it hath a very *sweet* Taste. This they gather, Boil, and then Dry, and so put it up into Bags or Baskets for their Use: Boiling it again, either whole or Grosly beaten, when they Eat it, either by it self, or amongst their Fish, or Venison, or Beavers or other Flesh; accounting it a Principal Dish.

These Green and *Sweet Ears* they sometimes Roast before the Fire, or in the Embers, and so Eat the Corn: By which means, they have sufficient Supply of Food, though their Old Store be done.

The *English*, of the full ripe Corn, Ground, make very good *Bread*: But 'tis not Ordered as other Corn. For if it be Mixed into stiff Paste, it will not be so good, as if made only a little stiffer than for Puddings; and so Baked in a very Hot Oven, standing therein all Day, or all Night. Because upon the first pouring of it on the Oven Floor, it spreads abroad, they pour a Second Layer or Heap upon every First, and thereby make so many Loaves: Which if Baked enough, and Good, will be of a deep *Yellowish* Colour; if otherwise, a *White*.

It is also sometimes Mixed with half or a third part of *Rye* or *Wheat-meal*, and so with Leaven or Yeast, made into Loaves of very good Bread.

Before they had *Mills*, having first watered and *Husked* the Corn, and then Beaten it in Wooden Mortars, the Courser part sifted from the Meal, and seperated from the loose Hulls by the Wind, they Boyled to a Thick Batter: to which, being Cold, they added so much of the Fine Meal, as would serve to Stiffen it into Paste, whereof they made very Good *Bread*.

The Best sort of Food which the *English* make of this Corn, is that they call *Samp*. Having first Watered it about *half* an *Hour*, and then Beaten it in a Mortar, or else ground it in a Hand or Other *Mill*, into the bigness of *Rice*, they next sift the Flower, and Winnow the Hulls from it. Then they Boil it gently till it be Tender, and so with Milk, or Butter and Sugar, make it into a very Pleasant and wholsome Dish.

This was the most usual Diet of the First Planters in these Parts, and is still in Use amongst them, as well in *Fevers* as in *Health*: And was often prescribed by the Learned Dr. *Wilson* to his Patients in *London*. And of the *Indians* that live much upon this Corn; the *English*, most acquainted with them, have been informed by them, that the Disease of the *Stone* is very seldom known amongst them.

The *English* have also found out a way to make very good *Beer* of this Grain: That is, either of *Bread* made hereof, or else by *Malting* it. The way of making *Beer* of *Bread*, is by breaking or cutting it into great Lumps about as big as a Man's Fist, to be *Mashed*, and so proceeded with as

Malt, and the Impregnated Liquor, as *Woort*; either Adding or Omitting *Hopps*, as is desired.

To make Good *Malt* of this Corn, a particular way must be taken. The *Barley Malt-Masters* have Used all their Skill to make good *Malt* hereof the Ordinary way, but cannot Effect it; that is, that the Whole Grain be *Malted*, and Tender and Flowry, as in other *Malt*. For it is found by Experience, that this Corn, before it be fully *Malted*, must sprout out both ways, (*i. e.* both *Root* and *Blade*) to a great Length; of a Finger at least; if more, the better. For which, it must be laid upon an *Heap* a convenient time; wherein on the one hand, if it lyeth of a sufficient Thickness for *Coming*, it will quickly Heat and Mould, and the tender sprouts be so Intangled, that the least opening of the *Heap* break them off, and so hinders the further Maturation of the Grain into *Malt*; On the other, if it be stirr'd and open'd to prevent too much Heating, the *Sprouts* which have begun to shoot, cease growing, and consequently the Corn again ceaseth to be promoted to the Mellowness of *Malt*.

To avoid all these Difficulties, this way was tryed and found effectual. Take away the top of the Earth in a Garden or Field 2 or 3 *Inches*, throwing it up Half one way and half the other; then lay the Corn for *Malt*, all over the Ground so as to cover it; then cover the Corn with the Earth that was pared off, and there is no more to do, till you see all the Plat of Ground like a green Field, Covered over with the *Sprouts* of Corn, which will be within 10 *Days* or a *Fortnight*, according to the time of the Year; Then take it up, and shake the Earth from it, and Dry it: For the *Roots* will be so Intangled together, that it may be raised up in great pieces. To make it very Clean, it may be Washed, and then presently dry'd on a *Kiln*, or in the *Sun*, or spread Thin on a Chamber-Floor.

This way, every Grain that is good will grow, and be Mellow, Flowry and very Sweet; and the *Beer* made of it, will be Wholsome, Pleasant, and of a good Brown Colour. Yet *Beer* made of the *Bread*, as aforesaid, is as well Coloured, as Wholesome and Pleasant, and more durable; this therefore is Most in use.

Improvement to be made by Maize; *by Sir* Rich Bulkley. *n.* 205. *p.* 928.

X. 1. The greatest Profit that ever *I* have heard of the *Field White Pease*, has been 20 Barrels Reap'd for one Sown: But *Maize* will yield more than 2000 for one. I made an Experiment in *Ireland*, with a *Grappe* of 8 sides, or *Rows*, having in each 30 Grains, (which Grew in *Brandenburg*) 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* being 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 2 or 3 elsewhere) every of which *Stems* had 4. 3: or 2 of these *Grappes*. So that we may suppose, that each Grain will give 3 strong *Stems*, and each of these *Stems* 3 *Grappes*, and each *Grappe* 240 Grains which makes 2160. for One.

There

There are ſome things very odd in the Manner of its growth, 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 20 or 30 *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 ſurpriſing, 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* (to which Grain it is the moſt like in Taſt and Figure) either in *Bread* (with *Wheat*) or Soup, or Pudding, or with Pork.

2. If the *Maize* be Equal in goodneſs 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 1000 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. *Conſider'd, by Mr. J. Ray. ib. p. 930.*

By Sir *Richard*'s Deſcription of it, I am Confirm'd in my Opinion, That there are two really Diſtinct *Species* of *Maize:* 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.

XI. A Diſtiller with us (at *Newcaſtle*) hath made a quantity of an Extraordinary *Spirit* of *Sugar*. It ſeems to be the Reſult of ſome *Anomalous Fermentation:* It is ſo ſtrong that no Man is able to Smell at it in an open Veſſel, without being made almoſt Breathleſs; neither do I think the Perſon that made it, can make it again. It was Drawn from bare *Sugar-Water* (which is nothing but the Water wherewith the Molds, Aprons, *&c.* are Waſhed) *Fermented* with the *Scum:* And it was ſo exceedingly *Volatile*, that it would not be Carried, but loſt all its Force in the Carriage, though it was very well Stopt. *An extraordinary Spirit of Sugar; by Dr. Lucas Hodgeſon. n. 130. p. 766.*

XII. *Saffron-heads* Planted in a Black Rich Sandy Mold, or in a Mixt Sandy Land, between White and Red, yields the greater ſtore of *Saffron*. A Clay, or ſtiff Ground, be it never ſo Rich, produceth little *Saffron*, though increaſe of *Heads* or *Roots*, if the Winter prove Mild and Dry: but the Extremity of Cold and Moiſture will Rot them. So that the Fineſt Light ſandy Mold, of an indifferent Fatneſs is eſteemed moſt Profitable. *The Culture of Saffron; by Mr. Ch. Howard. n. 138. p. 945.*

Plough the Ground in the beginning of *April*, and lay it very ſmooth and Level.

About 3 *Weeks* or a *Month* after, ſpread upon every Acre 20 Loads of Rotten Dung, and Plough it in.

At *Midſummer* Plough it again, and Plant the *Saffron-Heads* in Rows, every way 3 *Inches* diſtant one from another, and 3 *Inches* deep.

The moſt expedite way of Planting, is to make a Trench the whole length of the Field, 3 *Inches* deep with a *Spit-Shovel*. The *Spit-Shovel* is to be made of a Thin ſtreight *Iron* 10 *Inches* long, and 5 *Inches* broad, with a *Socket* in the ſide of it to put a Staff or Handle. Lay the *Saffron-Heads* 3 *Inches* diſtant in the Trench, and with the *Shovel ſpit* up 3 *Inches* of Earth upon them.

Obſerve this Order in *Planting* of whole Fields, whereby the *Heads* will lie every way 3 *Inches* one from another. Only Paths or ſhallow Trenches are to be left 2 or 3 *Yards* aſunder, which ſerve every Year to lay the Weeds to rott, that are to be Weeded and Pared off the Ground.

As ſoon as the *Heads* begin to ſhoot or *ſpeer* within the Ground (which is uſually a *Fortnight* before *Michaelmaſs*) *Howe* or Pare the Ground all over very Thin, and Rake lightly all the Weeds and Graſs very Clean, leaſt it Choak the *Flowers*, which will ſoon after Appear; and are then to be Gather'd and the *Saffron* to be *Picked* and *Dried* for Uſe.

The Ground muſt be very carefully fenced from Sheep or Cattle, which by Treading break the *Saffron Graſs*, and make the *Chives* come up ſmall.

In *May*, the *Saffron-Graſs* will be quite Withered away, after which the Weeds and Graſs the Ground produceth may be cut or Mowed off from time to time to feed Cattle till about *Michaelmaſs*, at which time the *Heads* will begin to *ſpeer* within the Ground. Then *Howe*, Pare and Rake the Ground Clean as before, for a *Second* Crop. The like Directions are to be Obſerved the next *Year* for a *Third* Crop. The *Midſummer* following Dig up all the *Saffron-Heads*, and Plant them again in another New Ground Dunged and Ordered as aforeſaid) wherein no *Saffron* hath been Planted, at leaſt not within 7 ~~Years~~ 9 Years

The *Flowers* are to be Gathered as ſoon as they come up, before they are full Blown, whether *Wet* or *Dry*.

Pick out the *Chives* clean from the Shells or *Flowers*, and ſprinkle them 2 or 3 Fingers thick, very equally on a double *Saffron Paper*. Lay this on the *Hair-Cloth* of the *Saffron-Kiln*, and Cover it with two or more *Saffron Papers*, a piece of Woolen Cloth or Thick *Bays*, and a Cuſhion of Canvas or ſack-cloth fill'd with Barly-ſtraw, whereon lay the *Kiln Board*.

Put into the *Kiln*, throughly Kindled, Charcoal, Oven-Coals, or the like, keeping it ſo Hot, that you can hardly endure your Fingers between the Paper and the *Hair Cloth*.

After an *Hour* or more Turn in the Edges of the *Cake* with a Knife, and looſen it from the *Paper*. If it ſtick faſt, wet the Outſide of the *Paper* with a Feather dip'd in Beer, and then Dry the *Papers*. *Turn* the *Cake*, that both ſides may be of a Colour.

If

If it ſtick again to the *Paper*, looſen it, and then dry it with a very gentle Heat, with the addition of a quarter of 100 *l.* Weight laid upon the *Kiln-board*..

The *Saffron Cake* being ſufficiently dryed, is fit for Uſe, and will laſt good many *Years*, being wrapt up and kept cloſe.

The *Beſt Saffron* is that which conſiſts of the Thickeſt and Shorteſt *Chives*, of a High Red and ſhining Colour, both without and within alike.

Saffron is oftentimes *Burnt*, and in Knots, ſpotted and mixed with the *Yellows* that are within the *Shells*.

It's uſually obſerved, that one *Acre* doth yield, at the leaſt, 12 *pounds* of Good *Saffron* One Year with Another; and ſome Years 20 *pounds*.

Good *Saffron* is ſeldom or never ſold at ſo low a Rate as 30 *Shillings per pound*, frequently at 3 *Pounds per pound*, and upwards. Wherefore one *Acre* bearing 12 *Pounds* at 40 *Shil. per Pound*, cometh to 24 *Pound per Annum*.

The Gathering and Picking of one *Pound* of *Saffron* is worth one *Shil.* which cometh to 12 *Shil. per Acre*.

The Fire and care of Drying may come to 3 *Shil.* more, at 6 *Pence* the *Pound*; which is in all 15 *Shill.*

The *Graſs* that is Mow'd and cut off the Ground for the uſe of Cattle, will be very near worth as much as will Countervail the Picking and Drying the *Saffron*; the Soil being enriched, not only by the Dung, but the *Saffron* it ſelf, as appears by the rich Crops the Ground yields for ſeveral *Years* after, without any other *Manuring* or Improvement.

Sixteen Quarters of *Saffron-Heads* are ſufficient to Plant one *Acre*. A *Quarter* of theſe *Heads* is uſually ſold in the place for 10 *Shill.* which comes to 8 *Pounds per Acre*.

Twenty Loads of Rotten Dung laid on the Ground, may be worth 40 *Shill.* at 12 *Pence* a *Load* for the Dung, and as much for Carriage into the Field.

For Thrice *Ploughing* the Ground 20 *Shillings*.

For Planting the *Heads* about 4 *Pounds*. Which in the whole makes 14 *Pounds* the Charges of Planting an *Acre*, which will bear 3 Crops.

So that all things reaſonably Computed, it appears that an *Acre* of *Saffron* will be worth, notwithſtanding all Caſualties, one *Year* with another, over and above the 14 *Pounds* Charges, for the *Firſt years Planting* (at the leaſt) 20 *Pounds per Annum*. Beſides the great Increaſe of the *Saffron-Heads*, which will be as 3 for one.

The *Kiln* conſiſts of an Oaken Frame, Lathed on every ſide; 12 *Inches* ſquare in the Bottom, 2 *Foot* high, and 2 *Foot* ſquare at the *Top*; upon which is nailed a *Hair cloth*, and ſtrained hard by Wedges drove into the ſides; a ſquare Board, and a Weight to preſs it down, weighing about a *quarter* of an *Hundred*.

The Inſides of the *Kiln* are covered all over with the ſtrongeſt Potters Clay, very well wrought with a little Sand, a little above 2 *Inches* thick.

The Bottom muſt be Lined with Clay 4 or 5 *Inches* Thick, which is the *Hearth* to lay the Fire on: Level wherewith is to be made a little *hole* to put the Fire. The Outſide may be Plaiſtered all over with Lime and Hair.

XIII. The

Melons Order'd; by M. De la Quintiny. n. 45. p. 901. *Fig.* 159.

XIII. The First thing appearing of *Melons* are two Leaves United, here call'd *Ears* (mark'd 11) Out of the midst of these two *Ears* there shoots some Days after, first One Leaf, which call the First Leaf or *Knot* (mark'd 2) and out of the same place, after some Days more, shoots a Second, call'd the Second *Knot* (mark'd 3) Out of about the midst of the Stalk of this Second *Knot* shoots the 3d. *Knot* (mark'd 4) And this 3d *Knot* it is, which must be *Cut* at the place mark'd 6 without hurting the Branch of the 2d *Knot*, whence this Third came; because that from that place will spring a Branch, which we call the First *Arm*, and this *Arm* will shoot forth first One *Knot*, then a Second, then a Third; and this Third it is, you are to *Cut* again in the same manner, as was said before. And you must be careful to *Cut* these Third *Knots*, without staying for the Shooting of the 4th or 5th ones. You'l see out of every *Knot* come forth *Arms* or Branches like to the First, spoken of before; and it is at those *Arms*, that the *Melon* will be produced. And they will be Good, if the *Foot* or *Root* be well Nourish'd in good Earth, and Cherish'd by a good *Hot-Bed* and the Sun. But let the *Foot* of the *Melon* never pass into the *Dung*, nor the Earth be *Watered* but moderately, when you see it grows too Dry; so as the Shoot might thereby suffer; which yet you must not delay, till it happen, least the Remedy come too Late. I *Water* twice or thrice a *Week* in very Hot Weather, and that about Sun-set; and I cover my *Melons* with a *Straw-Mat* from 11 of the Clock in the Forenoon, to 2 in the Afternoon; when the Heat of the Sun is too Violent, and too quickly Consuming that little Moisture which is necessary for the Root. And when it Raineth, I Cover also my *Melon-Garden*, least too much Wet hurt my Fruit.

If the *Root* produce too many Branches or *Arms*, *Cut* away the Weakest of them; and leave none but 3 or 4 of the Strongest and most Vigorous; and such as have their *Knots* neerest to one another. When I Transplant my *Melons* from the *Nursery-bed*, I put commonly 2 *Roots* together, except I find One very strong; which I then plant Alone, *Cutting* from it neither of the *Branches* that Shoot from each side (markt 77) betwixt the one *Ear* and the *Leaf* before spoken of. But when I joyn two Roots together, I quite Cut away both the Branches that shoot from the two *Ears*, standing one over against the other, to avoid the disordering abundance of Branches; which also would Wrong the *Foot*.

The *Melons* being *Knit*, I leave but two of them upon each *Foot*; chusing those that are best placed, and next to the first and Principal *Stalk*, that is to the *Heart* of the *Foot*. I also take Care, to leave none but Fair ones and such as have a Short and Thick *Tail*. The *Foot* also of your *Melon* must be short, well Truss'd, and not far distant from the Ground. *Melons* of a Long stem, and having the Stalk of the Leaf too Long and Slender, are never Vigorous; and cannot yield Good *Melons*.

It happens sometimes, that at the very first, there shoot out from between the two *Ears*, two Leaves, though I above spoke but of One: But this happens

pens but ſeldom, and when it does, ſuch two Leaves muſt be reckoned but for one *Knot*; and afterwards there will ſhoot out a ſecond, then a Third *&c.* and ſo on to 25 or 30 if you be not careful to Cut in time. And it is at the Extremity of thoſe *Branches* ſo Diſtant, that *Melons* will grow: But they cannot be Good, becauſe they are ſo far from the Place, which affords them their Nouriſhment.

I muſt not forget to tell you, that from the Midſt betwixt the two *Ears*, and the two Firſt Leaves, there ſhoots out yet One Branch more, which ought to be kept if Vigorous, but *Cut* if Weak.

He that is Curious muſt every Day walk often in his *Melon-Garden* to *Cut* off all the Branches, which he ſhall obſerve to be Uſeleſs or Hurtful.

Whenever you have a *Melon*, which comes well, Knit on a Branch, you muſt not fail to *Cut* away the reſt of that Branch, on this ſide of the Fruit: to the End that all the Nouriſhment, that would have been Diſperſed into the whole Branch, may paſs into that *Fruit*, which is found at the Extremity of the Branch; taking care notwithſtanding, that the *Fruit* be Covered with ſome Leaves of the other Branches, for its better Growth under the Shade, in thoſe Parts where 'tis very Hot. n. 46. p. 923.

There commonly needs no more than 40 Days from the time of a *Melon's Knitting* to that of its *Ripeneſs*.

For the keeping of the *Seed*, you muſt take no other *Seed* but ſuch as is found in that part of the *Mellon*, which hath been towards the Sun: And at the ſame time you Eat the *Melons*, you muſt well Clean ſuch *Seeds*, and Rub them with a Linnen Cloath, until they be very Clean and Dry; then putting them up in ſome convenient Cloſet till *Seed-time*.

Remember, not to Eat the *Melons* but ſome 24 *Hours* after they have been Gathered; putting them in the mean time in a Dry place, neither too Hot nor too Cold, and Free from any Dry Scents, Good or Ill.

Obſerve alſo, to Gather them ſeaſonably, when they are neither too *Ripe* nor too *Green* which you may know by their *Yellowiſh* Colour, and by their *Tail* commonly Splitting, and their Smell. A *Melon* ordinarily requireth One Day from the time of its being *Smitten*, to that of its being Gathered. I call that the Time of its being *Smitten*, when it begins to ſhew its being *Ripe* by a little *Yellowneſs*, appearing in ſome part or other of it. A *Melon* that *Ripens* too faſt, is never Good, ſuch a *Ripeneſs* not being a Good One, but proceeding from the Poorneſs or ſickneſs, of the *Foot*, which maketh it thus turn ſuddenly.

The *Melon* muſt be full, without any Vacuity, which, you know, is diſcerned by Knocking upon it. And the *Meat* muſt be Dry, no *Water* running out: only a little Dew is to appear, iſſuing out of the *Pulp*; which muſt be of a very *Vermilion* Colour.

Trouble not your ſelf to have Big *Melons*, but Good Ones. Thoſe who covet Great *Melons*, may have their Deſires, either by Sowing Seeds of the Great Kinds, or by much *Watering* others: Which *Watering* is a thing,

wherein

wherein great Care and Diſcretion is to be uſed. You may judge of the neceſſity of *Watering* by the Vigour, which is required in the *Foot* and *Leaves*, without which the *Fruit* cannot be Good for want of good Nouriſhment.

Dog-Mercury; *by Mr.* T. M. n. 203. p. 875.

XIV. 1. About 3 Weeks ago the Wife of one *W. Mathews* near *Salop* gathered ſome Herbs, and (having firſt boil'd them) Fryed them with Bacon for her own and her Families Supper, And after they had been about 2 *Hours* in Bed, one of the Children (which is Dumb, and about 7 *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 a Sleep. They took the Children to Bed as they were aſleep, and they themſelves went to Bed too, and fell Faſter a ſleep than ever they had done before. The Man waked the next Morning about 3 *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 been all the Day in a Fire, and was forced to keep his Hatful 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* 3 *Weeks*) 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 Waken her, but in vain. The other two Children *Slept* about 24 *Hours*, and upon their Wakening fell a *Vomiting* and *Purging* again, which I think ſaved their *Lives*. *Mathews* told me he never Eat ſo Pleaſant an Herb in his Life: But 'tis obſerv'd that the Cattle never browſe it. 'Tis Branched and Seeded like *Spinage* or *Mercury*, but Leaved rather like *Lake-weed*; The Leaves are *Dented* too.

By Dr. Sloan. *ib. p.* 876.

2. Mr. *Will. Baxter* did me the favour to ſend for a Dry'd *Sample* or *Specimen*, and it proves to be *Dog Mercury*; the Stalks, Leaves and ſpikes agreeing exactly in every thing with thoſe of *Dog-Mercury* or *Mercurialis Perennis Repens, Cynocrambe dicta. J. R.*

Hemlock; *by Dr.* Nath Wood. n. 231. p. 636.

XV. A Gentleman of my Acquaintance having a Horſe which was troubled with that ſtubborn Diſeaſe they call the *Farcy*, employed ſeveral uſually Efficacious Medicines Inſucceſsfully. At length being in a place where grew a great Quantity of *Hemlock* he obſerved the Horſe began to Feed thereon Greedily, eating it up. On which within 3 or 4 *Dayes* his Sores Dryed up, and he Recovered very faſt From whence it appears, that the *Leaves* at leaſt of *Hemlock* are not Noxious to ſome Animals, but rather Salutary. The *Seeds* alſo ſome Birds, as in our Obſervation *Buſtards*, will Greedily eat.

XVI. 1. A certain Woman near *Kilkenny* in *Ireland* eating by Miſtake ſome Root, I ſuppoſe of common *Hemlock*, among *Parſneps*, was immediately ſeiz'd with *Raving* and *Madneſs*, talked Obſcenely, and could not forbear Dancing. Thus ſhe continued for ſome time, till at length ſhe was taken with *Epilcptick Fits*: Of which Diſtemper being committed to my Charge, ſhe was ſoon Cured by the common Method, and has now for ſeveral Years Lived in Perfect Health. What Quantity ſhe eat is not known: But a piece of *Hemlock-Root* was found on her Trencher.

A Poyſonous Root like Hemlock; *by Dr.* Nath. Wood. n. 231. p. 634.

2. I am in ſome Doubt whether it was really the *Root* of *Hemlock*, which this Woman did Eat, and which had this Effect upon her, and not ſome other: Becauſe, 1. *Jo. Bauhine*, relating two Parallel Stories of the Effects of Roots which were taken for *Parſneps*, is of Opinion that they were the Roots of *Wild-Cicely*, *Cicutaria Vulgaris*, or *Myrrhis Sylveſtris*: Becauſe (ſaith he) the Roots of it are more like to *Parſneps*, than thoſe of *Cicuta* or *Hemlock*. 2. Mr. *Ja. Petiver* aſſured me, that he ſaw one Mr. *Henly* eat 3 or 4 *Ounces* of *Hemlock-Root* without the leaſt Harm: Whereupon he himſelf was Encouraged to do the like, eating about *half* an *Ounce*. They taſted ſomewhat like the Root of *Seleri*, or *Sweet Smallage*: And he perceived no Ill Effect, or Inconvenience from the Eating of them. 3. The Common People generally believe that the Roots which cauſe theſe Symptoms, are no other than *Old-Parſneps*, which have continued ſome *Years* in the Ground: and therefore call them *Madneps*.

By Mr. J. Ray, *ib. p.* 635.

Hiſt. Plant. Tom. 3. p. 181.

XVII. 1. Eight Young Lads (about 30 Years ago) went a Fiſhing to a Brook near *Clonmell* in *Ireland*, and there meeting with a great Parcel of *Oenanthe Aquatica Succo Viroſo*, (in *Iriſh*, *Tahow*) they miſtook the *Roots* of it for *Sium Aquaticum Roots*, and did Eat a great deal of them. About 4 or 5 *Hours* after going home, the Eldeſt of them, who was almoſt of Man's ſtature without the leaſt Previous appearing Diſorder or Complaint, on a ſudden Fell down backwards, and lay kicking and ſprawling on the Ground: His Countenance ſoon turned very Ghaſtly, and he Foamed at the Mouth. Soon after 4 more were ſeized the ſame way, and they all Died before Morning; not one of them having ſpoken a word from the Moment in which the *Venenate* Particles ſurpriſed the *Genus Nervoſum*. Of the other three, One ran ſtark *Mad*, but came to his right Reaſon again, the next Morning; Another had his Hair and Nails Faln off; and the Third (who is my Brother-in Law, and from whom I had this Account) alone Eſcaped, without receiving any Harm. Whether he Eat Leſs of this Fatal Root, or whether his Conſtitution, which is to this day very *Athletick*, occaſioned it, I cannot tell; Though I am of Opinion, that his ſpeedy Running above 2 *Miles* home, after that he ſaw the Firſt Young Man fall, together with his Drinking a very large Draught of Milk, Warm from the Cow, in his Mid-way, were of ſingular uſe to him. For his violent ſweating did doubtleſs Expel and carry off many of the *Venenoſe* Particles, and had a better Effect than perhaps, the Beſt of our *Alexipharmicks* (which you know are generally *Diaphoretick*) might have produced in

Hemlock-Water-Dropwort; *by Mr.* Fr. Vaughan. n. 238. p. 84.

this Case Besides, I believe, the Draught of Warm Milk did act its part; by involving the *Acid* or *Acrimonious Poisonous* Particles, and rendring them Unactive, and preventing their seizingthe *Genus Nervosum*, till they were expelled *per Diaphoresin*.

There was also a *Dutchman*, about 2 *Years* since, within 8 *Miles* of *Clonmel*, Poisoned by Boyling and Eating the Tops of this Plant shred into his Pottage. I believe he took it for *Apium Palustre*, which its Leaves much Resemble

By Mr. Ray. *ib.* p. 86.

2. Several Parallel and no less Tragical Histories of Later Date, of the Miserable Destruction of divers Persons, by the Eating of the *Roots* of this Pernicious and *Deleterious* Plant, I find Recorded by *Jac. Wepferus*, and in the *Miscellanea Curiosa*, *Dec.* 2. An. 6.

De Nox. Cicutæ. Aquat.

The Horned Poppy; *by Mr.* Ja. Newton. n. 242. p. 263.

XVII. Between *Pensants* and *Marketjew* in *Cornwall*, on the Sandy shore grows abundance of *Papaver Corniculatum Luteum*, or *Horned Poppy*, with a Yellow Flower, vulgarly call'd in *Hampshire* and *Dorsetshire*, *Squatmore*, or *Bruse Root*, (as I was there informed) where they use it against Bruises External and internal. One *Charles Worth*, dwelling at the Half way-House between *Pensants* and *Marketjew*, caused a Pye to be made of the Roots of the said *Poppy* supposing them to be *Sea-Holly* or *Eringo Roots* (for they had made Pyes thereof, which was very Pleasant to them) but he eating of the aforesaid Pye (whilst Hot) was presently taken with such a Kind of *Delirium*, that he call'd for a White Earthen Chamber Pot and after having Purged by Stool into it, he broke it into pieces, and bid the Bystanders to save them, for they were all *Gold*, the Man and Maid-servants, having also Eat of the same Pye, became *Delirious*, and fancied that most what they saw was Gold. A Child in the Cradle having also Tasted of the Pye, was much Dosed, and Turned its Mouth to and again. And thus they continued for some *Days*, and then became Well.

Perhaps the *Yellow* Colour of the *Flowers* running in their Minds (which the Eating of the *Roots* had now Deprav'd) might beget that Idea of *Gold* in them.

The Helmontian Laudanum; *by Mr.* Boyle. n. 107. p. 147.

XIX. There are two sorts of the *Helmontian Laudanum*; the One used by the Elder *Helmont*, the other by his Son. The former was a great Secret communicated to me by an Expert Chymist about 15 *Years* ago: Which because I have not Leave to Publish, meeting about 2 *Years* ago with that obliging and very ingenious Person *F. M. Baron Van Helmont*, Son to the Famous *Johannes Baptista*, I obtained from him, by word of Mouth, some Directions about the *Laudanum* he uses; which though he Confessed, and I soon perceived, to be differing from his Father's, yet he seem'd to think it not inferiour and more Parable.

I soon after committed it to Writing least it should Slip out of my Memory, and I had his Permission to communicate it for the Publick Good.

Take of *Opium* a *quarter* of a *Pound*, and of the Juice of *Quinces* 4 Pound at the least; the *Opium* being cut into very Thin Slices, and then as 'twere

Minc'd

Minc'd to reduce it into ſmaller parts, is to be put into, and well mixed with, the Liquor, (firſt made Luke-warm) and fermented with a Moderate Heat, for 8 or 10 *Days*; rather more than leſs. Then *Filter* it, and having infuſed in it of *Cinamon*, *Nutmeg* and *Cloves*, of each an *Ounce*, or an *Ounce* and *half*, let them ſtand 3 or 4 Days more; if it be a full *Week*, it may be ſo much the better. Then *Filter* the Liquor once more, having let it Boil a Walme or two after the Spices have been put in. This being done, evaporate away the ſuperfluous Water to the Conſiſtence of an *Extract*, or to what other Conſiſtence you pleaſe.

Laſtly incorporate very well with it two *Ounces* of the beſt *Saffron* reduced to Fine Powder, or as much *Extract* as can be Obtain'd from that Quantity of *Saffron*.

According to the Conſiſtence you deſire to have your Medicine of, you may order it ſo, as either to make it up into a Maſs of *Pills* (in which Form I have cauſed it to be given,) or keep it in a *Liquid* Form; but in this latter Caſe the Evaporation, muſt have been made more ſparingly, that after the putting in of the *Saffron*, or its *Extract*, it may not grow too Thick. In this Form the *Doſe* may be from 5 or 6 *Drops* to 10 or fewer, according to Circumſtances; and of the *Pills* a ſomewhat leſs Quantity is required.

The Uſe of Opium among the Turks, by Dr. Ed. Smith. n. 221. p. 288.

XX. One *Muſtapha Shatoor*, an Inhabitant of *Sediqui*, a Village 6 *Miles* from *Smyrna*, by Trade a Coffee Man, about 45 *Years* old, a moſt Famous *Opium-Eater*, told me, that his conſtant Eating, was 3 *Drams* a day of *Crude Opium*, one half of which was his *Doſe* in the Morning, and the other half in the Afternoon: But that he could ſafely take Double this Quantity.

Reſolving therefore to be an Eye Witneſs of what he could do, I provided the beſt *Opium* I could get, and weighed it nicely into *Drams*. He came to me at my Deſire, at 9 in the Morning, but excuſed his having taken *half* a *Dram* before, becauſe he wanted ſtrength to Riſe out of his Bed without it. I laid before him my *Opium* made up in *Pills*, each weighing a *Dram*, and deſired him to Eat what he pleaſed. He took *one Dram* and a *half* making it up in 3 *Pills*, and Chewing it with a little Water: He commended the *Opium*, but was not willing to Eat More at that time, and I would not preſs him for fear of Accidents. He ſtayed with me about *half* an *Hour* after he had Eaten the *Opium*: The viſible Effects it had upon him were to make his Eyes Sparkle, and to give a new Air of Life and Brightneſs to his Face. He told me that he was extremely Refreſh'd by my Entertainment: and *I* found him *half* an *hour* afterwards Labouring heartily at cleaving Wood to burn. At 3 in the Afternoon he came to me again, and took the ſame Quantity as in the Morning, and appeared after it with the ſame Symptoms. He ſays that it has always the ſame Effects, giving him Vigour and Spirit, and is now become as neceſſary to him as any other part of his Suſtenance; that it makes him Fitter for Procreation, for he has many Wives and Children; that it never Affects him with Sleep and Drowſineſs, but rather hinders his Repoſing, when

he happens to take to much of it; that he entered upon this Practice 25 *Years* ago, beginning with the bigneſs of a *Grain*, and ſo training up Nature gradually to Larger Quantities; and that the Want of it, and the Deſire of taking more, grows Daily upon him.

The Alteration and Impairment which this Cuſtom hath produced in him are Weakneſs, his Legs being ſmall; his Gums Eaten away, ſo that the Teeth ſtand bare to the Roots; his Complexion very *Yellow*; and appearing Older by 20 *Years*, than he really is,

Opium is commonly taken by the *Meſſengers* in *Turkey*, who are employed in making Quick Diſpatches; 'tis generally part of their Proviſion; they take it when they find themſelves Tired, and it gives them Strength and Spirit to Proceed. I had the following Relation of one of them, that coming from *Conſtantinople* to Mr. *Sam. Bernardiſton*, a Merchant of *Smyrna*, at entering into the Gentlemans Houſe, he fell down for Dead: at which, when the whole Houſe was Surpriſed and Concerned, one of the Servants rightly Judging that this Fainting away was occaſioned, by the Stock of *Opium* laid in for his Journey being Spent, forced a little of it into his Mouth, and by this means he preſently Recovered, and acknowledged the Servant had been his Phyſician.

The *Turks* uſe *Opium* made up with ſomething that renders it Palatable, at their Feaſt call'd *Biram*, to make them Cheerful; which may be one Reaſon of its prevailing ſo much: For finding it then entertains them with Pleaſing Fancies, they are Tempted to continue it, and ſo the Uſe of it becomes Neceſſary and Grows upon them.

Mackenboy; *by the Bp. of* Cloyne. n. 243. p. 294.

XXI. The Famous *Iriſh* Herb call'd *Mackenboy*, or *Tithimalus Hibernicus*, is reported by the Natives to be ſo ſtrong a *Purge*, that even the carrying it about one in their Cloaths is Sufficient to produce the Effect. But Dr. *Mullen* has lately proved this Story to be Falſe, by carrying its *Roots* for 3 *Days* in his Pocket, without any Alteration of that ſort.

The Snake-Root; *by Mr.* J. Baniſter. n. 247. p. 467.

XXII. The *Piſtolochia*, or *Serpentaria Virginiana* hath a Buſhy Root, conſiſting of a Number of ſmall Strings of a Yellowiſh Colour, and Hot Aromatick Scent and Taſte: Thence grow One or Two Smooth, at leaſt very little Hairy, *Stalks*; Round, and moſt commonly Upright, not Square nor Trayling. The *Leaves* grow Alternately on this Side and that, one at a Joint or Knee: They are Thin Long and Pointed, coming like a Heart at the *Foot-Stalk*; a little Hairy above, and Rough, with many Protuberant Veins underneath; and in handling, they ſtick a little to the Fingers. Near the Ground grow one or Two Hollow Flowers, each upon its proper *Foot-Stalk*, different in Form from the *Piſtolochia Cretica*, or any other yet known: All whoſe Flowers reſemble a *Cow's Horn*, the Top growing to the Rudiment of the *Seed Veſſel*, and the Open end cut Slaunting like a *Drenching-Horn*, whereas this of ours Terminates with a *Heel*, which ſupports a Broad, Round, Galerniculated *Lip*, the Center of which Opens into the Hollow of the *Flower*.

The

The *Lip* is of a light Ruſſet or Dirt Colour. The *Seed Veſſel* is *Hexagonal*, ſhap'd like a Pear, when full grown near *half* an *Inch* in Diameter. It is not an *Ever green*, but after the *Seeds* are Ripe, the *Leaves* and *Stalks* begin to Wither and Decay. It *Flowers* in *May*, and its *Seeds* are Ripe in *Auguſt*.

XXIII. *Succiſa*, or *Devil's-bit*, is excellent for *Poyſons*, eſpecially the *Plague*; and it is ſo Powerful a *Sudorific*, laying the ſick Perſon, whether of the *Plague* or other *Malignant Fever*, on a Bed of that Herb, moderately Hot, he ſhall *Sweat* till they take him off; and much more if he drink of the Decoction, or Juice of the Herb; which in Summer they take All, and in Winter of the *Root* only. Devils-bit; *by Sir* Theod. Mayerne. n. 211. p. 166.

XXIV. *Alcanna* is the *Leaf* of a Plant, Dried and Powdered; which, when ſteept a Night in Wine, will die the *Nails* Red. Alcanna; *by*---- n. 243. p. 295.

XXV. *An.* 1656. An *Aloe Americana Serrati Folia*, being of a *Pale Green*-Colour, and conſiſting of 11 *Leaves*, was bound about with a Red dry Cloth, and was hung up without *Oil*, as is uſual, in the Kitchin: It Weighed, Aloe Americana. *by Dr.* Merret. n. 25. p. 455.

	Weight.				*Loſs.*					*Weight*				*Loſs.*	
	℥.	ʒ.	℈.	gr.	℈.	gr.				℥	ʒ	℈	gr.	℈	gr.
Aug. 4.	21	6	0	2	*May*	1.		*May.*	1.	20	7	0	0	1	0
Aug. 19.	21	3	0	24	3	27		*May.*	28.	20	5½	0	0	1½	0
Sept. 6.	21	1⅓	0	0	1	14		*June.*	12	20	4	0	4	2	26
Feb. 20.	21	1	0	12	0	11		*Jul.*	1.	20	1	0	8	2	18
Mar. 16.	21	0	2	0	0	32		*Jul.*	20	19	6	0	1	3	7
Apr. 8.	21	0	0	0	0	40		*Auguſt.*	4	19	3	0	12	2	49

So that in a Whole Year it *Loſt* 2 *Ounces*, 3 *Drams*, 24 *Grains*. The ſucceeding *Year*, being Dryer and Hotter, it *Loſt* 3 *Ounces* 2½ *Scruples*; and more than double in the 6 Colder, than the 6 Hotter, Months. I kept it about 5 *Years*, and it *Decreaſed* much about the ſame Proportion. And in the *Year* 1660, Hanging it in a Colder Garret, it Periſhed.

Theſe Obſervatinns I had about it, that every Year two of the Greater Leaves firſt Chang'd Colour, and withered; and in the Spring time, there grew out two very Freſh and Green ones, never amounting to the bigneſs of any of the precedent. Inſomuch, that all this Time I had the ſame Number of *Leaves*. And then theſe New Leaves were more Freſh and Green, and not *ſerated*, and Thicker alſo in Proportion to their other Dimenſions. Whence perhaps it may probably be inferr'd, *viz.* from the Growth of theſe *Latter Leaves*, that there is a *Circulation* in this Plant of the *Succus nutritius*: For how is it poſſible, that the *Roots*, continuing as firm and ſolid as at firſt, ſhould ſupply ſo much Nouriſhment, as to Procreate *New Leaves*, unleſs it were

were from the Return of the ſaid *Succus*, from the *Old* and *Decaying Leaves* into the *Root*, and there protruded for the Production of *New* Ones? For all *Bulbous* Roots, as *Garlick*, *Onions*, *Tulips*, and eſpecially *Squills*, who Protrude their *Leaves*, placed in a Shop or Houſe, have their *Roots* Lighter, and more Spungy; the *Leaves* being formed out of the Subſtance of the *Root*, as a Chick out of the *Albumen*: In the mean while the whole *Decreaſing* in Weight, as in the aforeſaid *Aloe*.

The Tartarian Lamb. *by Dr.* Hans Sloan. n. 247. p. 461.

Fig. 160.

XXVI. *Fig.* 160. repreſents what is commonly, but Falſly, in *India*, called, The *Tartarian Lamb*, ſent down from thence by Mr. *Buckly*. This was more than a *Foot* long, as Big as ones Wriſt, having ſeveral Protuberances, and towards the End ſome *Foot Stalks*, about 3 or 4. *Inches* long, exactly like the *Foot-Stalks* of *Ferns*, both without and within. Moſt part of the Outſide of this was cover'd with a *Down* of a Dark yellowiſh Snuff-Colour, ſhining like Silk, ſome of it a *quarter* of an *Inch* long. This *Down* is what is commonly us'd for *Spitting Blood*, about 6 *Grains* of it going to a *Doſe*, and 3 *Doſes* pretended to Cure ſuch an *Hæmorrhage*. In *Jamaica* are many *Scandent* and *Tree-Ferns*, which grow on, or to the bigneſs of Trees, and have ſuch a kind of *Lanugo* on them, and ſome of our *Capillaries* have ſomething like it. It ſeem'd to be ſhap'd by Art to Imitate a *Lamb*, the *Roots* or *Climbing* Part being made to reſemble the Body, and the Extant *Foot-Stalks* the Legs. This *Down* is taken notice of by Dr. *Merret*, at the latter end of Dr. *Grew*'s *Muſ. Soc. Reg.* by the Name of *Poco Sempie*, a *Golden Moſs*, and is there ſaid to be a *Cordial*. I have been Aſſur'd by Mr. *Brown*, who has made very Good Obſervations in the *Eaſt-Indies*, that he has been told there by thoſe who have Lived in *China*, that this *Down* or *Hair*, is uſed by them for the *Stopping* of *Blood* in Freſh *Wounds*, as *Cobwebs* are with us: And that they have it in ſo great Eſteem that few Houſes are without it. I have known it much us'd for *Spitting* of *Blood*. But on Tryals I have ſeen of it, though I may believe it Innocent, yet I am ſure 'tis not Infallible.

p. 386.

A ſort of Seeds *which* Clarify Water; *by Dr.* Hans Sloan. n. 249. p. 44. *Fig.* 161. n. 43. p. 863.

XXVII. I have ſeveral times ſeen a ſort of *Seeds* come from the Coaſt of *Cormandel* and *Malabar*, which are there uſed for *Clarifying* Water. They are about the Bigneſs of a ſmall Pea, only broader and flatter, having *Striæ* run from their Center after the manner of the common *Nux Vomica*. The beſt Account I have had of the way of Uſing them, was from Dr. *Brown*, who lived in the *Eaſt Indies* ſome Time; he ſays they rub or grate them on the bottom of a ſmall Earthen Baſon, wherein is contained ſome Water: This Water and Powder is put into a large Quantity of *Muddy* or Foul Water, which is by this *Clarified*.

The True Amomum, *or* Tugus *of the* Phillippine Iſles; *by* P. Geo. Camelli. n. 248. p. 2.

XXVIII. Racemoſo *Tugus*, ſeu *Birao*, aliis *Caropi*, viſe Florum faſciculo, deguſtato ejuſdem Uvæ Acinis, ſeu oblongo ſemine; & facta collatione cum Botanicorum *Amomi* Deſcriptionibus; *Tugus* Legitimum *Dioſcoridis* eſſe *Amomum* decrevi.

Eſt

Eſt autem *Tugus* Planta quandoque ultra *Cubitos* aſſurgens. Folio ſimi i Plantæ *Tagbac*, ſeu *Bagongbonque*, excipe quod parte Prona ſuavi obſitum ſit Lanugine; Venoſius præterea, Longius & Suaveolens. Ad Plantæ Radicem ſeu *Caulis* Truncum, ex Folliacei Caulis Meditullio Racemiformis, & Piſtillo ſeu *Amomonti* Florum faſciculo non adeo ſimilis, prorumpit Florifera & Granigera Foliolorum ſeſquipalmaris Congeries, Floſculis exornata Rubicundis, quibus Uvæ in longiuſculum protenſæ Collum ſeu Floris Tubuli Reliquias ſubſequuntur; Dulci & pauco Cortice, unde à Muribus & Avibus una cum ſemine plerunque depaſtæ, pauca admodum & exigua colligi poteſt Quantitate. Quare & olim Rarum fuiſſe, nec paſſim naſci *Virgilius* inſinuare videtur, dum ſpondet quod *Aſſirium* vulgo naſcetur *Amomum*.

Hæ Uvæ Quina communiter, aut ſena continent Subruffa, Oblonga, Inæqualia, Aromatica, *Amuyong* minus Acria, & *Cubebis* Officinarum Suaveolentiora Grana, ſeu Acinos; ex quibus trajecto Filo, nunc per ſe nunc Sociatis *Margaritis*, ac *Corallio*, nonnullæ Puellæ *Judicæ Caropi*, ſeu *Monilia* ac *Armillas*, concinnare ſolent. Aliæ ex his, & ſemine *B lmuſci*, iis *Maricom*; Arundinis *Lithoſpermos*, iis *Tigbi*; *Cannæ* Floridæ, iis *Ticaſticas*; *Piſi Coccinei*, iis *Saga*; *Amomonti* præterea, *Badiang*; & *Calanos Seminibus*; ſimilia nectere aſſueverunt. Ob gratum vero quem ſpirant Odorem Grana *Tugus* Collo appenſa gerunt, ab Infecto etiam preſervare Aere, & ictui medere *Scolopendriæ*, maſticata ſi ſuper imponantur, Experientia docuit, *Radix* ſimilis eſt Radici *Tagbac* ſeu Calami Odorati Inſipida, Alba Interne de foris Rubicundis & ſubodoratis Cæpaceis contecta obvolucris. Ex Borongam ſcripto accepi, in Caulium apicibus alium & hunc Inodorum ferre Fructum, quem nec dum vidi. Idem *Indi Indanenſes* mihi affirmarunt: Sed eos hallucinari cenſeo, & Plantam *Tacbac* (*Tagbac*) pro *Tugus* vidiſſe puto.

Provenit in *Borongam* & *Paranas* Caput ex aliis Inſularum *Samar*, & *Leyte* locis. Nec dubito in *Luzone* quoque reperiri, maxime *Silanii* in Torrentium profunditatibus.

Nota. Florum *Tugus* recentia & Tenella Germina; aliquantum *Pſeudo Amomum Garciæ*, *Pedem Columbinum* referens, exprimunt. Ne autem quidquam deſideretur, mitto una cum his ſcriptis Plantæ *Delineationem*; & ſimiliorem *Caſtaneam* eſſe Ovo non deerit qui objiciat, quam Folia *Tugus* Foliis *Mali Punici*, quod lubens conceſſerim. Sed quicquid *Dioſcorides* & *Plinius* de *Amomo* tradidere ſolummodo de Florigero & ſemino turgente *Tugus* Racemo intelligenda eſſe cenſeo; utpote quibus Integra & ipſa Planta non innotuit. Hunc enim *Tugus Thyrſum* deprehendet. *B. L.* exigue fruticare *Palmi viz.* pluſve minuſve Altitudine: Ex ligno ſubruſſo, ſeu ligneſa Materia, Floſculis & Folliculis *Mali Punici* ſimilibus, ſeſe in Racemi modum convolvere, ſive ut *Barth. Merula* vertit eſſe Fructum ſimilem Botruo inveniet ſemine Uvis parvis ſimili, ſi ſeminis carnoſum ſpectet Tegumentum plenum valde Odorato & Aere Guſtu, vim habente Calefaciendi, Adſtringendi, & Exſiccandi, & cætera *Legitimi Amomi* ſigna, ut *Pedis Columbini* Effigiem ſi diligenter inveſtigaverit. *Amomum* in *Turcomania*, *Armeniæ* Provincia, provenire ſcribit *Joh. Botero Benes.*

XXIX. Nuperis-

The Ahmella *from* Ceylon; *by Dr.* Hotton. n. 257. p. 365.

XXIX. Nuperis Annis magnam celebritatem nacta est, ob vim *Lithontripticam* quæ ipsi ascribitur, Herba quædam à *Ceylonensibus Ahmella* dicta. An jam uspiam exstet nescio; sed eam colui, cum versarer in Præfectura *Horti Amstelod.* Flores fundit in summis Caulibus persimiles *Chrysanthemo Curassau elato caule flo. Aurantiis Par. Bat.* Semen ei Bidens, Caules Quadrati, Fol. *Lamii* vel *Urticæ* (quæ subacria sunt) conjugatis amicti; unde manifestè liquet ad *Cannabinæ* Genus, quod Bidens vocat *Cæsalpinus*, eumque sequutus *Tournefortius*, spectare; neque forte inconcinne nuncupari posse *Cannabinam* aut *Bidentem Urticæ foliam Judicam Lithontripticam.*

Nux Pepita, *or* Faba Sancti Ignatii; *by Dr.* Sloan. n. 249. p. 44. *Fig.* 163.

XXX. 1. *Nux Pepita*, seu *Faba S. Ignatii*, is about the bigness of a *Nutmeg*, and Triangular. This Fruit is very much esteem'd in the *Philippine Islands* for the Cure of many Distempers.

By ------ n. 250. p. 87.

2. 1. Habet hic Fructus Virtutes illius Metalli quod *Tumbaga* dicimus, & Compositi illius quod *Ilingo* dicitur; proficit enim contra *Spasmos* ac Ventos Infectos, & contra quoddam Genus *Spasmi* quod nos dicimus *Sotan.*

2. Proficit ut evomatur quodcumque *Venenum*, si Rasuræ ejus bibantur cum Aqua Frigida, item contra Morsus Venenatorum, si simul applicentur Morsui aliquæ Rasuræ ejus.

3. Item si aliquod Membrum laboret *Spasmo* proficit, si super partem infectam applicentur supradictæ Rasuræ.

4. Deinde ante dictæ Rasuræ stagnant *Fluxum Sanguinis*, applicatæ cuicunque Vulneri. Et cum Anno præterito, 1692. daretur bibi Fæminæ Laboranti *Profluvia Sanguinis* Diuturno, evasit incolumis.

5. Fugat *Febres*, nam me præsente, eodem Anno datum fuit cuidam Infantulæ laboranti Intensissimâ *Febræ* ut biberet, & illico aufugit *Febris.*

6. Juvat *Parientes* Fæminas, ad hoc ut facilius, & felicius Creaturam expellant.

7. Venio tandem ad quotidianam Experientiam: mire proficit pro quacunque Repletione & Cruditate *Stomachi*; & contra proficit pro *Dysenteria* & frequenti Dejiciendi cupiditate temperanda.

Dividat quisque Granum in tres partes, & cum senserit necessitatem, immittat in Os per quadrantem Horæ, vel per dimidium, & deglutiat *Salivas* quæ distillaverint, ac postea bibat quasi 2 aut 3 *Uncias* Aquæ frigidæ & videbit Effectum.

Aliter; Quæratur Fragmentum durissimum Testaceum, ac in parte concava ponatur parum Aquæ frigidæ, & ibi refricetur Fructus, & aqua illa ponatur in Vascula cum Rasuris; & iterum ter aut quater fiat similiter, usquedum habeas duas *uncias* illius Confectionis & Lotionis Fragmenti Testacei ac Grani Fruticis; ac postea revolvatur & bibat Patiens.

Item; Divisum Granum in frusta si frigatur cum Oleo, (præcipue *Olivarum*) & Oleum illud Bibatur, aut plagis applicetur, aut Membra *Spasmo* laborantia cum eo unguantur, est Medicinale ut supra.

3. *Catolongay*,

3 *Catolongay*, quam alii *Cantara* vocant, eſt *Nuces Vomicas* legitimas *Serapionis* ferens Planta, quæ Arbores quaſvis Altiſſimas ſeſe involvendo ſcandit. Truncus Lignoſus, Levis, Poroſus, & Brachialis quandoque Craſſitudinis, Corticiſque ſcabri, Craſſi, & Cinerei: Folia Ampla, Nervoſa, Amara, Folio ferme ſimilia: Florem *Balauſtiæ* ſimilem Fructus inſequitur *Melone* major, qui delicatiſſima cuticula, quæ ſplendens, Lævis, & Viroris Luridi, ſeu Alabaſtrini, coopertus, ſubterquam alius Cortex deliteſcit Subſtantiæ quaſi lapideſcentis. In hoc, Carne amaricante, flava, & Molli, qualis eſt Caro Fructus *Mangæ*, interjecta, noſtræ ſeu Legitimæ *Serapionis Nuces Vomicæ*, quæ recentes ab Argentea Lanugine ſplendicant, juglandis vix non pares, inæquales, variæque formæ, non raro 24 coarctantur: quas *Indus Igaſur*, & *Mananaog*, id eſt Victorioſas; *Hiſpanus Nucleos*, ſeu *Pepitas* de *Byſayas*, aut *Catbalogan*; alii *Fabas S. Ignatii* vocant. Hæ reſiccatæ *Avellana* Nuce cum putamine pares, aut etiam paulo majores: Nodoſæ, Duriſſimæ, Diaphanæ, & quaſi Corneæ Subſtantiæ ſunt; Saporis Semine *Citri* multo intenſius Amari; Coloris autem inter Album & Glaucum, prout & *Serapio* tradidit.

By P. Geo. Camelli. ib. p. 88.

Fig. 164.

Multi, neſcio quo Oraculo edocti, Nucem *Igaſur* reticulæ Fructus *Salagſalag* immittunt, ex Collo ſuſpenſum gerunt, & ita ab omni *Veneno*, *Peſte*, *Contagio*, *Incantationibus Magicis*, *Philtris*, & ſpecialiter à *Sopto*, ſeu Veneno quod ſolummodo in ſufflatum perimere narrant, imo & ab ipſo *Dæmone* ſe liberos ac immunes eſſe imaginantur.

Quod *Ch. Miralles* in ſuis Collectaneis affirmat, ſcribens non tantum Virtutem habere depellendi Corporis Morbos, ſed & *Malignis Spiritibus* ſpeciali quadam Oppoſitione reſiſtendi; *Magos* etenim, *Barangas* dictos, ad præſentiam hujus Nucis inquietari, conturbari, & Sudore ſuffundi, ac ſi in neſcio quo Arduo Negotio, anguſtiis periculiſque pleno, verſarentur: Quod Experientia didiciſſe, inſuper & id ipſum ſibi alios fide dignos viſos affirmaſſe, addit. Unde Pactum cum *Dæmone* habere dictos *Barangas*, ſeu Maleficos Herbarios, ſuſpicatur: præſertim cum Rumor ferat, hoſce Impios Medicos, ſi in *Simplicium* cognitione erudiri velint, Conſanguineorum proximum interimere obligari.

Alii à jam dicto *Sopto*, ſeu *Toxici Inſufflamine* quo Malevoli *Indi* paſſim quos male cupiunt perimunt, *Alexium Lopez* in *Guiguan*, & *Petrum Oriol*, præter alios hacce Nuce præmunitos, ſervatos fuiſſe ferunt. Sumunt autem, uti Vulgus narrat, ſupradicti Herbarii eis familiaria & nota *Aconita*, quæ faucium latere uno recondunt, Bucca altera vero *Contrayerbas*, prouti hujates loquuntur, id eſt Antidota, ne videlicet ſibimet ipſis Mortem maſticent. His ita Ore detentis Arte, & Dexteritate Diabolica, ſibi contrarios, & infenſos Viperarum more intoxicato Halitu impetunt, quo perculſi ac perplexi mox humi proſternuntur, & Animam agerent, niſi eis jam experto Remedio hacce *Scil. Nuce* Opem ferant. Addunt, ſi quis hanc Nucem ſecum portarit, ipſum qui ſimilibus Deleteriis buccellis alterum interficere attentaverat pœnas confeſtim luere Talionis, uti *Indus*, qui *Alexium Lopez* inter fictas amicitias de medio tollere cupiens, caſualiter hanc Nucem ſecum habentem, expertus fuit; qua Occaſione primum *Hiſpanis* innotuit *Igaſur* Virtus, & Efficacia. Quomodo autem

tem Naturaliter, ut nonnulli volunt, *Igaſur* Virtutem Toxici in diſtans agendo repellat, judicent alii.

Pulveris *Igaſur* ℈j. quondam *Vincentio Olzinæ*, temperamenti Melancholici prædito, ad Vomitum ciendum propinavi. Hic *Dyſpepſia*, *Diarrhæa*, & frequenti Vomitu, cum Ructibus Acidis, nec non Flatuum copia moleſtabatur: Sed ſtatim ac ſumpſiſſet, Tremore totius Corporis trium Horarum ſpatio perſiſtente, una cum Pruritu, & Vellicationibus *Convulſivis* horrendis, ut Pedibus inſiſtere nequiverit, quæ in *Maxillis* vehementiores erant, ac magis moleſtæ, ita ut quodammodo ridere cogeretur, correptus fuit; Nulla interim notabili Pulſus alteratione, Vomitu, aut alio quopiam inſequente Symptomate. De reliquo dein non nihilum melius ſenſit.

Similem Tremorem, & *Convulſiones Spaſmodicas*, quas *V. Olzina* expertus fuit ſenſit & paſſus eſt *Johannes Oſaëta*, una cum ſumma Præcordiorum anguſtia, Vertigine, Animi Deliquio, & Sudoribus Frigidiſſimis. Hic *Melancholico-Hypochondriachus* Sanitatis cupidus, *Nucem* recentem integram devoraverat. Cui *Oximel* & *Oleum* cum tepida exhibendo, quo plurimum Viſcoſi Phlegmatis cum Nucis Particulis rejecit, opem tuli.

Joachinus Aſſin Nucis ſumpſerat partem Tertiam, & ſimili modo ut *V. Olzina* & *Johanes Oſaëta*, ultra tres horas affectus fuit. Hic præter Motus Contractivos & Involuntarios, formicationis ſenſum, & ſpecialiter in Capite expertus fuit Similes denique pœnas, *A. Varaona*, *A. Girau*, & alii luere.

Vulgus autem Nucem *Igaſur*, ad cuncta abſolute Corporis Humani Mala amovenda, nulla habita Temporis, Morbi, Ætatis, aut Doſis ratione indifferenter exhibet, & adhibet: Miraculoſque ſublequutos affectus narrat, videlicet magnifaciendo ſuam *Panacæam*, & deprædicat Succeſſus bonos, reticens infauſtos. Nec dubium, quin aliquando à tam vehementi Spirituum Animalium Irritatione, ac alteratione Humorum, ab hac Nuce cauſata, Heterogenea ac Incongrua, una cum tam infeſti Medicamenti Particulis elimentur: quibus rejectis, humoribuſque Craſſi meliori reſtitutis, Sanitas optata ſubſequatur.

Modus Ordinarius, & communis utendi Nuce *Igaſur* eſt, imponendo eam integram aquæ Calidæ tantillo ſpatio donec amara reddatur, exhibendo dein dictam Infuſionem. Alii Pulveris modicum in ſubſtantia propinant. Alii unam alteramve offerunt deglutiendam fruſtulam. Alii Nucem integram, *Amuleti* ritu de Collo ſuſpenſam gerunt.

Vomitum pluries cauſare ſolet, *Dejectiones* nonnunquam, Motus *Spaſmodico Convulſivos* ferme ſemper in *Hiſpanis*; *Indis* non. In Veneni periculo, & Spirituum inordinate tumultuantium conflictu, poſthabita temporis ratione, uſurpanda erit: In aliis accidentibus aut Morbis, Jejuno *Ventriculo* in Aurora; attamen *Vomitus* ciendi gratia convenientius una alterave poſt aſſumptum cibum Rora, *Doſi* ℈ſs. cum aliis levioribus *Vomitum* cientibus exhibebitur.

Qui Nucem Integram ſecum portarint, affirmant multi (fides ſit penes Authores) præſervare à *Peſte*, *Incantationibus Magicis*, *Philtris*, *Sopto*, ſeu Herbarum

barum Venenatarum affiatu, *Aeris* præterea neſcio quo ut volunt *Contagio*, *Hiſpanis*, *Malaire*, & *Paſmo*, id eſt Stupore, *Indis Sautan* (à quo ſimiliter præſervare ferunt *Corallium nigrum*, Ungulam *Rhinocerotis*, *Dumbagam*, *Ingo*, & *Teſtudinis Scutum*); *Catalepſeos* attamen Species potius eſſe videtur, eo etenim correpti Terrore veluti Panico perculſi corruunt, Senſibus & Voce privati obſtupeſcunt, mortuiſve ſæpius ſimiles obrigeſcunt; Revulſoria vero, & crudeli Muſculorum in Tibiis, ac Brachiis Flagellatione, qua Sanguis inibi ageſtus dein *Scarificationibus* elicitur, revocantur & curantur.

Nucis fruſtulum, aut fragmentum (aut Raſuræ modicum) Viperæ *Baſil* (eſt *Erucæ Piloſæ* atque Nociferæ, ad tactum vehementem pruriginem cauſantis, Species,) aut aliorum *Venenatorum* Animalium morſui; Vulneri Sagitta vel alio *Intoxicato* Telo facto, ad impoſitum, venenum Lapidis *Colubrini* inſtar ad hærendo extrahere communicavit *F. de la Zarza*. Alii in *Hæmorhagia* Narium, & ad *Sanguinem* è Vulneribus profluentem ſiſtendum, Pulverem recommendant.

In *Malviento*, *Malaire*, *Soutan*, & *Paſmo*, (*Catalepſeos* Species eſt) Stupore *Apoplexia*, *Paralyſi*, ſive Syderatione, *Lethargo*, *Epilepſia*, *Morbo Caduco*, *Aſtmate*, & *Catarrho* Maligno ac ſuffocante, Dentium Dolore, & aliis Defluxionibus, fruſtellum ſupponitur Linguæ, *Apophlegmatizandi* gratia: ita enim Caput à copia Viſcoſi Phlegmatis liberatum, Ægripluries levamen percipiunt, & ſæpius jamjam Agonizantes, ut ita dicam reſuſcitentur, & aut *Confiteri*, aut alia quæ pro tunc conveniunt declarare, valent.

Pulverem, aut infuſum, aut Oleum infra deſcriptum, propinant & dilaudant in *Febri Tertiana* & *Quartana*. *Veneni* periculo, aut ſupradicto *Sopto*, *Buyaſſo*, (eſt *Buyo*, ſeu *Betele*, confectio mortifera, cum Semine ut opinor, *Stramonii*, aut ſimili *Narcotico*, quæ ſi aſſumptæ non perimit, Hominem perplexum, Attonitum, Hebetem, Stupidum, & Torpidiſſimum reddit; ab hujuſcemodi dico Confectione devorata, aut Maſticata, infra poſito *Oleo* curata fuiſſe ſcio, & *Botete Sardinæ* Nocivæ comeſtæ Suſpicione.

Ad *Urinas* item, *Menſes* & *Puerperia* ſuppreſſa provocanda, *Partum* Difficilem facilitandum, *Secundinam*, Fætum Mortuum & Lumbricos expellendos, efficacem reperi. In Dolore *Colico* præterea, Cibi *Indigeſtione*, Cruditate *Ventriculi* & Concoctione Læſa, *Diarrhæa*, *Teneſmo*, & Obſtructione *Epatis*, ac *Lienis*, uti & in omnibus ſupra enumeratis Morbis, exhibent.

Oleum vero ex *Igaſur* ſimpliciter infuſione paratum *Emeticum* eſt efficaciſſimum; valet ad eadem ad quæ *Nux* ipſa; hoc ad Magi *Barang* præſentiam Efferveſcere, & Vaſe quo aſſervatur exilire, vir retulit fide Digniſſimus. Idem & alii in ſuis Scriptis affirmant.

Hoc *Oleum* alii efficacius reddere cupientes componunt, ex *Igaſur*, *Tambal de Garigara*, *Tambal de Sangil*, *Tambal de Bornei*, *Salagſalag*, *Camaeſa*, *Manungal*, *Alagao*, *Salibutbut*, *Tambaliſay*, *Marbar Molavin*, *Borogtongon*, *Palyaccan Panambuc*, *Pancoro*, *Nolalaſſon*, *Bagatapon*, *Oringun*, & aliis; vulgo *Jazeite de Tambal*, à Cortice *Scil. Emetico Mananangtang*, appellatur, violenter Purgat, per Superiora, & Inferiora; *Doſis* ʒj. ʒij.

Lignum Sanctum Luzonis Quajaco utiliter ſubſtituitur; de reliquo Concoctionem adjuvat, & Dejectam Ciborum excitat appetentiam. *N. B. Prægnantibus* exhiberi non poteſt, quin *Abortum* patiantur.

Lignum Colubrinum Manungal, Decoctum ejus, venenis omnibus, venenatorumque Animalium morsibus, succurrit; *Febrifugum* est, & *Anti Asthmaticum*, Obstructiones inveteratas referans, & Abjectam Ciborum restaurans appetentiam; *Ictero* præterea, octo dierum spatio in aurora haustum medetur, *Lumbricos* pellit, & *Colicos* Doloris mitigat. Decoctum ex ʒij. paratum, Dejectiones ferme quinas causare solet.

Cortex Vomitorius Mananangtang, datur in pulvere à ℈j. ad ℈ iv. Pituitosa & Lenta, nec non Biliosa, per *Vomitum* & *Secessum* potenter evacuat: Unde in *Febribus*, *ventriculi* repletione aut ex humoris Viscosi turgescentia, *Cachexia*, & *Hydrope*, feliciter exhibetur. In omni *Veneni* periculo *c.* decocto *Manungal*, & ad Ventris *Lumbricos* educendos, plurimum facit.

By Dr. Hotton. n. 257. p. 365.

4. Noviſſime increbuit Usus *Fabæ*, quam vocant, *di S. Ignatio*; dicitur & *Higosur*, & *Faba di S. Nicholas*, & de *Cava Longa*. Semen est Amarissimum, quod nullam *Fabæ* præ se fert Similitudinem, ut ex ipso Semine videbis. Ad movendos Sudores & debellandos *Febres* præcipuum creditur: & *Diarrheæ*, *Dysenteriæ*, *Colicis* Doloribus, Motibus *Convulsivis*, ipsique *Epilepsiæ* mederi; & externe admotum, *Scabiei*: celebratur cum primis & ejus Virtus *Alexipharmaca*. Provenit in *Philippinis*, quas vocant, iisque vicinis, Insulis. Cujus Generis Stirps sit ignoratur; id tantum didici ex *D. Rafaele de Roa*, *Hispano* viro Egregio & Erudito, qui in iis Insulis diu vixit, convolvulaceam esse plantam Arbores altissimas *scandentem*, fructumque ferre *Mali Punici* magnitudine, quo complura Semina reconduntur, ex quibus Deciduis novæ plantæ subnascantur.

Cherry's *Recovered though almost Withered*; *by Dr.* Chr. Merret. n. 25. p 455.

XXXI. I had three *May Cherry-Trees* (Planted in a Rich Mould) which lay to a South Wall, shaded from the Sun by a High Building, till the beginning of *March*; when being High, and shining somewhat Fiercely upon them, the Fruit constantly *Wither'd*. But this Year (1665) the Season being very Hot and Dry, I bared the Roots of one of them, by making a Hole about it, and watered it every Morning and Evening with about a Gallon of Water, for about a Fortnight before the *Cherries* came to Redness, and the Fruit was *Full* and *Good*. The other two Trees, left without this Ordering, had most of their Fruit *Withered*; having only Skins and Stones. Then I made a Hole round about one of the other Trees, and fed it with Water Daily, as the Former: In a Week's time, those that were quite *Withered* fell off, and the rest that were not so, grew and increased exceedingly; the other Tree, that was not used after this Manner, had not any of its Fruit come to *Perfection*.

The Sorbus Pyriformis; *by Mr.* Edm. Pitt. n. 139. p. 978.

XXXII. I have lately found the *Sorbus Pyr formis* of *L' Obelius* or *Sorbus Procera* of *Bauhinus*, growing wild in a Forest of *Worcester shire*. It resembles the *Ornus* or *Quicken Tree*; only the *Ornus* bears the Flower and Fruit at the End, this on the sides of the Branch. Next the Sun, the Fruit hath a Dark Red Blush;

Bluſh; and is about the bigneſs of a ſmall *Juneting Pear*. In *Sept.* it is ſo Rough as to be ready to Strangle one: But being then gathered, and kept till *October*, they Eat as well as any *Medlar*.

2. Perhaps a *Verjuice* made of this Fruit, either ground with *Crabs*, or *Grapes*, or if plentiful, Alone, would, being kept for ſome time, prove one of the beſt *Acid-Aſtringent Sauces*, that Nature affords.

By ----- *ib.* P. 979.

XXXIII. The laſt Autumn I met with a *Double-Pear*. One part growing over, and being fixt in the other; not unlike an *Acorn* in its *Cup*. From the Edges of the *Lower-Pear* there grew up 5 *Leaves* of various Magnitude, at diſtances almoſt equal from each other. The largeſt of them was one *inch* long, *half* an *inch* broad; as large again as the ſmalleſt *Leaf*. Theſe *Leaves* grew out of the *Skin* of the *Lower Pear*, and had no *Fibres* riſing from the Carnous part of it. One of the *Leaves* (the Largeſt of them) had a *Fibre* of the bigneſs of a ſmall Hair, continued from the place where the *Leaf* riſes down, juſt within the *Skin* and looſe from it, to the *Pendunculus*. The *Outer* Coat of the *Pendunculus* was continued to the *Skin* of the *Lower Pear*, and this *Skin* to that of the *Upper Pear*. The *Inner Fibres* of the *Pendunculus* go through the *Lower* up into the *Upper Pear*, and diſperſe themſelves in it. The *Upper* Part was twice as big as the *Lower*, and had ſeveral *Kernels* in it, but the *Lower* none at all.

A Double-Pear, *by* ----- n. 260. p. 470.

XXXIV. I have Planted here (in *Virginia*) 10000 *Mulberry-Trees*; and hope within 2 or 3 Years, to reap good *Silk* off them. I have Planted them in a way Unuſual here, which advances them 2 or 3 Years Growth, in reſpect of their being Sown in *Seed*. I intend likewiſe to Plant them all, as if they were *Currants* or *Gooſ-berries*, ſo thick as Hedges. By this way of Planting them in *Hedges* they will be always Young Tender Plants; and conſequently will be eaſily cut in great Quantities with a pair of *Garden-Sizzers*: Whereby one Man may gather as many of them, as otherwiſe, when they are Planted in *Trees* at Diſtance, 4 Perſons can do. But perhaps it may be a better way to Sow ſome Acres with *Mulberry Seed*, and to Cut it with a *Sith*; and ever to keep it *Under*.

An unuſual way of Propagating Mulberry-Trees, *in* Virginia, *for the* Silk-Work; *by* ----- n. 12. p. 291.

XXXV. The Vulgar Husbandman (without the Expences, Curioſity, Care, or Trouble of *Grafting*) may Propagate the *Genet Moyles* by the *Knotted* Branches alone, in Ground that deſerves not to be called *Fertile*; as they do in the *Rye-Land*, and *Gorſty* Ground in *Wales*; and the *Cider* made of the Fruit (which when perfectly Ripe hath a peculiar Fragrancy,) is Delicately Agreeable to Tender Palates, till the Heat of *July* does too often alter the Caſe.

Choice of Fruit Trees, *for Speedy Propagation and Pleaſant Liquor*; *by Dr. J.* Beal. n. 71. p. 2146.

There is a *Summer-Apple* Call'd *French Cornel*, early Ripe, and very richly full of a moſt Pleaſing Liquor, which I dare Extol for a moſt Delicious Beveridge before the Ordinary time for *Cider* comes in. 'Tis a ſmall Tree all the Branches Criſped, and Curled full of *Knots* at every turning, and Apt to Grow by any Branch that is cutt off below the *Knot*. It proſpers beſt in a Good Mould,

better

better than that of the Common Fields: yet in the Dry *Rye-land* it bears Plentifully every Second Year, and when one of these Trees fails, the next of the same Kind may have a full Burthen.

Some Soil which doth hardly bear *Apples*, does most kindly bear *Pears*; and there is a great Variety of *Pears* to humour every Palate. In the Confines between *Worcester* and *Hereford*, from *Powick* to *Bosbury*, the *Bareland-Pear* grows in the Common Arable Field. That, and some other *Pears* of uncertain Names, in *Powick* do yield a very strong and long Lasting Liquor. The *Horse Pears*, as there they call them, the *White* and the *Red* of several kinds, yield abundance of Pleasant Liquor. The *Ailets*, Great and Little, Wild and Gentle, the *Linten-Pear*, *Lullam-Pear*, *Squash-Pear*, have their peculiar Excellencies for Liquor, and some of them for the Largeness of the Tree; yielding constantly some *Hogsheads* of Liquor yearly.

Where the Soil hath not been Tryed and found Kindest for *Apples*, 'tis the surest way to Plant *Pears* alternatively, and where the Liquor of *Pears* is Weak, or less Lasting, this may be helped by a Gentle Mixture of *Crabs*, or of the Harshest *Apples*, to Humour all Palates, and for a Help to the Stomack, the Mixture being made in the time of *Grinding* the Fruit together: And thus, when the better Soil is too shallow for *Apples*, but receives *Pears* kindly at a greater Depth, a Hedge-row of *Crabs*, or Wild Austere *Apples*, Raised on the *Mounds*, and Ripening in the same Season, will by well ordering it, afford such a perfect Remedy, that judicious Palates may be deceived, and take it for the Best *Cider*. Sir *W. S.* recommends the *Hamlin-Apple* of *Devon* for *Cider* equal to the Best, if not Excelling.

An Easy Way of Raising *Fruit-Trees; by Mr.* Lewis. n. 95. p. 6067.

XXXVI. Take a Piece of the *Root* of any *Apple-Tree* or *Pear-Tree*, *&c.* about 6 *inches* Long, and *Tongue-Graft* a Graft of an *Apple* or *Pear* into the *Root*. The way of *Tongue-grafting* is, to Cut the *Root* Sloping about *one Inch*, and the *Graft* Sloping in like manner *one Inch*; Cutting both very Smooth. Then Cleave the *Root* and the *Graft* likewise about *one Inch*, and enter them into one another, that the *Sap* of the *Graft* may joyn to the *Sap* of the *Root*, as much as you can. Lap the Joynted place about with a little *Hemp* or *Flax-hurds*; set the *Root* so Grafted into the Ground about 10 or 12 *Inches* deep, so as the Joynt may be covered at least 4 *Inches* under the Earth, that it may not be Bared at any time, but kept Moist by the Earth.

The *Root* you Graft upon, must not be Less than your *Graft*; it is no Inconvenience if it is Bigger: But it is Best that the *Root* and the *Graft* be of the same Bigness.

About 29 *Years* since I *Sowed* a Bed of *Apple Kernels* in *March*; The Spring following I pluck'd up 40 of those *Seedlings*, grown to the thickness of a Fair *Graft*; I *Grafted* them in this manner of *Tongue Grafting*, and Planted them again. They all grew, and 4 of them bore Fruit to Perfection that Year; so that in a *Year* and *half* from an *Apple Kernel* I had *Ripe Fruit*. Some of these Trees will now Bear 2 *Quarters* of *Apples* upon a Tree; and are Bigger than most

moſt of thoſe Trees amongſt which they Stand, which coſt 12 *d.* the Tree when theſe were *Kernels*.

I conceive that *Plumbs*, *Cherries*, *Apricoks*, *Peaches*, and all ſorts of *Fruit Trees* may be thus *Raiſed*.

XXXVII. 1. I never begin to *Plant* till *Valentine's Day*: and I approve of Late *Planting* before Early; The Cold in the *Winter* kills more than the Drought in *Summer*. We impute it indeed to the Drought, becauſe they Languiſh until *Summer*, and then Die: But they receive the Fatal Stroke by the Cold in *Winter*.

The beſt Seaſon *of* Tranſplanting; *by Mr.* Rich. Reed. n. 70. p. 2130.

For either we take our Stocks out of Woods, or out of Nurſeries; in either Place they lye Warm: And if you *Tranſplant* them in *October*, you expoſe them on a ſudden to an Open Air, and adventure them, being Weak, to a Long and perhaps Cold *Winter*, which they cannot bear. Add hereunto, that I can relieve them againſt the *Drought*, by Watering and Covering the Ground, to keep it Cool: But there is no Fence againſt the *Froſt*, which many times gets into the Roots, and Kills, ſo that they never Spring; or if they do, yet Pulingly, and Dye in the *Spring*; or if they Survive, as many do, yet come on very Slowly and pitifully. For, the *Bark* does Cleave to the *Wood* by Reaſon of the Cold, which Dries and Clings them together, that like an *Hide-bound Horſe*, they will not admit the *Sap*, which the *Root* would ſend Up; and other *Suckers* grow out at the Earth; and the Tree grows Dry, and turns Red: All which diſcovers the Obſtruction in the receiving the *Sap*, which would come from the *Root*; and then we are forced to Score and *Looſen* the *Bark*, as we can. Now on the other ſide, if the *Summer* prove Moiſt, the Danger and Fear of Late Setting is over, and they will Thrive and come forward a main; if otherwiſe, I ſeldom ſee but they always keep *Green* and *Freſh*, being maintained in *Life* and *Verdure* by the *Sap* they receive in the Beginning of the *Spring*, before they be *Tranſplanted*.

This therefore I do (which I ſubmit to better Judgments and Experience;) In the Dead of *Winter* I Prune and Cut the Tree I intend to *Tranſplant*, as I would have it be, to the end to Loſe Nothing of its Strength when I *Tranſplant*. Then I ſuffer it to abide Untouched by the Spade till *Valentine's Day*, and then Remove it after it hath taken in ſomewhat of the *Spring*. I am very careful to Preſerve and Set the *Roots* as large as I may; ſuppoſing the Larger *Root*, the more of Strength and *Sap* it contains, and ſo will Advance the more the Growth of the Tree; ſince every thing Grows in Proportion to the *Root* beneath. But I have heard from ſome Planters, who had Experience therein, that *Roots* Cut Short do beſt, as ſending forth New Roots, which Draw *Sap* and Nouriſhment beſt. And we ſee that *Moyles* ſet on *Slips* that have No *Roots*, come to a Tree ſooneſt; And I have oft Obſerved, that a *Moyle*, *Tranſplanted* after it hath taken *Root*, does not Live ſo certainly, or Thrive ſo well, as a *Slip* newly ſet.

2. Dr. *Lauremburg*, a Perſon of much Experience, agreeth with Mr. *Reed*, that Plants which cannot well Bear the Hardſhip of the *Winter*, ſhould be *Tranſplanted*

By Dr. J. Beal. n. 71. p. 2148.

Tranſplanted in the *Spring*; but that ſuch as are Able to bear the Extremity of a Cold *Winter*, ſhould be *Tranſplanted* in *Autumn*. In this only he Differs, that he ſaith, *Poma, Pira, Ceraſa vulgaria, Coryli, Oxyocanthi, Pruna, &c, facile* Frigus *ferunt*, & Autumno Tranſplantari *Optimo Succeſſu ſolent*: and then for the *Spring* he refers *Juglandes, Perſica, Abricoca, aliquot Ceraſorum Genus*; and I think, where he wrote and Practiſed, it is as Cold a Country as *England*. I ſhall only Add that 'tis an Old *Engliſh* and *Welſh* Proverb, concerning *Apples, Pears*, and the *Hawthorn Quick, Oaks, &c. Set them at* Allhallontide, *and* Command *them to Proſper*; *ſet after* Candlemas, *and* Intreat *them to Grow*.

Lauremb. *de Hort. Cult. l. i. c.* 28.

Bloſſoms *do not forthwith diſcover a* Blaſt; *by Dr.* Beal. n. 23. p. 424.

XXXVIII. It is to be Noted that the *Bloſſoms* of *Fruit-Trees* do not Forthwith Diſcover the *Blaſt*: for an Old experienced Country-man having once given me Notice of a *Blaſty* Noon, (it being then *Sultry* Weather, and ſomewhat *Gloomy* with the Thickneſs of Exhalations, almoſt like a very Thick *Miſt*) and within a *Day* or Two ſhewing the proof upon the *Cherry-Bloſſoms*, then flagging, but not much altering their Colour till two *days* more were paſt.

Cider; *by Mr.* Rich. Reed. n. 70. p. 2128.

XXXIX. 1. I do commend for the advancing of *Cider* in Richneſs, both for Taſt and Colour, a *New Cask*; provided it be made of Timber very well ſeaſoned: otherwiſe it may ſpoil it utterly. I have often Tryed it, and found that ſort of *Cask* to improve the *Cider*.

The beſt *Cider*, I ever had, was *Redſtrake* Grafted upon a *Gennet Moyle-Stock*, For, as thoſe kinds do beſt agree, and the Trees ſo *Grafted* ſeldom *Canker* (as do the Old *Redſtrake* upon a *Crab-ſtock*) ſo the Fruit is far more Ingenuous and Milder; and being Ripe, both Rich and Large, and Good to eat; and the *Cider* is more Smooth, and abates in Strength and Harſhneſs of that on the *Crab*; and needs leſs of Mellowing before making; the Stock in Degree altering and Reclaiming the Nature of the Fruit. For, as an *Apple* doth Beſt Grafted on a *Crab*, which gives Acrimony and Quickneſs to the Fruit, ſo a *Crab* (and the *Redſtrake* is no other) Grafted on an *Apple*, receiveth thence Gentleneſs, and Softneſs, and Largeneſs, and an excellent Alloy to the Sharpneſs, and (as Mr. *Evelin* calls it) the *Wickedneſs* of the Fruit.

An excellent Drink, from Apples *and* Mulberries; *by Mr.* Sam. Colepreſs. n. 27. p. 501.

2. A Compoſition of the Juices of good *Cider-Apples* and *Mulberries* produceth the beſt Taſted and moſt curiouſly Coloured Liquor, that many ever Saw or Taſted.

Vines; *by Mr.* J. Templer. n. 93. p. 6016.

XL. I have lately ſeen a pretty and pleaſant Culture of *Vines*, at the Houſe of a Gentleman, who makes very good *White Wine* of his own *Grapes*. He lets *Vines* aſcend by one ſingle *Stem* to the Eaves of his Houſe, (cutting off all the Luxuriant Branches by the way,) then gives them liberty to Spread upon the *Tiles*, all over one ſide the *Roof* of his Houſe. Thus he furniſhes his Dwelling Houſe, and many out-Houſes; by which Means the *Vines* are no Hindrance to his other *Wall Fruit*, and the Rays of the Sun being almoſt *Di-*

rect

rect upon the *Vines*, he hath Riper, Sweeter and Greater Plenty of *Grapes*, than when their *Vines* are placed as *Wall Fruit*.

To make Muſcadine-Wine; *by M.* de Martel. n. 58. p. 1183.

XLI. At *Frontignac*, they let the *Grapes* grow half Dry upon the *Vine*, and as ſoon as they are Gathered, they Tread and Preſs them immediately, and Tun up the *Liquor*, without letting it ſtand and *Work* in the *Fat*, the *Lee* cauſing its Goodneſs. Thus is made the true Genuine *Muſcadine*, without Mixing any other ſort of *Grape* with it. Lately a certain Perſon thought fit to paſs *White-Wine* of another kind upon the *Mark* or *Husks* (which are wont to be Caſt away) of the *Muſcadine Grapes*: And hath made in this manner an Excellent *Wine*, which hath the Taſte of *Muſcadine*, and is more Pleaſing to ſome, nor is ſo Heady, as the Franc or True *Muſcadine*.

The Way of making Vinegar *in* France; *by M.*.... n. 61. p. 2002.

XLII. They take two Great *Casks*, within each of which they put at the bottom a *Trevet*, which muſt be one *Foot* High, and as Large as the largeneſs of the *Cask* permits. Upon this *Trevet* they put *Vine-Twigs*; whereon they lay a ſubſtance called *Rape*, with which they fill both Veſſels, within *half* a *Foot* from the Top. This *Rape* is nothing elſe, but the Wood or Stalks of the Cluſters of *Grapes*, Dryed and Freed from the *Grapes*. The *Trevet* and the *Vine Branches* are put at the Bottom of the *Casks*, only to keep the *Rape* from the ſettling at Bottom. It is this *Rape*, which alone *Heats* and *Sowers* the *Wine*. The two Veſſels being almoſt quite Fill'd with the *Rape*, one of them is fill'd up with *Wine*, and the other only Half full for the time; and every Day they draw, by a Cock, Half the *Wine*, that is in the Full Veſſel, therewith quite to fill up the other, that is but Half Full; obſerving Interchangeable turns of Filling and Unfilling the Veſſels. Ordinarily, at the end of 2 or 3 Days, the Half-fill'd Veſſel begins to *Heat*, and this *Heat* Augments for ſeveral Days ſucceſſively, continuing to do ſo till the *Vinegar* is perfectly made; and the Workmen know, that the *Vinegar* is made, by the Ceaſing of the *Heat*. In Summer it is a Work of 15 *Days*: In Winter it proceeds more Slowly; and that according to the Degree of Cold Weather.

When the Weather is Hotteſt, the *Wine* muſt be drawn twice a Day, to put it out of one Veſſel into the other. It is only the Half fill'd *Cask* that Heats, and as ſoon as you have done Filling up, its *Heat* is Choaked and Stopped for the time, and the other *Cask*, which is Unfill'd, begins to *Heat*.

The Full Veſſel is quite Open at the Top; but a Wooden Cover is put on the Veſſel, that is but Half-full.

The Beſt *Wine* makes the Beſt *Vinegar*; but yet they make good *Vinegar* of *Wine* that is Turned.

The *Wine*, in Changing leaves a certain *Greaſe*, which ſticks partly to the ſides of the *Cask* (and that they take care to do Clean away) and partly to the *Rape*; ſo that if they Cleanſe not the *Rape* from it, almoſt every Year Once, the *Wine* Turns into a *Whitiſh Liquor*, which is neither *Wine* nor *Vinegar*.

At the time when they pour the *Wine* out of one Veſſel into another, a *Scum* ariſeth on the Top of the Veſſel, which muſt be taken carefully away.

In the *Casks*, which have never ſerved for this purpoſe before, the *Vinegar* is made more Slowly, than in ſuch as have been uſed already.

The *Rape*, as ſoon as 'tis ſeparated from the *Grapes*, (which is done immediately after *Vintage*) is carefully put up in *Barrels*, leaſt it take Air; without which it would *Heat* it ſelf and be Spoiled. *ib. p.* 2004.

There is no other way of Keeping the *Rape* that hath once ſerved already, than to *Drown* it; that is to ſay, to Fill the Veſſel wherein it is with *Wine* or *Vinegar*. *Rape* will ſerve a Year, more or Leſs, provided care be taken of Cleaning every Morning, with a piece of Linnen, the *Greaſe* that is on the Sides of the Veſſel; and with a little Broom, that which Swims on the Top of the Liquor. The *Rape* may be freed from its *Greaſe* with Water, rubbing it between ones hands. No body, that I know hath hitherto examin'd what this *Greaſe* is.

I have been lately informed that there have been Merchants here, who made *Vinegar* with *Phlegm* of *Wine*, remaining after that the *Aqua Vitæ* is Extracted from it.

Orange-Trees; *by* ------ n. 29. p. 554.

XLIII. A *Provencal* at *Paris*, pretends to keep *Orange-Trees* in that Town all the *Winter* long without any Fire, though they remain in the *Earth*, and not be put in *Caſes* or *Boxes*. This is thought to be Effected by a peculiar ſort of *Dung* uſed for that Purpoſe, and wrought deep into the Ground.

One Individual Fruit half Orange *and half* Limon; *by* ---- n. 29. p. 553. *By Mr.* ----- *ib.*

XLIV. 1. We have *Orange Trees* at *Florence* that bear a Fruit which is *Citron* on One ſide, and *Orange* on the Other. They have not been brought hither out of other Countries, and they are now much propagated by *Engrafting*.

2. A very Ingenious *Engliſh* Gentleman aſſerts that himſelf not only had ſeen, but Bought of them *An.* 1660. in *Paris*, whither they had been ſent by *Genoa Merchants*; and that on ſome Trees he had found an *Orange* on one Branch; and a *Limon* on another Branch; as alſo (conſtantly to the *Florentine* Information) one and the ſame Fruit *Half Orange* and *Half Limon*; and ſometimes 3 *quarters* of One kind, and *one Quarter* of the Other.

By Pet. Natus. n. 114. p. 313.

3. About 30 Years ſince a Tree was firſt met with in a Grove near *Florence* having an *Orange* Stock, which it ſeems, was ſo Grafted upon, that thence it became in its Branches, Leaves, Flowers and Fruit, *three formed*; ſome Emulating *Orange*, ſome *Limons* or *Citrons*, ſome partaking of *Both Forms* in *One*. And particularly as to the Fruit, ſome of this Tree are meer *Oranges*, yet ſome of them of an Oblong Shape like *Limons*, ſome Round like common *Oranges*, ſome between both: Others Taſte like Genuine *Oranges*, others have an *Orange* Shell, but a *Limon* Pulp. Moſt are of a very ſtrong Scent, and a Shell of a very bitter Taſte. But then the ſame Tree bears alſo a kind of *Citron Limon*, yet not ſo many as of the former kind. And not only ſo, but it produces alſo a Fruit, that is in *One* both *Limon*, *Citron*, and *Orange*; ſo as you may ſee outwardly two ſorts of Fruit repreſented in One Piece; one, *Citron Limon*, the other, *Orange*. But this Fruit is ſo diverſified, that ſome of them are *Half Citron-Limon*, *half Orange*; others have *Two Thirds* of *Citron Limon* and

One

One of *Orange*; others the contrary: And of all these, some are Oblong, some Round, some Bunchy, some Smooth, some Rugged, some Small, some of the bigness of two Pound Weight. Their *Flesh* is so distinguisht, that where the *Orange Pulp* Ends, that of *Limon* begins, and on the contrary. Again, the *Orange Pulp* is Narrower than that of *Limon*; but this is Tenderer than that; not so Agreeable to the Taste, as the Genuine single Fruit. They have either none, or very few, or Empty *Seeds*: Nature it seems, since this Tree is of the *Insititious kind*, nor can be Repaired or Propagated by *Seed*, is not at all solicitous in the *Generation* of them.

The first Original of this Tree was by *Inoculating Orange* upon a *Citron-Limon Stock*, so that by the Marriage of these Trees, Repeated for many Years, it was come to pass, that by the closeness of the *Inoculation*, whereby in length of time the Mixed Nature of both Trees was grown together; which the Different Juyces, permeating the common Fibres, had for a long time Nourished: Whence Emerged at length a *Germen*, or *Graft*, perfectly retaining the Nature and Species of both; into whose Different Branches when sometimes *one*, sometimes *both* kinds of Juyces did pass, it Produced on one of those Branches, a meer *Orange*, on another a *Citron-Limon*, on a third a *Citron-Limon-Orange*, and even sometimes upon one and the same Branch, All the *Three* sorts of this Fruit together.

XLV. Mr. *Edw. Clyve* (and he is the first), who brought a Dry'd Branch of the *Coffee Shrub* AA. from *Moha* in *Arabia-Felix*, gives this account of it: This Branch was taken off a Tree 7. or 8. *Foot* High, is about 5 *Foot* Long, and Covered with a Gray almost Smooth *Bark*. The Wood is White, and the Pith not very Large, the *Twigs* are covered with a Darker-Colour'd very smooth *Bark*, and rise Opposite to one another by *Pairs*, standing Cross to one another coming out of Opposite sides of the Branch, or the two *Pairs* next to one another Cutting each other at Right Angles. After the same manner stand the *Leaves* on the *Twigs*, as the *Twigs* on the Branches, at sometimes an *Inch*, and sometimes 2 *Inches* distance, each *Pair* of *Leaves* from the other 1. The *Leaves* have $\frac{1}{4}$ *Inch Foot Stalks*, being about 4 *Inches* long, and 2 broad in the Middle where broadest; whence they Decrease to both Extreams, Ending in a Point. They are Smooth, Whole, and without any *Incisures* on their Edges, somewhat like the *Leaves* of a *Bay*. The Fruit comes *ex Alis Foliorum*, hanging or sticking to the *Twig* by $\frac{1}{3}$ *Inch* Long Strings or *Foot-Stalks*; and sometimes 1. 2. or more, at the same place.

An Account of the Coffee-Shrub; *by Dr.* H. Sloan. n. 208. p. 63.

Fig. 165.

These *Shrubs* are Planted in *Arabia Felix*, call'd *Jaman*, every where in a Rich Ground or Mold in great Plenty, and are Watered in times of Drought as other Cultivated Vegetables there, by Artificial Channels from Rivers cut on purpose to Nourish them; and after 3, 4 or more *Years* Bearing, the Inhabitants are forced to Plant *New Shrubs*, because the *Old* ones become not so Fruitful after that time. They dry them in the Sun, and afterwards take off the Outward *Husk* of the *Berries* by means of *Hand-Mills*, as they do here

the *Husks* of ſeveral ſorts of Grain, to fit them for Uſe: And the *Arabians*, in Summer Heats, uſe theſe *Husks*, Roaſted after the manner of *Coffee-Berries*, eſteeming that Drink more Cooling, it being ſouriſh to the Taſte.

Explication of the Figures.

A. A. Repreſents the *Shrub*, wherein is obſerveable the *manner* of its *Branching*, and of the growing of the *Leaves* and *Fruit*.

aaaa. The *Fruit*, growing 2, 3, or more at a place on the *Twigs*.

B. One of the *Leaves*, of its Natural Bigneſs.

C. The *Fruit* of the true ſize and Figure.

c. The *Fruit* with the *Husk* on.

e. The *Fruit* with the *Outward Husk* taken off.

i. i. The *Berry* with *both Husks* taken off.

An Account of Coffee; by Mr. J. Houghton. n. 256. p. 311.

XLVI. I cannot learn the Uſe of any part of the *Coffee-Shrub*, except the *Berries*; of which, boiled in Water, a Drink is made, and drunk much among the *Arabians* and *Turks*. Perhaps 'twas their *Succedaneum* for *Wine*, which *Mahomet* had Prohibited: For by its actual Heat it refreſhes the weary, and does ſeveral other Services, as *Wine* that Acts by a Potential Heat.

It has not been in Uſe (as Mr. *Tavernier* tells us) much above 120 *Years*. However the Uſe of it quickly became General, and that made it a Trade in great Towns. Into the *Publick Coffee-Houſes* they would come by Hundreds, and among them Strangers would venture, where they learned the Cuſtom, and carried it into their own Countries. One Mr. *Raſtall*, an *Engliſh* Merchant, (whom *I* knew) found a *Coffee-Houſe* at *Leghorn* in 1651. The next Year Mr. *Dan. Edwards*, a Merchant, from *Smirna* brought into *England* a *Greek* Servant, call'd *Paſqua*, to make his *Coffee*: So that 'tis likely that this Merchant was the *Firſt* who uſed it in *England*; (tho' *I* am informed that the famous Dr. *Harvy* did frequently Uſe it;) as his Servant *Paſqua* (whom he thought fit to ſet up) was the *Firſt Coffee-man*.

The beſt *Coffee-Berry* is what is Large and Plump, with a *Greeniſh* Caſt, and having on the thin parts a Tranſparency; the other has a *Yellowiſh* Caſt, and is more Opaque; but when they are *Roaſted*, 'tis hard to diſtinguiſh.

I put ſome *Berries* into a Glaſs of *Water*, about a *Week* ſince, to ſee if they will *Sprout*, but as yet there is no appearance, altho' they are tolerably ſwell'd, and look White and Bright.

I have made a *Decoction* of them, which has made them *Shoot*.

The common way of *Preparing* the *Berry* for the Drink *Coffee*, is *Roaſting* it in a *Tin Cylindrical Box* full of *Holes*, through the middle of which runs a *Spit*; under this is a ſemicircular *Hearth*, wherein is made a large *Char-Coal-Fire*: By the help of a *Jack*, the *Spit* turns ſwift, and ſo it *Roaſts*, being now and then taken up to be ſhaken. When the *Oil* ariſes, and its grown of a Dark-Brown Colour, it's emptied into two Receivers, made with large *Hoops*, whoſe Bottoms are *Iron Plates*, theſe ſhut into, and there the *Coffee* is well ſhaken, and left till almoſt Cold, and if it looks Bright, Oily, and Shining, 'tis a Sign 'tis well done.

Of this, when freſh, if an *Ounce* be ground, and boiled in ſomething more

more than a *Quart* of Water, till it be fully Impregnated with the fine Particles of the *Coffee*, and the reſt is grown ſo Ponderous, that it will Subſide and leave the Liquor Clear, and of a *Rediſh* Colour, it will make about a *Quart* of very good *Coffee*.

The beſt way of keeping the *Berries* when *Roaſted*, is in ſome Warm place, where it may not be ſuffered to Imbibe any Moiſture, which will Pall it, and take off its briskneſs of Taſte. 'Tis beſt to Grind it as Uſed; except it be ramm'd into a Tin-Pot well covered and kept dry, and then I believe it will keep good a *Month*.

There will ſwim upon the *Coffee* an *Oyl*, which the *Turkiſh* great *Coffee-Drinkers* will take in great Plenty, if they can get it. When the *Coffee* has ſtood ſome time to Cool, the groſs parts will ſubſide, the briskneſs will be gone, and it will grow Flat and almoſt Clear again.

I ſent to the Chymiſts, 1 *pound* of Clean *Coffee*; 1 *pound* of Husked *Horſe-Beans*, and 1 *pound* of pick'd *Wheat*; and I received back.

Coffee.				*Horſe-Beans.*				*Wheat.*			
	℥	ʒ	℈	℥	ʒ	℈	gr.	℥	ʒ	℈	
Spirit net.	VI.	VI.	o.	VI.	I.	o.	XII.	VIII.	II.	I.	
Oyl	II.	IV.	II.	I.	III.	o.	X.	I.	o.	gr.	VI.
Cap. Mort.	V.	III.	o.	V.	III.	o.	o	IV.	VI.		

By this Account it appears that *Coffee* yields, by *Diſtillation* in a *Retort*, almoſt Double as much *Oyl* as *Beans*, and almoſt Treble as much as *Wheat*.

The *Oyls* are very Thick, but they and the *Spirits* have all of them Ill Savours, as is uſual from Burnt Materials.

By *Spirit* is meant the *Phlegm*.

The *Capita Mortua* have no Smell. They have been Calcin'd over and over, with all the Art my Chymiſt has; but he cannot reduce them to a *Calx* or *Aſhes*, and concludes there is no *Salt* to be gotten from them.

From what is ſaid, *I* note, that from the common Drink call'd *Coffee*, there is little good can come from any part but its *Oyl*, becauſe its other Thin Parts are Evaporated, and its Thick ſubſides; but its *Oyl*, *I* ſuppoſe, to be Nutritive *quaſi* an *Oyl*, and Warm *quaſi* a *Chymical Oyl*, for all the Warm parts are brought hither as to a Point, and thereby it may enliven and invigorate ſome heavy parts in the Fermentative Juyces; and nouriſh weak Parts within, as other *Chymical Oyls* do the Parts External when rubb'd, but being dilated, as it uſually is, *I* queſtion whether it does any more Good, than Hot Tea, Hot Broth, or any thing elſe that is Actually Hot; for *I* believe that Actual and Potential Heats are much of the ſame Operation.

It has been generally thought to be an *Anti-hypnotick*, or hinderer of Sleep, which *I* dare not gainſay, Dr. *Willis* and other Learned Men having declared it ſo: But now it is come into frequent Uſe, the Contrary is often obſerved; although perhaps Cuſtom, as it does with *Opium*, Alters its natural Qualities.

I

I am told that our Three *Kingdoms* ſpend about 100 *Tun* a Year, whereof *England* ſpends about 70 *Tun*; which at 14 *Pounds* a *Tun*, (a middle Price now a Days) will amount to 20586 *ll. ſterling*; and if it were to be all ſold in *Coffee-Houſes*, it would reach Treble, or 61740 *Pounds*, which at 10 *Pounds* a Head, will find Imployments for 6174 Perſons, although *I* believe all the People of *England*, one with another, do not ſpend 5 Pounds each.

Coffee, when *Roaſted*, loſes about a 4*th* part; then there is ſpent about 52 *Tun* and a *half* of Roaſted *Coffee*, which makes 117600 *Pound*, or 15252800 Drachms, which, if there be 8 *Millions* of People, is not 2 *Drachms*, or *half* a *Pint* of *Coffee* a piece for a Year.

Beſides what we Uſe, we ſend a great deal Abroad; and, *I* doubt not but in ſhort time, the Gain of what we ſend abroad, will pay the firſt Coſt of all we ſhall ſpend at home; which is one of the beſt ways to make *Advantage* of *Foreign Trade*.

The Cacao-Tree, *by*--- n. 93. p. 6007.

XLVII. The Body of a *Cacao-Tree* is commonly about 4 *Inches* in Diameter, 5 *Foot* in height, and above 12 from the Ground to the Top of the Tree. Theſe Trees are exceedingly different amongſt themſelves; for ſome ſhoot up in 2 or 3 Bodies, others in One. Their Leaves are many of them Dead, and moſt diſcolour'd, unleſs on very young Trees. We reckon a Bearing Tree yields from 2 to 8 *Pound* of *Nuts* a Year; and each *Cod* contains from 20 to 30 *Nuts*.

The manner of *Curing* them is, to Cut them down when they are Ripe, and to lay them to *Sweat* 3 or 4 *Days* in the *Codds*; which is done by laying them on heaps. After this, they Cut the *Codds*, and take out the *Nuts*, and put them into a *Trough* covered with *Plantan* Leaves, where they *Sweat* again about 16 or 20 Days. The *Nuts* that are in each *Codd*, are knit together by certain *Fibres*; and have about them a white kind of *Pulp*, that's agreeable to the Palate. By the turning and ſweating, their little *Strings* are broken, and the *Pulp* is imbibed and mingled with the Subſtance of the *Nut*. After this, they are put to dry 3 or 4 *Weeks* in the Sun, and then they become of a *Reddiſh-dark-Colour*.

The *Codds* grow only out of the *Body*, or great Limbs and Boughs, and at the ſame place, there are *Bloſſoms*, *Young*, and *Ripe Fruit*.

The greateſt Crop at moſt of our *Cacao Walks* in *Jamaica*, is in *December* or *January*: But at one of Collonel *Modiford*'s *Walks*, they bear moſt in *May*; yet its not above 5 *Miles* from thoſe *Walks*, which bear always in *December*: But thoſe that bear then, have ſome Fruit in *May*, as the other have in *December*.

It's *Planted* Firſt in the *Nut*, always under Shade. Some do it under *Caſſave*; others, under *Plantane-Trees*, and ſome in the Woods. The *Spaniards* uſed a certain large ſhady Plant, call'd by them *Madre di Cacao*; we, only the others. It muſt alſo be always Sheltered from the *North-Eaſt* Winds. We ſeldom Tranſplant, only where it fails: As it doth many times in Open, Poor, and Dry Lands; for this Tree requires

Fig. 157.

Fig. 163.

Fig. 161.

Fig. 160.

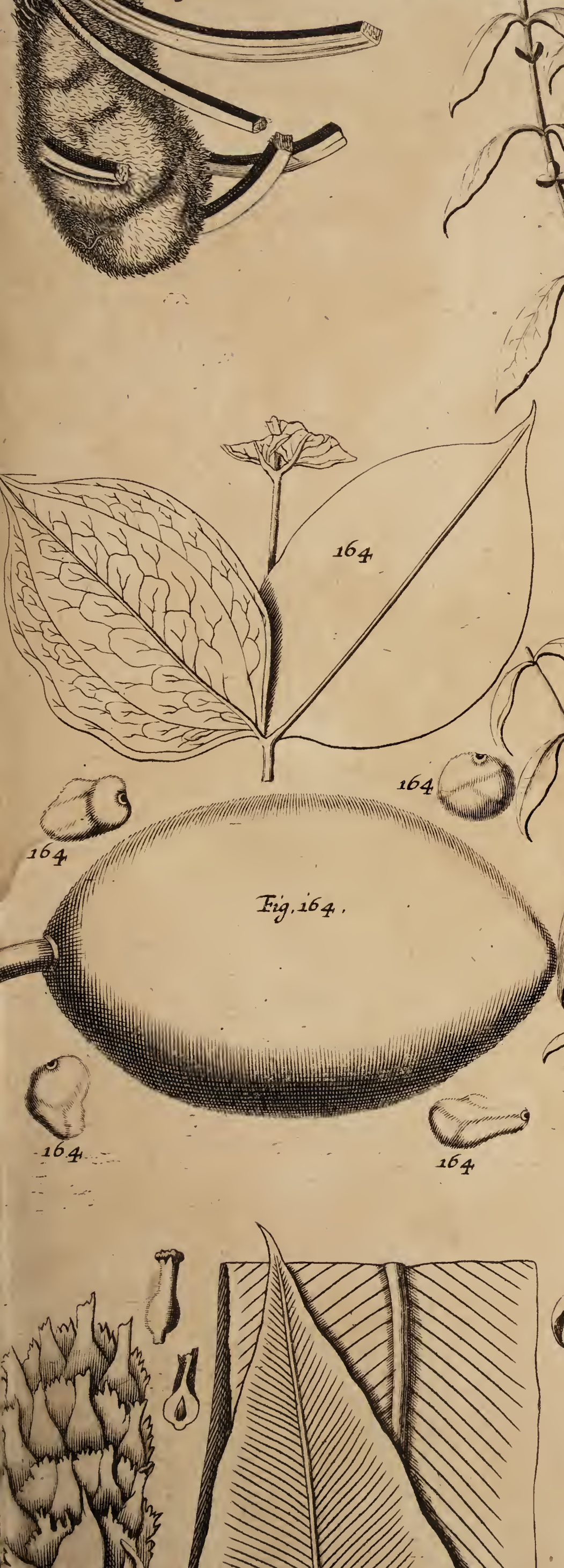

Fig. 158.

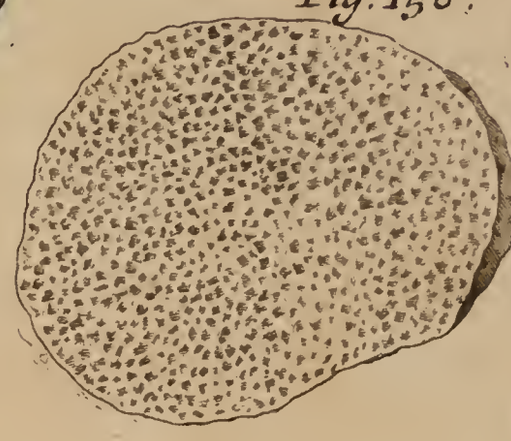

Fig. 159.

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Fig. 164.

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Fig. 165.

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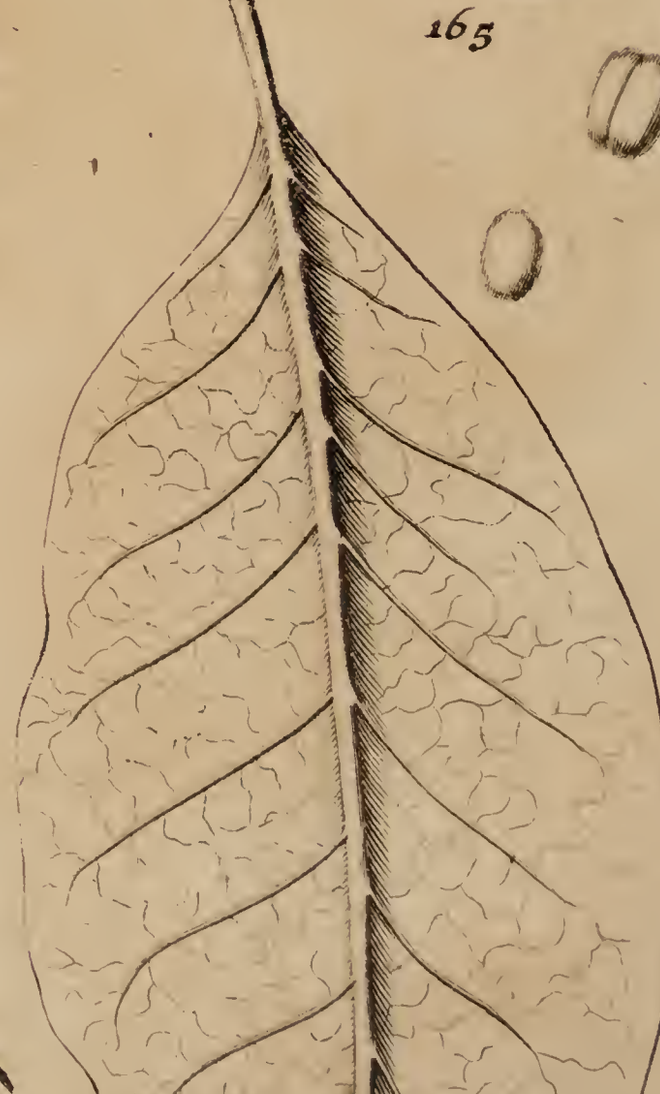

Fig. 162.

requires to have a Flat, Moiſt, Low Soil, which makes them to be Planted commonly by Rivers, and between Mountains; So that it is ill living where there are good *Cacao-walks*. In a Years time the Plant comes to be 4 *Foot* High, and hath a *Leaf* 6 times as big as an Old Tree, which, as the Plant grows bigger, falls off, and Leſſer comes in their place.

The Trees are commonly planted at 12 *Foot* Diſtance: and at 3 *Years* old; where the Ground is good, and the Plant proſperous, it begins to Bear a little; and then they Cut down all or ſome of the Shade; and ſo the Fruit Increaſes till the 10*th*. or 12*th*. Year; then the Tree is ſuppoſed to be in its Prime. How long it may continue ſo, none with us can Gueſs: but it's certain, the Root generally ſhoots out *Suckers*, that ſupply the place of the Old *Stock* when Dead or Cut down, unleſs when any ill Quality of the Ground or Air kill both.

Cacao was Originally of theſe *Indies*, and Wild; Towards *Maracajo* are divers Spots of it in the Mountains: and I am informed, the *Portugueſes* have lately diſcovered whole Woods of it up the River *Maranon*.

The *Cacao* paſſes by detail for Money in *New Spain*, and the Silver Countries.

XLVIII. The *Myrtus Arborea Foliis Laurinis aromatica, Piementa*, or *Jamaica-Pepper-Tree*, has a *Trunck* as thick as ones Thigh, riſing ſtraight about 30 *Feet* high, covered with an extreamly 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 Extreams, Ending in a point, Smooth, Thin, Shining, without any inciſures, of a deep green Colour, and ſtanding on *inch-long Foot-ſtalks*; when bruiſed very Odoriferous, and in all things like the Leaves of a *Bay Tree*. The ends of the Twigs are branched into Bunches of *Flowers*, each *Foot ſtalk* ſuſtaining a *Flower*, made up of 4 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 4 *Foliola* or ſmall 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*, 2 large *Acini*, or Seeds, ſeparated by a *Membrane* lying between them; each whereof is a Hemiſphere, and both Joyned, make a Globe or Spherical (appearingly one) *Acinus*, whence *Cluſius* makes it One Seed diviſible into 2 parts.

The Jamaica-Pepper-Tree; *by Dr.* H. Sloan. n. 192. p. 462.

Fig. 166.

It grows on all the Hilly parts of the Iſland of *Jamaica*, but chiefly in the North ſide thereof: and wherever theſe Trees grow, they are generally left ſtanding when other Trees are fell'd; and they are ſometimes Planted where they never grew; becauſe of the great Profit from the Cured 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

the *Fruit* ſoons Ripens; but 'tis to be obſerv'd, that in Clear'd Open Grounds 'tis ſooner Ripe than in Thick 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*, *Cinnamon*, 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* Dryed 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 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, ſtrengthning the Stomach, expelling Wind, doing thoſe friendly offices to the Bowels as 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 Chewed, a *Stinking Breath*; *John de Barrios* tells us, 'tis one of the Ingredients of *Chocolate* in *New Spain*; and *Franciſcus Vria*, 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 *Stomachick* and *Cephalick* Medicine, moderately given.

Exper. Nat. p. 132.

It has been taken by *Cluſius* for *Pliny's Garyophyllon*, and by others for *Amomum*: But it is not likely that it was known to the Ancients; not being known to grow in the *Eaſt*, but *Weſt Indies*.

It is very likely that *Hernandez* does deſcribe this under the Name of Xococoxite, *ſeu Piper Tavaſci*; his Deſcription agreeing in every thing, only the Flower; which no ways agrees to this. And perhaps this is the Tree which *Piſo* Deſcribes under the Name of *Anhuiba Miri*.

Cinnamon *and* Millium; *by M.* J. n. 172. p. 1031.

XLIX. *M. de Villermont* has a ſort of *Cinnamon*, which comes from *Guardaloupe*,

daloupe, which is *White*; and another ſort, which comes from *Marragnan*, which is like that of *Ceilon*.

He has an *Ear* of the ſmall *Milium* of *Guinee*, about 10 *Inches* long, made juſt like the great Knob of a *Cane*: the Grains are no bigger than a *Pin's Head*, and are very good to Eat; the *Negros* making their Finer Cakes of them.

L. *Arbor Baccifera, Laurifolia, Aromatica Fructu Viridi Calyculato ramoſo*, or *Wild Cinnamon Tree*, commonly but Falſly call'd *Cortex Winteranus*, has a Trunck about the thickneſs of one's 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 upon it, and ſeveral ſhallow Furrows of a Darker Colour, running variouſly through it, making it Rough, of an Aromatick Taſt. The *Inward Bark* is much Thicker than *Cinnamon*, being as Thick as a *Mill'd Crown* piece; ſmooth, of a Whiter Colour than the *Outward*, of a much more Biting and Aromatick Taſt, ſomething like that of *Cloves*, and not glutinous like *Cinnamon*, 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 2 *inches* long, and *one inch* broad, near the end where Broadeſt; and Roundiſh, being narrow at the 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 5 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, 4 black ſhining *Seeds*, or *Acini*, of an irregular Figure. *The* Wild-Cinnamon-Tree; *by Dr.* H. Sloan n. 192. p. 465.

All the parts of this Tree, when Freſh are very Hot, Aromatick, and Biting to the Taſt, ſomething like *Cloves*; which is ſo troubleſome, 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-Fort* and the Town of St. *Jago de la Vega* in *Jamaica*; in *Antigua*; and other the *Caribbean 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 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 *Stomach*, 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 envigorate the Blood; being in *London* Druggiſts and Apothecaries Shops uſed for thoſe Purpoſes, under the Name of *Cortex Winteranus*; which it is not, 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 *Diſtill'd per Veſicam*, 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*. *Peter Martyr* mentions it under the Name of *Cortex Cinnamomi Saporem, Gingiberis Amaritudinem, & Caryophilli Suavem Odorem præ ſe ferens*; *Nic. Monardes* deſcribes it under the Name of *Lignum Aromaticum*; *Cluſius* calls it *Lignum, ſeu potius Cortex Aromaticus*; And I queſtion not but this is the ſame with the *White-Cinnamon*, or the *Canella Alba* in ſome other Authors. *Linſchoten* in his Deſcription of *America*, Tranſlated into *French*, gives an Account of it under the Name of *Arbre ou les Pigeons nichent*; Dr. *Trapham* calls it *Winter Bark*, or *Weſt-Indian Cinnamon Tree*; *Hernandez* and *Ximenes*, *Caninga*.

But it may be doubted whether this be the *Aſcopo* of *Hariot*.

The true Cortex Winteranus; *by* Dr. H. Sloan n. 204, p. 922.

LI. Capt. *Winter*, who went out with Sir *Fr. Drake* when he went Round the World, at his Return brought with him from the *Streights* of *Magellan* an *Aromatick-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 this Captain's Name, calls it *Cortex Winteranus*, and the Tree *Magellanica Aromatica Arbor*. The Writer of the Journal of the *Dutch* Ships that went to the *Streights* of *Magellan* about 1599 calls it *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 *Caſpar Bauhine* calls it, *Laurifolia Magellanica cortice Acri*; *Johnſton*, *Arbor Laurifolia Magellanica*.

Fig. 168. *Fig.* 169.

But Mr. *Geo. Handyſide*, who came from thence about 2 or 3 Years ſince, gives the Beſt Account of it; having brought with him a *Specimen*, or Sample of its *Leaves* and *Flowers* on the Twig and it's Seed; by which *I* cannot Reduce it to any of our kind of Plants ſo well as the *Peryclemenum*: and therefore *I* ſhall call it, (tho' it Differs in many things from the *Honyſuckle*,) *Periclymenum rectum Foliis Laurinus 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

on *half 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 ¾ *Inch long Stalks*; 2. 3. or more of them together, ſomething like thoſe of the *Periclymenum*; each of them are Milk-White, *Pentapetalous*, and ſmell like *Jaſſamine*; to which Succeeds an *Oval Berry*, made up of 2. or 3. 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 Aromatick *Seeds*, ſomething like the *Stones* in *Grapes*.

It grows in the middle of the *Streights* of *Magellan* very plentifully.

The *Leaves* of this Tree were Uſed, with other Herbs, by Mr. *Handyſide* 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 *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 *Poiſonous* ſort of *Seal* in thoſe Parts, call'd 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 Peel'd 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 Extoll'd 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 Deſcription of this Tree and that of *Wild-Cinnamon* it appears that the *Cortex Winteranus*, commonly ſold in 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 Faces: Yet their Taſt is much the ſame, and I believe they may be uſed as a *Succedaneum* one for another; tho' the *True* be much to be valued beyond the *Falſe* being much More *Aromatic*.

LII. *I* have diſcourſed a poor meer *Iriſh*-Labourer, (who, by having worked many Years under a Head-Gardiner in a Gentleman's Garden, has got a Genious 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 Raiſed in ſmall *Beds* ſuch vaſt Numbers of them, that he ſells them, of 3 or 4 *Foot* long, at 2 *Shill.* a *Hundred*, and will carry them any where within 5 *Miles* and Plant them into the Bargain.

An Account of the Propagation of Elms Seed; *by Sir* Rich. Bulkley. n. 205. p. 971.

A ſort of Sugar *from* Maple; *by* ----- n. 171. p. 988.

LIII. The *Savages* of *Canada*, in the time that the *Sap* riſes in the *Maple* make an Inciſion in the Tree, by which it Runs out: And after they have Evaporated 8 *pounds* of the Liquor, there remains 1. *pound*, as *Sweet*, and as much *Sugar*, as that which is got out of the *Canes*; part of the ſame *Sugar* is ſent to be Refined at *Roven*.

The *Savages* have practiſed this Art, longer than any, now living among them, can Remember.

There is made with this *Sugar* a very good *Syrup* of *Maiden Hair*, and other *Capillary Plants*, which is uſed in *France*.

Oak *prepared for* Tanning; *by Mr.* Ch. Howard *of* Norfolk. n. 105. p. 93.

LIV. Every part of the *Oak Tree*, of what Age or Growth ſo ever, and all *Oaken Copice-Wood* of any Age or Size, being Cut and procured in *Barking-Time*, will *Tan* all ſorts of *Leather*, as well, at leaſt, as *Bark* alone.

This Material being gotten in its Proper Seaſon, it muſt be very well Dryed in the Sun, and more than *Bark*; then houſed Dry, and kept Dry for Uſe; and when it is to be Uſed, the Greater Wood may be *Shaved* ſmall, or Cleft, and the ſmall Bruiſed with a *Hammer*, and *Cut Small*; which done, it muſt again be Dryed very well upon a *Kiln*, and then *Ground*, as *Tanners* uſually do their *Bark*.

Such Wood as it is to be Uſed Preſently after 'tis gotten, will require the better and more Drying upon the *Kiln*; otherwiſe it will Blacken and Spoil all the *Leather*.

Inſtead of an *Anvil*, to Beat and Bruiſe the *Tanning Stuff* upon, Fit into a Wooden Block a *Plate* of *Iron* about 4 *Inches* deep, 9 *Inches* broad, and 12 *inches* long. The *Hammer* for Bruiſing the *Stuff* may be of 6 *l.* weight, and have the *Head* about 3 *Inches* ſquare, to Work with both Hands; but to work with one Hand or for a Youth to uſe, let it be of about 3 *l.* weight, and the *Head* about 2 *Inches* ſquare. The Surface of one end of theſe *Hammers* is beſt to be Smooth; but that of the other, Dented; the better to enter into the *Stuff* for quicker Diſpatch. They are to be well *Steel'd* at both Ends. The *Handles* of theſe *Hammers* may be about a *Foot* long; the Bigger ought to be ſomewhat longer.

The *Knife* to Cut the bruiſed *Stuff* may be 8 or 9 *inches* broad, and neer as much in Depth; made like a *Tobacco Knife*, with a *Handle* to work.

Where *Oak* is ſcarce, *Thorns* may indifferently well ſupply that Scarcity.

Birch ordered and uſed inſtead of *Oak*, is very fit for *Soal Leather*.

As theſe ingredients will *Tan* better than *Bark* alone, and that with far leſs Charge, ſo may this invention ſave the *Felling* of *Timber* when the *Sap* is up: Which, when 'tis done, cauſes the Outſide of the Trees to Rot and grow Worm-eaten; whereas if the Trees had been *Fell'd* in *Winter*, when the *Sap* was Down, they would have been almoſt all *Heart* (as they call it,) and not ſo ſubject to *Worms*. Beſides that, this Invention will greatly improve the Value of *Under woods*.

LV. There

LV. There is no such *Dwarf-Oak* in *England*, growing Wild, as was sent you out of *New England*; nor in any other Country where we have been; unless it be the *Ilex Coccifera*, which is a *Low Shrub*, bearing large *Acorns*, and hath a *Prickly Leaf* like *Holly*. If it prove that, it will be a Lucriferous Discovery.

A Dwarf-Oak *from* New-England; *by Mr.* Fr. Willoughby. n. 58. p. 1200.

LVI. Five *Leagues* from *Marseiles* are very high Mountains, which are (for the most part) covered with Forests of *Pine-Trees*, which there grow Wild; *half* a *League* out of the Road, you see the making of *Pitch*, *Tar*, *Rosin* and *Turpentine*; which is thus; *viz.* in the Spring time when the *Sap* runs most, they pare off the *Bark* of the *Pine* to make the *Sap* run down into an Hole, which they cut at the bottom to receive it; as it runs, it leaves a *Cream* or *Crust* behind it, which they take and temper in Water, and sell (by a Cheat) for *White Bees-Wax*, that they make *Flambeaus* of, and is a great deal dearer. Then they take up the *Juice* in *Spoons* from the bottom, and after they have so gotten a good quantity, they strain it through a *Grocers Basket*, such as they put their *Malaga-Raisins* in; that which runs through easily is the common *Turpentine*. Then they take that which remains above, and adding a sufficient Quantity of Water, distil it in an *Alembick*; that which is so Distilled is *Oyl* of *Turpentine*, and the *Calx* that remains is Common *Rosin*. Then they cut the *Stock* of the Tree into large *Chips*, and pile them hollow in a *Cave*; Covering it on the *Top* with *Tiles*, but so as to let some Air come in to feed the Fire; then burning them, there runs a *Thick Juice* down to the bottom, where they make a small *Hole* for it to run out at, (a larger *Hole* would set it all in a *Flame*,) and that which so runs out is *Tar*. Then they take off that, and Boiling it gently over again, to consume more of the Moisture, they set it to Cool: which when Cool is *Pitch*.

The Way of making Pitch, Tarr, Rosin *and* Turpentine; *by Mr.* Tho. Bent. n. 243. p. 291.

LVII. In *Jamaica*, the Neighbouring Isles, and Continent of *America*, grow many sorts of *Misseltoe*; *Parasitical Plants*, as they are called by some, or *Epidendra* by others; which grow on the Bodies or Arms of Trees, after the manner of *Misseltoe*, like to which they bring forth Roots, Leaves, Stalks, Flowers and Seed. From this likeness I have given the name *Viscum*, to all the several Families of them; tho' they Differ very much from it, and almost as much amongst themselves.

A sort of Missel-toe *in* Jamaica; *by Dr.* H. Sloan. n. 251. p. 113.

There is one Family among them which I call *Viscum Cariophyloides*, from having its *Seed Vessel* somewhat like that of *Clove-July Flowers*: and a particular one of that Family which I name *Viscum Cariophyloides Maximum*, *Flore Tripetalo pallide-Luteo Semine Filamentoso*, and which is commonly in that Island called, *Wild Pine*; whose Description follows. A great many *Brown-Fibrils* encompass the *Arms*, or take firm hold of the *Bark* of the *Trunk* of the Trees whereon they Grow: Not as *Misseltoe*, Entering the *Bark* or *Wood*, to suck Nourishment, but only weaving and matting themselves among one another, and thereby making to the Plant a firm and strong Foundation. From hence rise several Leaves on every side, as *aaaa*. after the manner of *Leeks*, *Ananas*, whence the name of

Catal. Jam. Plan.

Fig. 170.

Wild-

Wild-Pine, or *Aloes*, being folded or incloſed one within another; each of which is 2 *Foot* and a *half* long; from a 3 *Inch* breadth at Beginning, or Baſe, Ending in a Point; having a very Hollow or Concave Inward-ſide, and a Round or Convex outward One. So that by all of their Hollow ſides, is made within a very large *Reſervatory*, *Ciſtern*, or *Baſin*, *b.* fit to contain a pretty deal of Water: which in the Rainy Seaſons falls upon the Uppermoſt parts of the ſpreading Leaves, which have *Channels* in them, conveying it down to the *Ciſtern*, where it is kept, as in a *Bottle*; the Leaves, after they are ſwelled out like a *Bulbous Root* to make the *Bottle*, bending inwards, or coming again cloſe to the *Stalk*, by that means hindering the Evaporation of the Water by the Heat of the Sun. They are of a *Light Green* Colour below, and like *Leeks* above. From the midſt of theſe riſes a Round, Smooth, Strait, Freſh *Green* Coloured Stalk, 3 or 4 *Foot* long, *c.* having many Branches; when Wounded, yielding a clear *Mucilaginous Gum*. The Flowers came out here and there on the Branches; they are made up of 3 long Yellowiſh, White, or Herbaceous *Petala*, and ſome Purple-ended *Stamina*, ſtanding in a long *Calix*, or *Tubulus*, made up of 3 *Green* viſcid Leaves, with *Purple* Edges, to which follows a long triangular *Capſula*, *d.* *Greeniſh Brown*, being ſomewhat like thoſe of the *Cariophilli*; having under it three ſhort *Capſular Leaves*, and within ſeveral long *Pappous Seeds*, the Seed it ſelf being Oblong, Pyramidal, and very ſmall, having very ſoft Hairs down, or *Tomentum*; much longer in Proportion to the *Seed*, than any *Tomentum* I know; being as long as the *Pod* or *Capſula*.

It grows on the *Arms* of Trees, every where in the Woods, as alſo on the *Barks* of their Trunks; eſpecially when they begin to decay, their *Barks* receiving the *Seed*, and yielding then more eaſily to the *Fibrils* of this Plant's Roots, which in ſome time Diſſolves them, and Ruins the whole Trunk.

The *Contrivance* of Nature in this Vegetable is very Admirable; the Seed has long and many *Threads* of *Tomentum*; not only that it may be Carried every where by the *Wind*, as the *Pappous* and *Tomentoſe Seeds* of *Hieracium Liſymachia*, *&c.* are, but alſo, that it may by thoſe *Threads*, when driven through the Boughs, be held faſt, and ſo ſtick to the Arms and extant parts of the Barks of Trees. So ſoon as it Sprouts or Germinates, altho' it be on the Under part of a Bough, or the Trunk of the Tree, its Leaves and Stalk riſe Perpendicular, or ſtrait up: Becauſe if it had any other Poſition, the *Ciſtern* before mentioned (by which it is chiefly Nouriſhed; not having any Communication with the Tree,) made of the *Hollow Leaves*, could not hold Water which is Neceſſary for the Nouriſhment and *Life* of the Plant.

In the Mountainous as well as Dry Low Woods, in ſcarcity of Water, this *Reſervatory* is Neceſſary, and ſufficient, not only for the Plant it ſelf, but likewiſe is very Uſeful to Men, Birds, and all ſorts of Inſects; whither in ſcarcity of Water, they come in Troops, and ſeldom go away without Refreſhment.

There are ſome *Contrivances* in *Plants* Growing in *Europe*, which come near thoſe of this kind of Vegetables, in ſome Particulars. The *Virga Paſto-*

ris,

ris, or *Wild Teaſel*, (and moſt Plants call'd *Perfoliated*) has its *Leaves* incloſing its *Stalk*, and ſo ſet by Pairs oppoſite to one another, and joined by their *Baſes*, that they may make a Hollow place, fit to contain ſome Water, which, tho' Open, yet without doubt, contributes to the perfecting of the Plant.

Several *Fuci* are lately diſcovered to have *Seeds*, which, when Ripe, break out of their Places, and by means of a *Glewy Juice* faſten themſelves to the Stones, or other Subſtances at the *Bottom* of the *Sea*, where they are to grow. The common *Viſcum* had ſuch a *Glewy Subſtance*, *I* ſuppoſe, for faſtning its *Seed* to the *Barks* of Trees.

Small *Moſſes*, heretofore thought to have no *Seed*, are now known to have great plenty: And that ſo ſmall, as *I* have ſeen it riſe up from the *Ripe-Head*, in form of *Smoak*; which is without Queſtion, that it may be carried by the Air and Wind, to Walls, Trees, or other fit *Matrix* for its *Vegetation*.

There is a *Fungus*, call'd by *Cluſius*, *Fungus Minimus Anonymus*; and by Dr. *Merret*, *Campani formis Niger multa ſemina plana in ſe contingit*, (which *I* have ſhewn the *R. Society* many Years ſince) that when Ripe opens in the *Rain*, by which one filling a *Cup*, wherein lies its *Seeds*, they are Waſhed out on every hand, to Propagate its Kind.

There are many *Families* of *Plants* with *Pappous*, or *Tomentoſe*, *Seeds*; as *Dandelion*'s, *Erigerum*'s, *Lyſimachia*'s, *Clematis*'s, *Anemone*'s, *&c.* which being Ripe, their *Seeds* are by means of their *Feathers*, or *Wings*, ſcattered to all Neighbouring Parts by the Wind. This is ſo effectual a way, that the *After Canadenſis annuus non deſcriptus*, *Brunyer*, or *Conyza*, *annua Alba Acris*, *Moriſ.* (which came at firſt from *Canada*,) is now become a *Wild-Plant* in many Places of *Europe*, where it never was Obſerved to grow, and far from the Gardens where it was firſt Planted; from whence the *Seed* had been carried by its *Wings*; ſo that *I* have ſeen it in ſome parts of *France*, very many *Leagues* from ſuch Places. *Hort. Bleſs.* p. 10.

There are likewiſe many Plants, which have *Seed-Veſſels* ſo Contrived, as with a *Spring*, and ſometimes, *ſmart noiſe*, when they are *Ripe*, to throw off their *Seeds* ſeveral ways, to a conſiderable Diſtance. Moſt Plants having *Pods*, as *Furze*, *&c.* thoſe called, *Noli me Tangere*, or *Herbæ Impatientes*, *Cucumis aſininus*, *Cranes-bills*, and many others, have this Artifice to ſow themſelves. Amongſt thoſe who have this Property, none is more ſurpriſing than one in *Jamaica*, called *Spirit-weed*, which when its *Seed* is *Ripe*, the *Veſſel* containing it, on the leaſt Touch of whatever is Wet, does inſtantly Open its ſelf, and with a ſmart noiſe, throws its *Seed* Several Ways to a Conſiderable Diſtance; likely the Deſign of Nature being, that the *Rainy Seaſon* being proper for Sowing, its *Seed* ſhould be kept in its *Seed-Veſſel*, the beſt Preſerver of it from Injuries till then.

Lichnis's, *Poppies*, *Antirrhinum*'s, and many others, have their *Seeds* in *Heads*, which when Ripe, are Open at Top; and by the Winds, and help of their *Partitions*, are ſcattered and Directed to all Quarters.

Theſe

Theſe Inſtances, and many more, very Obvious and Wonderful, tho' not taken notice of, might be given to ſhew the great Endeavours of Nature to *Perfect* the *Individuum*, and *Propagate* the *Kind*; which for that Reaſon, *I* am apt to believe, are all (without the loſs of *One Species*) Preſerved to us, from the Creation to this Day.

The Silver-Pine *from the* Cape *of* Good Hope; *by Dr.*H. Sloan, n. 198. p. 664. *Fig.* 171.

LVIII. A Branch of the Silver-Pine, or *Conifera ſalicis Facie, Folio & Fructu, Tomento ſericeo candicante obductis, ſemine Pennato*, was lately brought into *England* from the *Cape* of *Good Hope*, by Mr. *Goddard*. The Twig of this Tree had a great many *Leaves* ſet round it very Cloſe to one another, ſo as to hide the Twig it ſelf there where they grow; each of the largeſt of them being about 4 *Inches* Long, and $\frac{3}{4}$ of an *Inch* Broad, in the middle where broadeſt, from whence they decreaſe towards both Extreams, ending in a Point; being like thoſe of the *Oſier Willow*, only broader, and all covered over with the Thickeſt, Fineſt and longeſt White Silken Hair or *Down*, that ever any Plant *I* remember to have ſeen has. The *Cones* are of *Fig.* 172. the bigneſs of thoſe of the *Cedars* of *Lebanon*, and of the ſame ſhape; the *Cuticula*, or ſmall Skin of each *Scale*, being covered over with a White ſhort *Down* or Wool, ſhining alſo like Silk; between the *Scales* is lodged the *Seed 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 *D.* which has on its Top 4 *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.

Dr. *Plucknet* has figur'd it under the Name of *Leucadendros Africana Arbor tota Argentea, Sericea Foliis integris*; *Atlas-Tree*, *D. Herman.*

Another Coniferous Tree, from the Cape *of* Good Hope; *by Dr.* H. Sloan. n. 198. p. 666.

LIX. *Conifera, Alypi folio, Seminibus pennatis pluribus in medio Coni conglomeratis, & non inter, Squammas, aliorum Conorum more, naſcentibus.*

A Branch of this Tree with its *Fruit* was lately brought from the *Cape* of *Good Hope*, by Mr. *Goddard*. It had a Brown Colour'd ſmooth Bark, with a Whitiſh hard *Wood*, and ſmall *Pith*. The *Leaves* (expreſſed to their Natural Bigneſs *F.*) were Round it without any Order, very thick ſet, having no *Fig.* 173. *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*, *G.* which is ſurrounded by 3 or 4 Twigs, *H. I. K.* Overtopping it, and with their *Leaves* almoſt Hiding it. It is about 5 *Inches* long, and is made up of many *Scales*, Hard and Red, encloſing one another: The Lowermoſt and Outwardmoſt being very ſhort, the Inwardmoſt 4 *Inches* Long, each of them ending in a Point; ſome *Scales* having on their Outſides a Gummy Juice. In the Middle of theſe *Scales* were the firſt Rudiments of many *Seeds* as *L.* the ſame not being fully Ripe; each of which is ſet about with a great Quantity of $\frac{3}{4}$ *Inch* long, yellow, Fine, ſilken *Down*, *M.* having 2 *Inches long Stylus*,

or

or ſtring *N.* and yellowiſh Membranes *O.* encloſing the *Stylus* and *Tomentum*; being *Feathered* at Top with *Feathers*, like the *Silver-Pine*, and for the ſame Purpoſes.

Obſervations and Experiments concerning Vegetation *and the* Running *of* Sap; *by Dr.* J. Beal, *and Dr.* Ez. Tonge, n. 43. p. 853.

LX. 1. There are ſeveral ſorts of *Vegetables* that will Grow the Wrong End ſet downwards in the Ground: As *Elders*, *Briars*, *Sallies*, *Willows*, the *Black-Elder*, *Vines*, and moſt *Shrubs*; two or three of their *Joynts* being covered in the *Mould*, and the *Stem* cut off near the overmoſt *Joynt*, which ſhould be half covered in the *Mould*, and the *Mould* ſomewhat raiſed, as it Spirts out and Grows. *Dr. B. Curran-Trees*, and ſuch like as are of a *Soft-Wood*, and *Quick-Growers*, ſeem moſt apt to this Improvement. *Dr. T.*

2. The *Branch* of a *Plant* being laid in the Ground, whilſt yet Growing on the *Tree*, and there taking *Root*, being Cut off whilſt ſo Growing, will Grow on both Ends, if it be well *Rooted* in the Propagation; and the like Care had of the laſt *Knot* or *Joynt*, as was before preſcribed. *Dr. B.* The *Layers* of thoſe *Trees* and *Shrubs* mentioned in the former Obſervation, will Grow on both Ends: and aptly Parted when they have ſpread *Roots* both ways, make two *Plants* out of each *Layer*. *Dr. T.*

3. In the *Tapping* of *Trees*, the *Juice* certainly Aſcends from the *Root*, and after it is Concocted to partake of the Nature of the *Plant* (which feeds as well on the *Air*, as the *Juyce* furniſhed through the *Root*) it *Deſcends* (as the Liquor in a *Limbec*) to the *Orifice*, whence it iſſues. *Ratray* the Learned *Scot*, affirms, that he hath Calculated Experimentally, that the *Liquor*, which may be drawn from the *Birch* in the *Spring* Time, is equiponderant to the Whole Weight of the *Tree*, *Branches*, *Roots*, and All together. And perhaps this kind of Large *Natural-Limbeck*, where it may be had, may ſometimes prove more effectual, than our Little *Artificial*, and more Troubleſome *Diſtillations*. And the Congeniality of the Sun in his Alternative Viſits, and the Aſſiduous Intercourſe of the Free Air with the *Spirit* of the *Plant*, yet Living and Growing, may have a more effectual Influence for a Specifick Virtue, than we are apt to imagine. Though we cannot See, nor Hear, the *Lungs* of Vegetable *Beating*, yet we may ſometimes ſmell their *Breath*, ſtrong enough, both to Pleaſe and Offend exceedingly; as in *Savin*, *Firrs*, *Cypreſs*, *Elder*, *Roſemary*, *Mirtles*, and generally in all *Bloſſomers*. And ſome that cannot be Smelt by us, may yet have a very Wholeſome *Breath*. One Experiment I will here beſtow on you. When both my Hands were manacled for many Years (and ſometimes my Arms alſo) with Deep Corroding *Teaters*; to the Bluſh of my many friendly *Phyſitians*, and in Deſpight of many of the beſt *Medicines* and *Purgations*, all was ſuddenly Healed, and hath ſo Continued theſe 20 *Years*, by the Application of the *Gum* of *Plum-Trees* diſſolved in *Vinegar*. I muſt not forget to Add, that I applyed *Vine-Leaves*, and ſometimes Opened *Raſins* to draw a Möiſture from theſe *Teaters*, ſome few Days before *I* uſed the *Gum*. *Dr. B.*

Dr. *Tonge* is of Opinion, that *Sap* always *Riſes*, and never properly *Deſcends*, having only a kind of *Subſiding* or *Recidivation*, which he ſaith he cannot call a *Circulation*, nor reſemble to the *Motion* of *Liquors* in a *Pellican*; but rather to the Sinking of Liquors in an *Alembick*, whilſt the Thinner Parts are forced over the *Helm*; yet ſomewhat Imitating the *Motion* of *Blood* in *Animals*, for as much as it

it continually ſupplies the Want and Expence of *Sap* in the *Exteriour* Parts, from the Stock of the *Sap* in the *Trunk*, *Root* and *Branches*.

He underſtands it thus; that the *Sap*, Neceſſary to the Growth of the *Leaves*, *Fruit* and Upper *Branches*, being Diſpenſed, and Converted into the Form neceſſary for theſe purpoſes, when the *Tree* is fulleſt of *Sap*, in ſuch manner that the *Sap* in the innermoſt Coats feeds the innermoſt, and the *Sap* of the outward Coats, the outward Parts, of *Fruits*, *&c.* that which remains in the *Body* betwixt the ſeveral Coats, and betwixt the *Bark* and *Body*, begins to Condenſe there alſo, firſt into a *Gelly*, and after into *Wood*, *Bark*, *Roots*, &c. according to the ſeveral Places to which it hath ſubſided. And becauſe it Condenſeth faſter in ſome parts than in others, according as they be Higher or Lower, (whether it be by Heat or Cold, or Exhalation of Thinner Parts) the *Sap* Condenſed above or below, filling leſs Room, muſt needs cauſe the *Sap*, which is not yet Condenſed, in appearance to Deſcend or Subſide, and to Sink as it were Lower and Lower in the *Pores* of the *Timber* and *Bark*, *i. e.* to be leſs High, not Deſcend from any Place, to which it was formerly Riſen, unleſs (as in *Blood-letting*) when ſome Lower Part is opened, all the *Sap* Above continually flows thither, till the *Tree* be Emptied, or the continual Flux of the *Sap* (the *Natural balſome* of the *Tree*) Heal the *wounds*, as that of the *Blood* does thoſe of the *Body*; and ſo much Quicker and Eaſier, by how much the *Air* is more Favourable, or is better kept out; which he obſerves for their Direction, who are Curious in *Innoculation*, as the Ground of their Succeſſes or Miſcarriages. The *Trees* obſerved by the ſame *Dr. T.* to Run, are the *Vine*; the *Birch*, plentifully at *Body*, *Branches*, and *Roots*; the *VValnut-Tree*, at the *Roots* and Pruned *Branches*; ſome *VVillows* and *Sallies*; and ſome ſorts of *Maple*; the *Sycamore*, which is the greater *Maple* (ſome call it the *Plane*) at a *Gaſh* made on the *Bark* of his *Body*, and at the *Roots* and *Branches*; the *Poplar* and *Aſp*. Some *VVoodmen*, affirm that in ſuch *Oaks* as are *windſhaken*, that have large Hollowneſſes in their *Arms* and *Bodies*, they have found great Quantity of *Sap* in the Cutting of them, whereof having Drunk, they Quenched their Thirſt without any prejudice. To theſe add the *VVhitting* or *Quicking Tree* (*Lat. Fraxinus Sylveſtris*, and by ſome *Fraxinus Cambro Britannica*) which in its Seaſon, as ſome affirm, will *Run* plenteouſly; and whence they would have us expect a Soveraign Drink againſt ſome Stubborn Diſtempers, eſpecially ſuch as are *Scorbutical* and *Splenetick*. I have kept (ſaith *Dr. T.*) ſome of the *Juice* of the *Berries* (which being expreſſed Ferments of it ſelf) theſe 2 *Years* in Bottles, and it hath now the Taſte of an Auſtere *Cyder*; And I ſuppoſe from its Grateful Smell, that it may be kept till it Ripen, and become a Strong *Vinous Liquor*. It is the Houſhold Drink of ſome Families in theſe Parts, about *VVales* and *Herefordſhire*; and ſome out of Curioſity have Brewed Ripe *Berries* with ſtrong Beer and Ale, and kept it till it Tranſcended all the other Beer in goodneſs.

Dr. *Tongue*'s attempts upon the *Poplar*, *Aſpe*, *Elme*, *Oak*, *Aſh*, *Elder*, *Whitting-Berrie* or *Quicking-Tree*, *Thorn*, *Buckthorn*, *Tile*, *Nut*, *Sloe*, *Briar*, *Bramble*, &c. have not ſucceeded; and he doubts, that they, and all *Apples* and *Pears* have ſome Degree of *Gumminеſs* in their *Juyces*, ſo that they will not *Run*.

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4. The *Sap* apparently *Riſeth* by the *Inward Bark*, where you may ſee the *Quick* begin, and where the *Graft* firſt Incorporateth. *Dr. B.*

Dr. *T.* Obſerves that there are *Circles* in *Trees*, which are the Diſtances of thoſe *Films* or *Coats* by which the *Tree* receives its *yearly Increaſe* in Thickneſs. Through theſe, looking full of Circular *Pores*, the *Sap* ſeems to *Aſcend*, in the ſame manner between *Coat* and *Coat*, as between the *Bark* and the *Body*. Now the *Aſcent* of *Sap* is by all Parts and *Pores* of the *Tree* in ſuch ſmall Quantities, as can hardly be Diſcerned, unleſs the *Tree* be quite Sawed off; eſpecially near the *Root*: for then it will appear, how it *Aſcends*. In *Birches*, and ſuch like, the *Sap* iſſues very plentifully in all parts of the *Body*, when they are Cut down near the *Root*.

The *Bark* is Double, *Outward* and *Inward*. The *Outward* is Dry, and in ſome *Trees* Rough: The *Inner* is probably a Superadded New Coat of that Years Growth, or ſomething like it, between the Nature of *Wood* and *Bark*. The *Sap* Riſes within and without that Superadded Coat.

To perfect the Experiment about *Sap*, and to find, whether it *Aſcends* more or leſs in the *Prickt-Circles* of the *Body*, than in thoſe betwixt the *Body* and the *Bark*; let the *Tree* exempted from all its *Sap* the Day before, be firſt pierced with an *Auger*, only through the *Bark*, and the Quantity of *Sap* it yields in an *Hour* exactly Meaſured and Weighed: then, at the ſame time, let another *Hole* be bored into the *Body* of the *Tree*, above an *Inch* and an *half* deep; and ſo round about on every ſide of the *Tree*, ſome Deeper, and ſome Shallower, with a good Large *Auger*; and One quite through, Sloaping. From which Experiment, after various Tryals, may be found the Difference of the *Sap*, Riſing on the *North* and *South*; and ſo likewiſe of that which comes from the *Bark* only peel'd off, and That which *Aſcends* in the Inner Part of the *Tree*. The Weight may alſo be compared of That which iſſues from the *Bark*, with That which *iſſues* from the *Body*. The Internal *Heart Sap* may alſo be drawn apart, by Boring a ſmaller *Auger-Hole* in the Middle of a Greater, and fitting it with a Long Pipe adjuſted to that Inner *Orifice*. n. 46. p. 913.

5. Dr. *Beal* ſaith, experimentally, that if a *Circle* be drawn round about any Common *Engliſh Tree*, as *Oak*, *Elm*, *Poplar*, &c. by *Inciſion*, to the *Timber* (how thin ſoever the *Knife* be) ſo that no part of the *Rind* or *Bark*, to the very *Solid Timber* be Uncut, the *Tree* will *Dye* from that Part Upwards. Only the *Aſh*, (of all that I could Try) will *Grow* on, and Proſper, notwithſtanding the *Inciſion*. My Brother (*T. B.*) ſhew'd me ſome Old and Huge *Aſhes*, which were *Bared* of the *Bark* by the *Deer*, from the *Root*, 4 *Feet* upwards, quite round, yet they had continued their *Growth* many Years; and ſome parts of the *Bark*, which were Left in Few Places not ſo Broad as the Palm of my Hand, had a *Freſh Verdure*, more Lively than the Parts of the *Bark* which remained above the *Baring*. Yet if ſome *Inciſions* by Hackings be made, or if the *Branches* of ſome *Fruit-Trees* (eſpecially the *Gennet Moyle*) be quite *Bared* under a *Knot* near the *Body* of the *Tree*, and that *Knot* and *Bare* part, be well Cover'd with *Loame*, or Good *Mould*, in *June*: that *Branch* will not only *Survive*, but will be apt to take *Root*, and become a *Young*

Tree of ſpeedy Growth, if Cut off below the *Baring*, and ſet at a fit depth at the end of *Autumn*; or about *Candlemaſs* rather. Where ſuch Tranverſe *Hackings* are made, or *Contuſions* in the *Bark*, many *Vegetables* are apt to gather *Knobs*, and ſometimes Small *Branches* will ſpirt out above, and ſometimes about the Part *Contuſed*. To get the *Gum* of the *Plum Trees*, I have ſometimes *Wrenched* the *Branch*, till the *Solid Timber* hath Crackt, and the *Rind* forced open in ſome Parts; ſo leaving it to Grow, but forced to continue in a Poſture ſomewhat Wreathed, it hath not failed to yield me ſtore of *Gum* next Summer.

Vid. inf. Sect. LXIX.

Dr. *T.* A *Branch*, whoſe *Bark* of the breadth of about 2 or 3 *Inches*, is taken off round towards the Bottom, in ſome *Trees*, and particularly the *Lime-Tree*, will *Live*, and bear *Leaves* for many Years; and *Grow*, as other *Branches*, by means of the *Sap Aſcending* through all the *Pores* of the *Inner Coats*, as was ſaid in the 3*d* Obſervation.

6. The *Juyce* which *deſcends* by *Tapping*, and which maketh the *Pulp* or *Coat* of any *Fruit*, *Aſcends* by the *Bark* or *Rind* of the *Plant*, and not by the *Pith*. But I can affirm, by many Experiments, that the *Pith* and the Timber have ſome Correſpondence with the *Seed* of the *Plant*, to convey an Intercourſe of the ſame *Spirits* and *Nature* from the *Root* to the *Seed*. Dr. *B.*

Dr. *T.* ſaith, That *Piths* are of a very different Nature and Subſtance; In the *Walnut*, is a multitude of *Films* manifeſtly diſtant from one another; In Others, as in *Elders* and *Briars*, 'tis a continued Soft, Looſe, Dry Subſtance.

7. The *Points* or Ends of the *Roots* being Cut off, they will in Proportion *Bleed* as copiouſly, as the *Branches*, and probably more; certainly Longer, becauſe there is Greater Plenty of *Juyce* Aſcended above Them, than the *Branches*, and conſequently more will iſſue by Them, than by any part of the *Tree* Higher than Them. *Dr. T.*

8. From the Latter End of *Jan.* to the Middle of *May*, Trees will *Bleed*. Thoſe that are ſaid to *Run Firſt*, are the *Poplar*, *Aſp*, *Abele*, *Maple*, *Sycamore*; ſome, as *Willows*, and the *Birch*, tryed by my ſelf, are beſt to *Tap* about the Middle of the 2*d* Seaſon; and the *Walnut*, toward thes Latter End of *March*. They generally *Bleed* a full Month in the whole. Mr. *Midford* of *Durham*, a very Expert Gatherer and Preſerver of *Saps*, affirms, that the *Saps* of the *Poplar* and *Aſp* Riſe ſo briskly in *January*, that they will *Bleed* before the End of that Month; the *Sycamore* will *Run* in Hard Froſt, when the *Sap* Freezes as it Drops. *Dr. T.*

By. Dr. Tong. n. 43. p. 862. n. 44. p 880. n. 58. p.1199.

9. The beſt Time of the *Day* for *Tapping*, is about *Noon*. In the Latter Seaſon, when *Sap* is not very plenteous in *Trees*, they will neither Run *Morning* nor *Evening*, nor probably at any time of the *Night*; but when they are very Full of *Sap*, and Emptied but by ſmall *Vents*, the *Sap* may Run *Night* and *Day*, till Exhauſted; but never in large *Vents*. I have often obſerved, that when a large *Walnut* would yield no *Sap* any longer in the *Body* or *Branches* at any time of the Day; it would run longer at the *Roots* on the *South* or Sunny ſide, than on the *North* or Shady ſide, conſtantly governing the Courſe of its *Sap* in its beginning to Riſe, and to ſtop daily at the *Riſing* and *Setting* of the *Sun*.

10. *Trees*

10. *Trees* afford no *Juyce* at all (that has been Obſerved) in *Autumn*: But *Birch-Trees Bored* in the *Spring*, ſo late, in reſpect both of the Year and Day, that they have afforded no *Sap* at all at the *Body*, have been found ſome Time after, to have Iſſued ſuch Plenty of *Juyce*, as hath Condenſed in the *Hole* to a ſtiff *Gelly*.

11. *Rain* being ſcarce, the *Juyce* will be ſcarcer. Plenty of *Rain* can only give ſuch Plenty of *Sap*, as the *Pores* will admit. And too much *Cold Rain* may, by Over-cooling, Hinder the *Sap*, by abating from the degree of *Heat* neceſſary to the *Pulſion* of *Sap* into the *Root*, and to the *Digeſtion* in the *Tree*: which is alſo in *Watering*. On this Ground it ſeems probable, that *Drawing Sap* conſtantly from *Trees* every Year, will not hinder their Growth, in *Body*, *Branches*, *Leaves*, nor *Fruit*, to any great *Prejudice*; for *Pulſion* will ſtill ſupply *Juyce* into the emptied *Pores*, till their Capacity be Filled. It is alſo Poſſible, that *Trees* may *grow* better, and give more *Fruit*, if the Right Art of *Drawing Sap* be found out for that end; as ſome Perſons grow *Fatter* by often *Bleeding*.

12. In the Change of the Nature of a Tree, the Application of *Juyces* is, in my Opinion, not otherwiſe conſiderable than from the Scarcity, Plenty, or Goodneſs, of the *Nouriſhment* of ſuch *Juyces*; not from the *Taſte*, or *Reliſh* in them. Yet probably Hot Nouriſhments, whether in *Juyces* or *Earths*, may digeſt the *Sap*, and conſequently the *Fruit* better in *Trees* of *Flaſhy Fruit*, than in Others; and *vice verſa*. In the mean time to change the *Taſte* of *Fruit*, the probableſt way may be thought not very Hopeful to *Bore* the *Roots* and the *Body*, downwards and Tranſverſe, and to fill the *Holes* with Plenty of its Own or ſome other Tree's *Sap*, in which ſome *Aromatick Subſtances* have been ſtrongly *Infuſed*. n. 44. p. 877.

13. If no *Rain* come to the *Roots* of Trees at all, nor other Moiſture, they will not Grow: but if the *Points* of the *Roots* only be Watered, though all the reſt remain Dry, (as it happens naturally in *Fir-Trees*) they may *Grow* very Well. For the *Points* of the *Roots* ſhoot out Yearly a ſharp pointed tender Part, ſomewhat like the Sharp *Bud* on the End of a *Sprig*, by which the *Root* not only Enlarges it ſelf in the Earth, as the *Branches* do in the Air, but alſo receives its *Nouriſhment*: And that tender part moves its ſelf towards the Beſt Moiſtned and the Tendereſt Earth. So that to promote the *Growth* of *Trees*, 'tis very Effectual to looſen the *Earth* about the *Points* of the *Roots*; and there alſo to Miniſter *Nouriſhment* or proper *Liquors*; and this intrenches where the Amendment may remain, rather than above; throwing out the Dead Mould out of the *Trenches*, and ſpreading it above to kill *Weeds*.

14. The *Roots* of *Plum* and *Lime-Trees Inoculated* upon, will ſhoot out their *Buds*; as I have experimented. I failed of Succeſs in the *Walnut*, in regard *I* think I had not well provided for what was neceſſary to keep the part *Inoculated* from the Moiſture of the *Earth* and *Rain*. To make a ſucceſsful Trial, ſuppoſe in an *Alkermes-Oak* (a Delicate Tree, and Difficult to be otherwiſe *Inoculated* upon,) Let the *Root* to be *Grafted* on, be Bared in the *Fall* of the *Leaf*, taken out of the Earth, and at convenient Diſtance from the *Body* of the *Tree*, *Bow'd*, and Raiſed a Foot above the Earth; and then the *Points* and *Fibres* of the *Root* carefully laid about with Freſh Earth, and Water'd till they take

take well, and till the *Root* raiſed in the Air have a *Bark* like that of a *Branch* of a *Tree*; which probably it will get in the next Seaſon of *Inoculation*. The *Inoculation* it ſelf is made on the Part Raiſed after the ordinary way. When 'tis done, let it be carefully covered with ſome *Soft Wax* (as is known) to Defend it from the *Rain*; it is to be ſtopp'd, and order'd in all things, as in other *Inoculations*.

15. The *Arms* of the *Roots* of Trees are to be Cut for the Advantage of their Growth, according to the proportion they have to their *Head* and *Body*; or according to the Deſign you have to encreaſe *Wood* or *Fruit*. For ſuch *Roots* as are more *Outward*, feed *Wood*; ſuch as are *Inward*, the *Fruit*.

16. The *Depth* of *Trees* to be ſet, ſhould never be below the reach of the *Sun's Heat*, nor the Goodneſs of the *Mould*; and rather too ſhallow than too deep; for as much as they are apter to ſink lower, than to raiſe themſelves Upwards, if they be out of the convenient reach of the Sun's Heat, the Cauſe of *Pulſion* and *Nouriſhment*.

17. The *Seeds* of *Fir*, *Pine*, *&c.* which bring up the *Shells* of their *Seeds* upon the *Heads* of the Firſt *Shoot*, will either not grow at all, or difficultly, if the Blunt End be put Downwards; becauſe in that Poſture it muſt Turn it ſelf, before it can Emerge into the Air, for the *Root* is ſhot downwards at the *Sharp end*: But it may very well Grow, if ſet Horizontally.

18. Such *Trees* as were mentioned in the *firſt* Obſervation, may Grow, though no part of the *root* be in the Earth. And all ſuch as may be Propagated by ſhort Sticks cut off at both Ends, and laid in the Ground, as *Mulberries*, will do ſo. Some young *Plants*, if their *Heads* be kept moiſt, will live all Winter, if mild, though their *roots* be in the *Air*, as I tryed in Seedlings of *Apples* and *Crabs*. Their *roots* ſet afterwards in the *Spring*, Grew and Lived. The Reaſon why ſome *Plants* grow in *Sticks*, may be the ſoftneſs of ſuch Wood, apt thereby to receive Nouriſhment like a *root*, and to ſhoot out *roots* and *Fibres* from themſelves. But in ſome *Slips*, taken from firmer Wooded Trees, as *Bayes*, a Moiſt Temperate Seaſon is to be obſerved; and ſome Stone, or Chip of ſome Wood, to be cloſed to the end of the *Slip*, and ſet in the Earth with it, which helps its *rooting*.

19. I am inform'd by a Curious and Intelligent Perſon, that the *Corruption* of *Timber* depends not upon the *Time* of the *Year*, and the *Aſcent*, or the Plenty or Scarcity of *Sap*, ſo much as upon the Seaſon of the *Moon* or *Wind*. And he affirms that *Timber Trees* Fell'd when the *Wind* is in the *Weſt*, eſpecially in the *Old Moon*, will keep them free from *Grubs* (as they call it) *i. e.* from being *Worm-eaten*; and on the Contrary, that when cut down in an *Eaſt Wind*, the *Worm* will ſeize on them, in what Seaſon of the *Moon* ſoever it be fell'd. To prevent which *Corruption*, 'tis adviſed that ſuch *Timber* ſhould be forthwith Thrown into *Water*.

n. 46. p. 913.

20. *Ethelbert Jay*, an Ingenious and expert Planter in *Lemſter*, ſuppoſeth, that the fitteſt time to *Inoculate*, is preſently after *Mid-Summer*, becauſe (ſaith he) the *Sap Deſcends*; but I ſay, becauſe 'tis then moſt plentiful, and begins to *Jelly*. The ſame aſcribes it to the *Sap aſcending*, to take the *Bud inoculated* before *Mid-Summer*; and to the *Sap Deſcending*, to take it after *Midſummer*.

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The time he limits to a few Days before *Mid-Summer*, and to 8 or 10 Days after it. Mr. *Auſtin* limits 14 Days before, and as many after, and would have the *Bud* Unty'd after 14 Days, as I remember.

It is all one, whether the *Sap* be exhauſted Below, by being converted into *Wood*, *Roots*, and other *Uſes*; or by *Diverſion*, as when the *Branch* is cut, or the *Bark* Opened Below: The *Sap* in both Caſes *Deſcends*, or rather *Sinks* indifferently, to ſupply the *Defect*, and Heal the *Wound*, and ſo it comes to paſs, that there being about *Mid-Summer* the Greateſt Plenty of *Sap* in *Apple Trees*, a *Bud* then *Inoculated* will Thrive, eſpecially Before *Mid-Summer*; for then it draws its Share in the *Sap Aſcending*, and all the Neceſſary Uſes of the upper *Branches* being ſerved, it partakes of the *Flood* of the Abounding and Superfluous *Sap*, remitted to it from them.

21. My Friend informs me that to Cut off the *Head* of the *Stock*, Above the *Inoculated Bud*, will make a Better *Shoot*, than in the Uſual *Inoculation*; if this be done a Few Days before *Mid-Summer*.

22. If the *Sap*, in its *Subſiding*, be Conſiderable in the matter of *Inoculation*, it ſeems, that *Inoculation* will hold beſt and Longeſt in Seaſon, in the *Root*.

For *I* have Obſerved the *Sap* to *Subſide* unto the *Roots* out of the *Body* at ſuch times of the Day and Year, when in the Branches *I* found none to Spare.

23. To make a *Barren* Tree *Bear* again, Cheriſh it with Dung in Trenches, and Pare and Renew the Extremities of its Longeſt *Roots*, and Cut off the Outermoſt and Shorteſt, neareſt the *Body*. Hence it may ſeem, that *Plowing* helps *Fruit-Trees*.

24. *Croſs-Hackings* promote Fruitfulneſs, Cure the *Phyllomania*, whereof the Reaſon ſeems to be, that (as was above intimated) *Outward Circles* and *Barks* feed the *Wood*, and the *Inner* onely reach out to the *Outermoſt Sprigs* of the Laſt Year, to which the *Fruit* is Appendant. For ſome *Trees Bear* Only on this Years *Shoot*; and ſome Only on that of the Laſt; poſſibly ſome Only on the 3*d*. Years *Shoot*; and Ceaſe *Bearing* when they Shoot no New *Sprigs*. Seaſonable *Baring* the *Roots*, which they call *Ablaqueation*, probably hath the ſame Effect, becauſe it hinders the *Nouriſhment* eſpecially of the *Outward Coats*, and of *Bark*, *Leaves*, and *Suckers*: But becauſe it ſeems that as ſome *Suckers* or *Shoots*, lately Sprung in *Outward Coats*, Robb the *Fruit* of the *Riſen Juice*; ſo *Later Roots*, come from the Outward Parts of the *Main Roots*, Rob them alſo of their Firſt *Nouriſhment* in the Earth. They ought to be *Pruned*, as well as all *Suckers* and *Not Bearing Branches* and *Sprigs*, every Year. For which Reaſon alſo *Dung* and other Amendments, as was ſaid above, ought to be applyed in *Trenches* nigh to, and beyond the Fartheſt *Points* of the *Roots*; to Draw them out of the *Shade* and *Drops*. To this end, Diſtance and Situation is to be Obſerved.

25. One of the beſt Ways of obtaining the Greateſt Store of *Sap* in the Shorteſt Time from the *Body* of any *Tree* is, not only to Pierce the *Bark*, nor to Cut the *Body* with a *Chizel* almoſt to the *Pith*, (as ſome have directed) but quite thorow all the *Circles* and the inner *Rind* it ſelf, on both ſides of the *Pith*,

Pith, leaving only the Outermoſt *Circle* and the *Bark* on the North-Eaſt ſide Unpierced. But this *Hole* is to be bored Sloaping Upwards, as lar geas the Biggeſt *Auger* you can get will make; and that alſo thorough, and under a Large *Arm*, near the *Ground*. So will it not need any *Stone*, to keep Open the *Orifice*: nor *Spigot*, to direct the *Sap* into the *Receiver*. This way the *Tree* will in ſhort time afford *Liquor* enough to *Brew* with: And with ſome of theſe *Sweet Saps*, One *Buſhel* of *Malt* will make as Good *Ale*, as 4 *Buſhels*, with Ordinary *Water*; though you ſhould *Brew* even in *March*, held the propereſt time for *Brewing*, in regard of the Goodneſs of the Water at that Seaſon. *Sycamore I* take to yield the Beſt *Brewing Sap*, being very Sweet and Wholſome.

26. To Preſerve *Sap* in the beſt Condition for *Brewing*, what you Gather Firſt, muſt be *Inſolated* by a conſtant Expoſure of it to the *Sun* in Glaſſes or other Fit *Veſſels*, till the Reſt be Gathered and Ready; Otherwiſe it will ſoon contract an *Acidity*. Having been thus Expoſed to the *Sun*, till a Sufficient Quantity is Collected; put into it ſo much very thin Cut and hard Toaſted, but no ways Burnt, *Rye Bread*, as will ſerve to *Ferment* it; and when it *Works* take out the *Bread*, and Bottle the *Liquor*, Stopping it up with *Waxed Corks*: If you Bake *Sage*, or any other *Medicinal Herbs*, in ſuch Thin *Rye-paſt*, till they be very *Dry*, you may expect a very Wholſome *Drink*. If you put a few *Cloves* in every *Glaſs*, into which the *Sap* Runs from the Tree, it will certainly Keep a *Twelvemonth*: But *I* have Wondered, whilſt *I* Obſerv'd how Speedily it Drew the *Taſt* and *Tincture* of the *Clove*. In ſome Few Bottles *I* was ſo Happy as to draw out my *Cloves*, with a *Cloth* in which *I* ty'd them up, in ſuch a Seaſon, as not to change *Colour* nor *Taſt*; and yet I preſerved the *Birch-Sap* by that Slight *Fermentation*, above a *Twelvemonth* without any Alteration, which elſe would have *Sowred* in a Few Days.

27. Some propoſe *Oyl* of *Sulphur* to perfume the *Bottles* with.

28. *Spirit* of *Wine* Ferments the *Juyce* of ſome *Berries*, and poſſibly may not only Preſerve but Advance the Vertue of *Saps*, a little being poured on the Top of them in the *Bottles*; or ſome other *Oyly-Spirit*.

29. *Raiſins* infuſed in the *Liquor* of *Birch*, is one ingredient of the *Durham* Gardner. *I* have been informed, that he uſes *Sugar*: But *I* believe, he puts it not in till he opens a Bottle preſently to be Drunk, becauſe it maketh the Liquor Sparkle in the Glaſs.

30. A certain Lady *Ferments* it with *Rye-Toaſt*, not put in, but only hung Over it, in ſuch Quantity and at ſuch Diſtance, as may give ſome light Warmth, Motion and Alteration to the Surface of the Liquor.

31. *I Fermented* ſome with *Ale Barm*, which Converted my Delicate *Birch Juice*, kept in Bottles, into Pitiful *Small Beer*: Which *I* wondred at; for *I* knew One, who uſed, by the *Barm* of *Ale*, to improve *Small Beer*, and thereby to keep it the better in Bottles.

32. *Hony* will not mix with *Cyder* though Boyled therein to make *Meath*; but after a while the *Cyder* lets fall the *Hony*, and becomes Simple *Cyder* again.

33. Some affirm, that the *Tops* and *Leaves* of *Birch* Decocted in the *Sap*, will

will Preſerve it from Sowring the Whole Year; and that any ſort of Dryed *Aromatick Herbs*, as *Sage*, *&c.* boyl'd in *Beer*, will keep it as well as *Hops*, *Ling*, *(Heath) Broom*, or *Worm-wood*. *I* had a Friend who uſed *Bay-Leaves* in his *Beer* and *Ale*.

34. The *Aſps* Run only (as Mr. *Midford* relates) before *February*; the *Hopp*, about *Hopp Harveſt*; *Withies*, in *April*. n. 58. p. 1199.

35. In thoſe *Trees*, whoſe *Sap* ſeems to be of a *Gummy Nature* when condenſed, as *Plums*, *Cherries*, *&c.* I know no Experiment, by which any Drop of *Sap* can be Collected. And *I* ſuſpect, ſome other *Fruit-Trees* to be of that Nature, whoſe *Sap* I could not Draw out, at any Seaſon, of *Hot* or *Cold* Weather, though they have not been obſerved to yield any *Gum*. Perhaps there may alſo be ſome *Fruit* and other *Trees*, whoſe *Saps* are *Viſcous*, though not *Gummy*; and theſe, *I* doubt, will not yield any *Sap* to be Gathered in any Common or known Way. n. 68. p. 2072.

36. It is not *Feaſible* to gather all the *Sap* of thoſe *Trees*, whoſe *Juice* is *Fluid* and Plentiful, and Condenſeth into a *Gelly*; becauſe it ſeems at Moſt Seaſons of the Year to *Aſcend* imperceptibly; and that not Only in the *Outward*, but *Innermoſt* Parts and *Pores* of the Tree; not only betwixt *Bark* and *Wood*, but betwixt every *Coat* of the Wood, and even through the moſt Solid Parts of each *Coat*; as Mr. *Willoughby*'s Obſervations have Diſcovered. *Vid. inf.*

37. An Eminent Planter in *Gloceſterſhire* has diſcovered to us, that by *Binding* the *Trees* round about very Cloſely and Strongly with *Cords*, ſo as to Intercept what *Riſeth* 'twixt the *Bark* and the *Body*, he Retards their *Bloſſom* and *Bearing*: And ſo may in ſome Years (when the Open Weather haſtening *Bloſſoms* is like to Deſtroy the *Fruit*) Prevent a Scarcity of forward Fruit, uſually Nipped by the Late Froſts.

38. I kept ſome *Sap* in a Large *Retort* of 2 or 3 *Gallons*, expoſed Night and Day (without any other Stop than the Obliquation of the *Retorts* Neck, and a little Paper to keep out *Inſects*,) many Months, and it Contracted a *Coat* on its *Top*; the *Taſt* pleaſing my Palate, *I* adventured to *Brew* with it at *Cider-Seaſon*, and made a good Quantity of good Cordial Drink, with 8 *Buſhels* of *Chopt Apples*, Brewing them like *Malt* with Hot Water, and putting my *Juyces* and *Saps* into my *Water Cyder* at the latter end of their Boyling. I filled a *Stand* with it, which contained half the Quantity of the largeſt *Rheniſh-Wine* Veſſel, *viz.* about 40 *Gallons*, as *I* remember. I had not half *Sap* in this Liquor (the greateſt part of my *Brewing* being made with *Water*) yet *I* got 5 *Buſhels* and more of Warming Cordial and Pleaſant Drink for every Buſhel of my *Apples*. If it had been all *Sap*, it would have been much more Cordial and Strong. There was in it a Conſiderable Quantity of *Juyce* of *Borrage-Roots* and *Herbs* (at that Seaſon uſually thrown out of Gardens,) which *Borrage Liquor* Works and Purges it ſelf when Tunned, and Turns into an excellent Clear Brown Liquor. *I* drank my Drink in *Eaſter* following: So my *Sap*, Gathered at *Spring*, and Brewed about *Michaelmas* continued Good till *Eaſter*, and after it. *ib. p.* 2075.

39. Some affirm, that the *Dividing* of *Crab-Stock-Roots*, from the *Stem* left in the Ground, is the beſt way of Multiplying *Crab-Stocks*, or a Commendable One at leaſt.

40. 1. *I* have heard that a *Chip* of *Soft-Wood*, laid to the end of a *Bay-Slip*, promotes its *Rooting:* And that *Mulberry Slips* are eaſily Propagated, ſet in the Latter End of *January*, or Beginning of *February*, in a Moiſt ſeaſon, not in a Dry *March*. Such Slips *Root* beſt, if they be *Suckers*, and taken off with part of the Old *Bark*; or if they be Laſt Years *Shoots*, Cut off from *Arms*, taken with ſome Older *Bark* from the place where they ſhot Out. I have ſet many formerly, which all Throve. *I* affect to Propagate them for *Pear*, and other *Stocks*, namely *Quinces*, *Medlars*, *Plums*, to turn their *Pulp* and *Juice* Red, by taking *Grafts* from ſuch *Trees*, as have been *Grafted* on *Mulberries*. Perhaps the *Blood Red Pears* and *Red-Redſtrakes* were thus Raiſed at firſt, or may be thus Propagated to Advantage.

By Mr. Fr. Willoughby *and Mr.* Wray. n. 48. p. 963.

2. 1. In *Birch* Trees, the *Sap* iſſues out at the Leaſt Twiggs of Branches, and Fibres of *Roots*, in proportion to their Bigneſs.

2. In all Trees the Gravity promotes the *Bleeding*; ſo that from a Branch or Root, that Bends Downward, there will iſſue a great deal More *Sap*, than from another of the ſame Bigneſs in a more Erect Poſture.

3. Branches and young Trees Cut quite off when they are Full of *Sap*, and held Perpendicularly, will *Bleed*; as we Experimented in *Willow*, *Birch*, and *Sycamore*: And if you Cut off their Tops, and *Invert* them, they will *Bleed* alſo at the little Ends. Hence one may conjecture, that the *Narrowneſs* of the Pores is not the ſole Cauſe of the *Aſcent* of the *Sap*; for, Water that hath Aſcended in the little Glaſs Pipes, will not fall out again by its own Gravity, if the Pipes be taken out of the Water.

4 Roots of *Birch* and *Sycamore* cut aſunder will *Bleed* both ways, that is, from that part Remaining to the Tree, and from the part ſeparated: But a great deal Faſter from the part Remaining to the Tree. But in a *Cold Snowy* Day the Root of one *Sycamore*, we had Bared, *Bled* Faſter from the part Seperated; and Ten times Faſter than it did in *Warm* Weather before

5. In *Birches* the *Sap* does not iſſue out of the *Bark*, be it never ſo Thick, but as ſoon as ever you have Cut the *Bark* quite through, then it firſt begins to *Bleed*.

6. The *Bark* being quite Pared off above an Hands breadth Round, about ſeveral *Birches*, did much abate the *Bleeding* of the Trees above the Bared places, but did not quite ſtop it.

7. The *Sap* doth not only *Aſcend* between *Bark* and *Tree*, and in the *Prickt Circles* between the ſeveral *Coats* of Wood; but alſo through the very *Body* of the *Wood*. For, ſeveral young *Birches* being nimbly cut off at one Blow with a ſharp Axe, and white Paper immediately held hard upon the Top of the remaining Trunk, we ſtuck down Pins in all the points of the Paper as they appeared Wet: and at laſt, when the moſt of the Paper became Wet, taking it away, but leaving the Pins ſticking, we found them without any Or-

der,

der, ſome in the *Circles*, and ſome in the *Wood* between. And to confirm this further, we cauſed the Body of a Tree to be cut off aſlope, and then cut the Oppoſite ſide aſlope likewiſe, till we brought the Top to a narrow Edge; ordering the matter ſo, that the whole Edge conſiſted of part of a *Coat* of *Wood*, and had nothing of a *Prickt Circle* in it, which notwithſtanding, the *Sap* Aſcended to the very Top of this Edge, and wetted a Paper laid upon it.

8. To find out the *Motion* of the *Sap*, whether it *Aſcended* only; or *Deſcended* alſo, we bored a Hole in a large *Birch*, out of which a Drop fell every 4*th* or 5*th* Pulſe. Then, about a Hand's breadth juſt under the Hole, we ſaw'd into the Body of the Tree, Deeper than the Hole: Whereupon the *Bleeding* diminiſhed one *half*; and having Saw'd juſt Above this Hole to the ſame Depth, the *Bleeding* from the Hole Ceas'd quite; and from the Saw'd Furrow below Decreaſed about *half*: And it Continued *Bleeding* a great while after at both the ſaw'd Furrows, the Hole in the middle remaining Dry. We Repeated this with much the like Succeſs upon a *Sycamore*

9. Some Trees of the Same Kind and Age *Bleed* a great deal Faſter and ſooner than others; but always Old Trees ſooner and Faſter than Young.

10. A *Wound*, made before the *Sap Riſes*, will *Bleed* when it doth *Riſe*.

11. While we were making theſe Experiments, the Weather Changed from *Warm* to *very Cold*; whereupon the *Bleeding* in the *Birches*, which begun to Abate before, Ceas'd quite: But all the *Sycamore* and *Walnut Trees*, we had Wounded, *Bled* abundantly; (ſome whereof *Bled* not at all, and thoſe that did, did ſo but Slowly;) and ſo continued Night and Day, when it *Froze* ſo Hard, that the *Sap* congealed as faſt as it iſſued out. The *Cold* Remitting, the *Birches Bled* Afreſh, the *Sycamores* Abated very much, and the *Walnut Trees* quite Ceaſed.

12. We Pierced two *Sycamores* on the *North* and *South* ſides, and both of them from equal Inciſions *Bled* a great deal faſter from the *North* ſides, than the *South*; which is Conſonant to the Preceeding Experiment.

13. We ſet ſeveral *Willows* with the *Wrong* Ends *Downward*, and cut off ſeveral *Bryars* that had taken Root at the ſmall Ends. This 29*th* of *May* 1669. the *Willows* have ſhot out Branches near Two *Foot* Long; and from the Top of the *Sets*, which were a Yard high: the *Bryars* have alſo grown Backwards, from that part which we left remaining to the Roots at the *Leſſer* Ends; they have great Leaves, and are ready to Flower.

14. Dr. *Tonge* found, by His Experiments in the Roots and Branches of Trees, that not only *Cold* Weather but *Cold* Wind and *Sunſetting* ſtopped or Abated the *Motion* of *Sap* in the *Sycamore*: But His Experiments were made in *February*, and Ours towards the End of *March*. The *Cold* which cauſed that increaſe of the *Bleeding* in the *Sycamore* and *Walnut*, happened upon the 23, 24, 25, 26. of *March*; and one *Sycamore*, which Ceaſed to *Bleed* from the 11*th* of the ſame Month, *Bled* afreſh copiouſly from Wounds that had been made ſo long before. The Buds before the *Cold*, were juſt ready to open into Leaves, and the *Sap* had begun to Coagulate above Fortnight before. In *Jan.*

By Mr. Willoughby. n. 57. p. 1165.

$16\frac{69}{70}$ making Inciſions in the *Sycamore* and common *Maple*, immediately upon the Relenting of the firſt Froſt, we found that they both *Bled*, and faſter, as the Weather grew *Hotter*; nor did the ſucceeding *Cold* Promote, but rather hinder their *Bleeding*. So that the Learned Dr. doth moſt ingeniouſly conjecture, that the *Aſcent* of the *Sap* in Trees, depends upon a certain Degree of *Heat*, ſufficient to Raiſe, but not to Coagulate their reſpective Juices. In thoſe Months, wherein the *Heat* ordinarily falls ſhort of that Degree, an Accidental *Heat* or *Warmth* of Weather Promotes the Bleeding; but in thoſe Months, wherein the ordinary Temper of the Air Exceeds that Degree, an Extraordinary fit of *Colder* Weather makes them *Bleed* again.

15. In *Walnut-Trees*, we never yet found, that *Heat* Promoted their *Bleeding*, but always *Cold*. From a Wound, made in a *Walnut-Tree*, in *Jan.* and the Beginning of this preſent *March* $16\frac{69}{70}$, in Mild Weather, nothing Iſſued: But the Weather Changing and growing *Colder*, it *Bled* plentifully.

16. *March* 11. $166\frac{8}{9}$ Roots of *Birch*, great and ſmall, *Bled* both ways; and about the ſame time, *Sycamore* Roots alſo. The ſame *Birch* which firſt began to *Bleed*, *March* 3. $16\frac{69}{70}$. *Bled* Three Weeks ſooner the Year before.

17. It was obſerved in *Autumn* 1669. by Mr. *Mart. Liſter*, that upon the firſt *Froſt*, which happen'd in *November*, a *Sycamore* Bled copiouſly; ſo that the *Sap* cannot be ſaid to Riſe in *January*, but immediately after the *Fall* of the *Leaf*, in this Tree.

n. 58. p. 1199. 18. After the Leaves were Explicated in the Year 1670, we Obſerved the *Sycamore*, after ſeveral *Froſty* Nights to *Bleed* afreſh in the Morning, ſoon after *Sun-riſing*, when it had Ceaſed ſeveral Days before; though this muſt not be underſtood of all *Sycamores*, but of ſome only that are more ſenſible and Obſervant of the Weather.

April 3, and 4. all the *Sycamores* quite Ceaſed.

The 5*th* being after a *White Froſt*, they began to *Bleed* about 8 a Clock, and Ceaſed towards Noon.

The 9, 12, 13, 15, they *bled* again.

The 16, they *bled* not, it being *Rainy*, and the Sun not ſhining.

From the Obſervations we have hitherto made, we think it may be certainly inferr'd, That a *Morning Sun* after a *Froſt*, will make all the *Bleeding Tribe* Bleed Afreſh, though they had before Ceaſed; and that this New Bleeding towards the latter end of the Seaſon commonly Ceaſeth before Noon. Poſſibly ſome may *Bleed* after a *Froſt*, yet further in the *Summer*.

19. I obſerved in *Auguſt*, a Copious and ſpontaneous Exſudation, very like *Bleeding*, of a Viſcous Yellow Juyce out of the *Buds* of a *Black-Poplar*.

20. Our *Wallnut-Trees* Bleed here at *Middleton* in *Warwickſhire* in *January*.

By *Dr.* Tonge. n. 68. p. 2070. 21. I am very much confirmed in my Apprehenſions, that Trees and other Plnts, if we could Contrive them, as I have (but ſlenderly) Projected in my *Sap-wiſer* to that Purpoſe, would far better indicate the

Altera-

Alteration of *Weather*, as to Heat, Cold, Moiſture, Drought, than any *Weather-Glaſſes* I have yet Experimented. For my *Weather-Glaſs* continuing at one and the ſame ſtation, in a manner all this Day (*April* 13. 1670) my Trees have Altered their Temper ſo much, that 24 of them, that Ran tollerably this Forenoon, yield not a *Pint* of *Sap* this Afternoon; and though one of them Ran moſt part of the Day, the Reſt Ceaſed about one or two of the Clock in a Fair, Clear, *Sun-Shiny* Seaſon retarded (ſo far as I could Obſerve) only with a *Weſtern* Wind, though that be Reputed Mild and Cheriſhing.

Theſe Trees Ran above 2 *Quarts* in the Morning; the *Weather-Glaſs* continues the ſame, *viz.* about 11 *Inches* Water, theſe two Days. *Thurſday* 14, it was $9\frac{1}{2}$ only.

Friday 15. My *Weather-Glaſs* at Noon was advanced from 9 to $10\frac{1}{2}$, yet the Quantity of *Birch Water* this Day Exceeded my former from theſe Trees; for I had above $2\frac{1}{2}$ *Quarts* before Noon.

But for *Cold*, I find that the Air, when any whiſtling Blaſt of *Cold* Wind ſtirs, ſtays my *Birches*.

Saturday Apr. 16. Theſe 24 *Birches* began to *run* preſently after *Sun-riſe*, and ran about 3 *Quarts*, and Ceaſed about 2 a Clock after Noon; having till then continued to Run.

Sunday 17. It Rained ſo, that we could make no Obſervations what Sap theſe Trees might ſpend; neither did Rain and all amount to much above a *Gallon* and a *half*. *Monday* 18. They ran until Noon. *Tueſday* and *Wedneſday* the 19 and 20, wherein was expected greater Store of *Sap*, after the *Rain*, the Trees ſpent not a Drop.

Saturday Apr. 23. My *Weather-Glaſs* ſtood at $7\frac{1}{2}$, it being a *Rainy* and Boiſterous Morning, the *Rain* not allaying the Wind. At 9 a Clock of that Forenoon, my *Birch-Water* worked in the Barrel, *per ſe*, which ſeems to verify Mr. *Souton*'s Relation from his Brother, a *Swediſh* Merchant, importing that *Birch-Water* in *Sweden* worketh *alone*, (perhaps collected in great Quantity.) Only I put a very few *Cloves* into my *Sap*. Boil'd to a Third or leſs, it Keeps well, eſpecially when Boil'd with the *Buds* or *Sprigs* of the ſame Tree, as I have been Informed.

April 16, 17, 18. In the Year 1670. *Birch-ſap* mixed with *Rain VVater* at the Tree, Fermented, with *Roſemary Sprigs* ſteeped in *Spirit* of *VVine*; which warmed the Stomack as ſtrong *VVine*, and Pleaſed the Palate; though the Taſte in the Mouth was ſomewhat Wateriſh.

22. We find that Branches of *VVillow*, *Birch*, and *Sycamore*, Cut off and held perpendicularly, will *Bleed* without *Tipping*; and that the cutting off of their Tops does not ſenſibly Promote the *Bleeding*. *By Mr.* Fr. Willoughby, n. 70. p. 2125.

We doubt not of Mr. *Liſter*'s Diligence and Veracity, and wonder our Experiments ſhould Differ. The *Sycamore Bleeds* upon the firſt conſiderable *Froſt*, after the *Leaf* is *fallen*, as it did plentifully *Nov.* 16. 1670. And both that, *VValnut*, and *Maple*, *bleed* all Winter long after *Froſts*, when the Weather Relents, and the Sun ſhines out; but *VValnut* and *Maple* Begin not ſo ſoon as the *Sycamore*. The *Birch* will not *Bleed* till towards the *Vid. Inſ.*

Spring

Spring. *An.* 167$\frac{0}{1}$. it Began ſomething ſooner than ordinary about the Beginning of *Feb.*

Ib. p. 2142. 23. In a very ſharp *Froſt* the *Bleeding* is ſtopp'd till the Weather begins to Change; but in a Moderate *Froſt*, though it ſtop in the Night, yet in the Day time, if the Sun ſhines out, the Trees will *bleed*, though the *Froſt* continue. What we ſaid formerly that *Cold* did not Promote, but Hinder *bleeding*; we find holds True, if the *Cold* be without *Froſt*.

Ib. p. 2126. 24. We Cut off pretty big Branches of *Birch*, and having Tipp'd the Ends, Inverted them, and faſtened a *Limbus* or Ring of ſoft Wax to the great Ends, which we held Upwards, making with the Plane of the End, a Veſſel of about an *Inch* Deep, whereinto we poured Water, which in a few Minutes ſunk into the Pores of the Wood, and running quite through the length of the Branch, Dropped out of the Ends conſiderably faſt, continuing ſo to do as long as we poured on Water. The like Experiment we made by Faſtening ſuch Rings of Wax to the *Leſſer* Ends, and pouring in Water, which ran through the Wood, and dropp'd out of the greater Ends as faſt or faſter. This we try'd Once upon a *Sycamore* without ſucceſs: But afterwards *I* made Tryal both upon *Sycamore* and *VValnut*, and found that Water runs through both, but nothing ſo Faſt as through *Birch*.

Ib. p. 2142.

By *Dr.* Liſter. n. 68. p. 2067. n. 70. p. 2120, 2126. 3. 1. About the Beginning of *November* 1669. *I* pierced a *Sycamore* growing in a Sandy Soil at *Nottingham*; the Turgeſcnce of the *Buds* inviting me thereto, and engaged my ſelf in Keeping a *Journal* till the latter end of *March* following: from which *Journal*, *I* think *I* may note, 1. That the wounded *Sycamores* never *bled*, neither in *November*, nor *December*, nor *January*, nor *February*, nor *March*, (which yet they did above 40 ſeveral times, that is, Totally Ceaſing and then Beginning a-new,) unleſs there Preceeded a ſenſible and viſible *Froſt*; for *I* had no other way of recording the Temper of the Air. 2. That the *Froſts* did not always ſet a Bleeding the *VVounds* they found made before they came, though ſometimes they did: But upon their Breaking up, or very much Relenting, the *VVounds*, either made at that Inſtant of time, or made many Months before, did never fail to *bleed* more or leſs. 3. That particularly upon the Breaking up of the *Two* great and long *Froſts* (the *firſt* of which happened that Year in that Country to be on the 3 of *January*; the *ſecond* about the 12, 13 and 14 of *February*) all the *wounds* Ran moſt plentifully; ſo that ſuch times may be looked upon as the moſt proper Seaſon of Gathering great Quantities of Juice from this Tree.

2. In *May* 1670. I *wounded* ſome *Sycamores* in *Craven*, but they did not *bleed*, neither the remaining part of that Month, or the following Months of *June* and *July*: But had the Orifice of the *VVounds*, made with a ſmall *Auger*, in a manner quite grown up, and would ſcarce admit a Pigeon's Feather. Wherefore the 30 of *July*, *I* cut out a ſquare piece of about 2 *Inches* of the *Bark* of a large and well grown *Sycamore*, about my height, in the Body of it. This *VVound* began to Run the next Morning about 9 a Clock, ſo as to Drop, and that was all, and Dryed up by 11 in the Morning. The like Cut *I* made in a young *Sycamore* the 8 of *Auguſt*, which in like manner *bled* the next Morning, but ſtopp'd before 9 a Clock. It did ſo for 2 or 3 Days; but then totally dry'd.

3. *Nov.*

3. *Novem.* 1. 1670. here at *York I* Pierced and otherwiſe Wounded 2 *Sycamores* growing in a Wet Clay, but they never Stirr'd, till the Beginning of *February* following. Yet Mr. *Wray* hath Aſſured me, that thoſe of *Warwick ſhire Bled* the 16 of *Nov.* Copiouſly, and afterwards the *Walnut Tree* alſo.

I am apt to think that the *Sap* in all parts of the Tree at the times of this Anomalous *Bleeding* is ſome ways notably Altered in its Temper and Conſiſtence: And this *Bleeding* by ſtreſs of *Weather* may in theſe Trees probably be look'd upon as a Violence done to their Natures from an Unkind Climate; conſidering the *Walnut* and *Sycamore* as *Strangers*, and not *Natives* of *England.* 'Tis indeed True, there are many ſorts of *Engliſh* Plants, which will *Bleed* in *Winter*: but Note alſo, that ſuch Plants never Refuſe to do ſo at any time of the Year, no more than a Man, who may *Bleed* a Vein when he Pleaſeth.

4 *Feb.* 1. 167$\frac{0}{1}$. It *Froze*, the Wind at *North*; the *Froſt* and Wind Continued (ſome little *Snow* and *Rain* falling) the 2, 3, 4, 5, 6. until the 7. in the Morning, when the Wind came about to the *South Eaſt*, and the Weather broke up apace. The *Sycamores Bled* not all this while, but the 7 about Noon all Trees of that Kind *Bled* very Freely, both at the Twigs and Body, and *I* ſtruck above a *Dozen*.

At this ſame *Critical* Seaſon *I* alſo Struck the *Haw-thorn, Hazel, Wild-Roſe, Gooſeberry Buſh, Apple-Tree, Cherry-Tree, Blather-Nut, Apricock, Cherry-Lawrel, Vine walnut*: yet None *Bled* but the Laſt named; and that Faintly in Compariſon of the *Sycamore*.

Feb. 11. All was here Covered with a *white-Froſt* betwixt 9 and 11 in the Morning.

The Weather Changing, *I* made the Experiments which follow, upon the *Sycamore, Wallnut, Maple.* A Twig cut aſunder would *Bleed* very Freely from that part Remaining to the Tree: and, for the part Separated, it would be altogether Dry and ſhew no ſigns of Moiſture, although we held it ſome pretty time with the Cut-End Downwards: But if this ſeparated Twig was never ſo little *Tipp'd* with a Knife at the other End, it would forthwith ſhew Moiſture at Both Ends; the ſame Day, late in the Afternoon, the Weather very Open and Warm, a Twig Cut off in like manner as in the Morning, would ſhow no moiſture at all from any Part. But I have ſince been convinced, that 'twas rather ſome Unheeded Accident which cauſed this *New Motion* of the *Sap*, than meerly the Striking off their *Tops*. *ib. p.* 2128.

5. Becauſe *Sap* is ſaid to *Aſcend* from the *Root*; when it is found to Move in *Tapping*, *I* Lopp'd off certain Branches of a *Sycamore*, the Morning betimes of a *Hard-Froſt* (*Feb.* 21.) before they would *Bleed*, or ſhew any Sign of Moiſture. And not willing to wait the Change of the Weather, and the Sun's Heat, *I* brought them within the Air of the *Fire*: and by and by, as *I* expected, they *Bled* apace, without being Senſibly the warmer. *ib. p.* 2123.

This Experiment Repeated afforded me divers *Phænomena*, which follow; and proved almoſt an Univerſal way of *Bleeding* all ſorts of Trees, even thoſe, which of themſelves would not ſhew any Signs of *Moiſture*.

1. *Poles*

1. *Poles* of *Maple*, *Sycamore* and *Walnut*, Cut down in Open Weather, and brought within the Warmth of the *Fire*, did *Bleed* in an Inſtant. Alſo *Willow*, *Hazel*, *Cherry*, *Wood-bind*, *Blather nut*, *Vine*, *Elder*, *Barberry*, *Apple-Tree*, *Ivy*, *&c.* *Whicking* and *Egge-berrie Tree* (i. e. *Padus Theophraſti*) Tried in the ſame manner in *Craven*.

2. *Briar* and *Rasberry*-rods were more Obſtinate; *Aſh* utterly Refuſed, even Heated Hot.

3. *Branches*, that is *Poles* with their *Tops* Entire and Uncut, *Bleed* alſo when brought to the *Fire* ſide: but ſeem not ſo freely to Drink up their *Sap* again when Inverted, as when made *Poles*.

4. The ſame *Willow Poles* left all Night in the Graſs-plot, and return'd the next Day to the *Fire* ſide, Bled afreſh.

5. *Maple* and *Willow Poles* Bleed and Ceaſe at pleaſure again and again, if quickly Withdrawn and Balanced in the Hand, and often Inverted to Hinder the Falling and Expence of *Sap*: Yet being often Heated, they will at length quite Ceaſe, though no *Sap* was at any time Senſibly loſt. And when they have given over *Bleeding*, that is, ſhewing any Moiſture, by being brought within the Warmth of the *Fire*, the *Bark* will yet be found very full of *Juyce*.

6. An Hard *Ligature* made within a quarter of an Inch of the End of a *Wood-bind* Rod did not hinder its *Bleeding* at all, when brought within the Warmth of the *Fire*.

7. *Maple* and *Willow-poles*, &c. quite Bared of *Bark*, and brought to the *Fire*, will ſhew no Moiſture at all in any Part.

8. One *Barberry* or *Pipridge-pole* Bared of its *Bark*, brought to the *Fire*, did ſhew Moiſture, from within the more *Inward Circles*, though not any from the *Outward*.

9. *Maple* and *Willow-poles*, &c. half Bared of *Bark*, would *Bleed*, by the *Fire*, from the Half only of theſe *Circles*, which lay Under the *Bark*.

10. *Maple* and *Willow-poles*, Split in two and Planed, would not ſhew any Moiſture on the Planed *Sides*, but at the *Ends* only.

11. A *Pole* of *Ivy* did of it ſelf Exſudate and ſhew a Liquid and yellowiſh *Roſin* from the *Bark* and near the *Pith*; but when brought to the *Fireſide*, it *Bled* a *Dilute*, Thin and Colourleſs *Sap* from the Intermediate *VVood Circles*.

12. A *Pole* of *Willow* (for Example) Bent into a Bow, will Ouſe its *Sap* freely, as in *Bleeding* either Spontaneouſly or by the *Fire*.

13. One or Both Ends of the *Pith* of a *Willow pole* Seal'd up with Hard Wax, will yet freely *Bleed* by the warmth of the *Fire*. *ib. p.* 2126.

14. *March* 23. 167$\frac{0}{1}$. was the Greateſt *Froſt* and *Snow* we have had this winter in theſe parts about *York*; when ſome Twigs and Branches of the very ſame *Willow-Tree* as formerly, and likewiſe of many other *Willow-Trees*, taken off that Morning, being brought within the Air of the *Fire* would ſhew no *Moiſture* at all; no not when Heated warm, and often and long Turned.

15. *March* 24. the ſame *Willow-Branches*, which the day before would not Bleed, and were thrown upon the Graſs-plot all Night; did, both they and other

New

New cut down, by the *Fire* ſide freely ſhew Moiſture and *Bleed* in the Morning upon the Breaking up of the *Froſt*.

16. *Aſh-Poles* and Branches that Day and the Day before, would by the *Fire* be no more Moiſt, than when *I* formerly Tried them.

17. The ſame Morning, a Twig of *Maple*, which had had the Top Cut off the 7 of *Feb.* (and which then *Bled*,) being quite taken off from the Tree, and brought within the Air of the *Fire*, and held with the Formerly-Cut End Downwards, did not run at all at that End, but held on in that Poſture, it did run apace at the Other New-Cut End Uppermoſt, ſo as to ſpring and Trickle down.

Note, That this doth well Agree with my Experiments made the year before at *Nottingham* where *I* obſerv'd *Wounds* of ſome Months Standing to *Bleed* apace at the Breaking up of every Hard Froſt. For *firſt*, in theſe Parts, there hath been no Hard Froſt this Year; not comparable to that Year. *Again*, thoſe *Nottingham Trees I* Wounded in the *Trunk*, and they ſtood againſt a Brick-wall, and the Wounds were on the ſide next it; and beſides had Horſe-dung ſtopp'd in all of them, for ſome Reaſons, which things did undoubtedly Defend them much from the Air and Winds, and Keep the Wounds ſtill Green and Open: Whereas the Tops of theſe *Maple-Twigs*, ſpoken of in the laſt Experiment, were expoſed in an Open Hedge to the Air and Winds; as alſo the 2 *Sycamores* here at *York*, mentioned above to have been wounded in *Novem.* 1670 and not to have ſhew'd any *Signs* of *Moiſture*, for that very Cauſe, that they were not Freſh Struck at *Bleeding* times.

LXI. I am inclined to think, that there is ſome kind of *Circulation* of the *Juices* of *Vegetables*; 1. Becauſe *I* find, that all the *Juice* of a *Plant* is not *Extravaſate* and Looſe, and like *Water* in a *Spunge*, but that there are Apparent *Veſſels* in *Plants*, Analogous to *Veins* in *Animals*: which thing is moſt conſpicuous and clear in ſuch *Plants*, whoſe Juice is either *White*, or *Red*, or *Saffron coloured*; for inſtance in each Kind of *Juice* we propoſe *Lactuca*, *Atractilis*, *Chelidonium majus*. 2. Becauſe that there are very many *Plants* (and theſe laſt named are of the Number) whoſe *Juice* ſeems never to be at *Reſt*, but will Spring at all times, freely as the *Blood* of *Animals*, upon *Inciſion*.

The Circulation *of Sap: by Dr.* M. Liſter, n. 70. p. 2322.

The way of *Ligature* by *Metalline Rings*, is an Expedient *I* have not uſed: but other *Ligatures I* have, upon a great Number of our *Engliſh Plants*, not without the Diſcovery of many Curious *Phænomena*. The ſucceſs of an Experiment of this Nature upon *Cataputia minor Lobel* was as follows: *I* Tied a Silk Thread upon one of the *Branches* of this *Plant*, as Hard as might be; and not Break the *Skin*. There followed no greater *Swelling*, that I could Diſcern, on the one ſide of the *Silk* than on the other; although in often repeating the Experiment, ſome *Silks* were left hours and days Unlooſed: and yet the Dimple which the *Thread* had made in the Yielding *Branches*, had a little Raiſed the immediate Sides, but both alike. The *Plant* in Like manner would *Bleed* very freely both above and under the *Tye*. This was alſo, *I* thought, very Remarkable, amongſt other things, in this Experiment, that

in Drawing the *Razour* round about the Branch juſt above or below the *Tye*, the *Milky Juice* would ſuddenly Spring out of infinite *Small Holes*, beſides the made *Orifice*, for more than half an Inch above and below the *Tye*: which ſeems to Argue, that though there was no Juice intercepted in appearance from any Turgeſcence, (as in the proceſs upon the Members of a *Sanguineous Animal*) yet the *Veins* were ſo over-thronged and full, that a large *Orifice* was not Sufficient to diſcharge the ſudden *Impetus* and Preſſure of a ſome ways Streightned *Juice*.

The Deſcent *of* Sap *in* Winter; *by Mr.* Richard Reed, n. 70. p. 2129.

LXII. 1. To Prove that the *Sap* does *Deſcend* in *Winter*, *I* have obſerved that the *Graft* hath influence either to *Corrupt* or to *Heal* the *Stock*; nay farther, to *Alter* and Change the very Nature and VVay of the Growing of the *Root* in the Earth: which *I* cannot ſee how it ſhould do, but by ſending *Down* its *ſap* thither. *I* have by Certain Obſervation found, that *Crab-ſtocks* Grafted with ſome ſorts of *Fruits*, which the Soil Liketh not, They not the Soil, will (not One or Two, but *All* of that Sort) *Canker*, not only in the *Graft* but the *Stock* alſo: which if you *Graft* Again, upon the Former *Graft* with a *Fruit* Liking to the *Soil*, will all *Heal*, and ſo become *Trees*. And further, Certain it is by my Obſervation, that 20 *Pear-ſtocks* being *Wild*, Grafted *Young* with the ſame ſort of *Pear*, and 20 with another, the *Roots* of each of them of One ſort will Grow alike: and ſo Thoſe of the Other. Generally, thoſe that Naturally Grow *High*, as the *Bare-Land-Pear*, Root Deep, and *All* do ſo: Thoſe whoſe *Heads* are *Buſhy* and Thick, as the *Summer-Bonchreſtien*, their *Roots* run VVide, and are Matted Below; and *All* are ſo. This Diverſity of the VVay of *Growing* of the *Root*, muſt be by *Grafting*: and could not be but by the intercourſe of *Sap* which it receiveth from the *Graft*, and that cannot be, but by the *Return* of *Sap*.

By Dr. J. Beal, n. 71. p. 2144.

2. 'Tis no wonder if the Effects which Mr. *Reed* mentions do follow from that Correſpondence in *All* Parts of the *Whole Plant* (which is by me acknowledged,) eſpecially, ſince by the *Leaves* and all the *Pores* in the *Branches* and *Body*, the *Plant* draws a kind *Suſtenance* from the *Sun*, *Air* and *Dews*, as by the *Roots* from the *Succulent Soil*. And as the *Channels* (which *I* may call the *Conduits* and *Strainers*) of ſeveral *Stocks* and *Cions* do Differ, ſo may ſome Change of the *Liquor* be made by ſeveral kinds of *Diſtillation*. And from the fore noted Difference of *Stocks*, and the Differing *Grains* of the *Shoots* and *Timber*, as alſo from the Differing *Leaves* (if accurately inſpected, and conſider'd,) we may in time perhaps Diſcover ſome Particular Cauſes of the Differing *Sap*, *Fruit*, and *Bloſſoms*.

'Tis about 15 Years ſince *I* publiſhed a Hint, how to Diſcover by the *Colour*, *Figure*, *Tenderneſs*, and *Aſperities* of the *Leaves* of Young *Apple-Plants*, and *Crabs*, firſt appearing in the Spring, which *Plant*, would yield the more *Delicate*, and which the more *Auſtere Fruit* and *Liquor*, to ſeveral Kinds and Degrees of Delicacy and Auſterity; Flatneſs and inſipidneſs, and

and Vigour and Briskneſs. And this, I think, allows a Conſideration for ſome Efficacy, or ſign (at leaſt) of Change or Operation in the *Deſcent* of *Sap*. But as far as *I* dare, or did, Deny the *Deſcent* of *Sap*, *I* meant it in the Vulgar ſenſe of that Expreſſion, *viz.* the Main Quantity of *Sap* which *Aſcends* in the *Spring*, and is Gradually Hardened into *Leaves*, *Bloſſoms*, *Fruit*, *Timber*, in ſuch manner as the *Oſſification* in Young *Animals* is Deſcribed by Dr. *Kerckringius*. *Anthrop. Ichn.* 'Tis a large Quantity of *Sap*, which is Expended on the *Fruit* and Growth of ſome *Trees*, on *Acorns*, *Wallnuts*, *Cheſnuts*; and this *Returns* not to the *Root* in *Winter:* Yet conſiſts well with the Sentiment of the *Circulation* of the *Sap*, which in ſome Seaſons may *Run* the Round more *Swiftly* than in Other.

LXIII. 1. Some Years ago I made a few Obſervations concerning the *Veins* or ſuch *Ductus*'s, as ſeem to contain and carry in them the Nobleſt Juices of *Plants*: and I am of the Opinion that they will prove *Veſſels Analogous* to our *Humane Veins*. Thoſe Parts of a *Plant*, which *Pliny* calls by the Names of *Venæ* and *Pulpæ*, are nothing elſe in my Opinion, but what Dr. *Grew* calls *Fibres* and *Inſertments*, or the Lignous Body interwoven with that which he takes to be the *Cortical*, that is, the ſeveral Diſtinctions of the *Grain*. But that theſe Veſſels are not any of the *Pores* of the *Lignous* Body (to uſe the Doctors Terms) is plain in a Tranſverſe *Cut* of *Angelica Sylveſtris magna volgatior J. B.* for Example; the *Veins* there very clearly ſhew themſelves to an attentive view to be Diſtinct from *Fibres*, obſervable in the *Parenchyma* of the ſame *Cortical* Body together with themſelves; the *Milky Juice* ſtill Riſing beſides, and not in any *Fibre*. Alſo in the like *Cut* of a *Burdock* in *June*, the like *Juice* Springs on this and on that ſide of the *Radii* of the *Woody Circle*, that is, in the *Cortical* Body and *Pith* only. Again, where there is no *Pith*, there is none of this *Juice* to be obſerved, and conſequently none of theſe *Veins*; as in the *Roots* of Plants, and *Trunks* of Trees: but ever in the *Bark* of either. Theſe Particulars are plainly obſervable in the *Spondylium*, *Cicutaria*, many of the *Thiſtle* kind, *&c.*

Veins *in* Plants *Obſerved by Dr.* M. Liſter. n. 79. p. 3052.

Further, neither are they probably of the Number of the *Pores*, deſcribed by Dr. *Grew* in the *Cortical Body*, or *Pith:* Not ſurely of thoſe *Pores* extended by the *Breadth*, becauſe the Courſe of the Juice in theſe Veſſels is by the *Length* of the Plant; as *I* have ſometimes very plainly traced in the *Pith* of a Dryed *Fennel Stalk*, following them by Diſſection quite through the Length of the *Pith*. It remains, that, if *Pores*, they are of thoſe *Pores* of the *Cortical Body*, that are ſuppoſed to be Extended by the Length thereof; which yet ſeems (to me at leaſt) not enough: But we think them *Veſſels* Inveſted with their own proper *Membranes*, Analogous to the *Veins* of our *Humane Body*; for theſe Reaſons: 1. Becauſe they are to be found in the *Pith*, and ſometimes in the *Cortical Body* of a Plant, not included within the common *Tunicle* of any *Fibres*, as is above noted. That *Fibres*, or the *Seminal Root*, are *Cloathed*, is

moſt plain in ſome Plants, as in *Fern* and *Geranium Batrachoides*; the *Fibres* of the former are *Coated*, at leaſt in ſome Parts of the Plant, with a Black Skin, in the latter likewiſe with a Red one; and in theſe Caſes, had they not, I ſay, their own Proper *Membranes*, we ſee no Cauſe, why the very Porous and Spongy Body of the *Pith* and *Cortex*, ſhould not be in all places fill'd Alike with the Juice, and not Riſe (as moſt plainly it doth) in a Few Determinate and ſet Places only; that is, according to the Poſition and Order of theſe *Veſſels*. 2 Again the Experiment I made, concerning the Effect of a *Ligature* on *Cataputia minor Lobel. viz.* The ſuddain Springing of the *Milky Juice* out of Infinite *Pores* beſides the *Inciſion*; (The Cauſe of which *Phænomenon* I take to be the Diſſected *Veins* Impetuouſly diſcharging themſelves of part of their Juice within the *Porous Parenchyma* of the *Bark*; whence it is Probable, that if there was no *Coated Veſſel* to Hold this *Milky Juice*, we might well expect its Springing upon the bare *Ligature*, (as when we Squeeze a Wet Sponge) the External *Cuticle* of the Plant, as this Experiment ſhews, being Actually *Perforated*.

Vid. Sup. §. LXI.

In the next place it is very Probable, that theſe *Veſſels* are in all Plants whatſoever. For, as it is Truth-like of all the other Subſtantial Parts of Plants, that they are actually in, and common to all Plants, though ſpecified by Divers Accidents in Figure and Texture; ſo of theſe *Veins*, which though they be Diſcernable moſtly in thoſe Plants where they Hold *Diſcoloured Juices*, yet we may very probably think, that they are not Wanting, where the Eye finds not that Aſſiſtance in the Challenging of them. And in theſe very Plants, where they are Leaſt Viſible, there is yet a Time when they are, if not in all yet in ſome parts of theſe Plants, plain enough to the Naked Eye. The Tender *Shoots* of the *Greater* and *Leſſer Maple* in *May* are Full of a *Milky Juice*, *viz.* the known Liquor of theſe *Veins*. Again to this purpoſe, if you apply a Clean Knife Blade to a Tranſverſe Cut of the like *Shoots* of *Elder*, the *Gummy Liquor* of theſe *Veins* will be drawn forth into Viſible *Strings*, as is the Nature of *Bird Lime* of the *Bark* of *Holly*, or the *Milk* of *Cataputia minor Lobel.* Further, the *Leaf Stalks* of our *Garden-Rubarb* do ſometimes ſhoot (by what accident we enquire not here) a Tranſparent and very Pure *Chryſtalline Gum*, though the *Veins*, that Held this *Gummy Juice*, are by no ordinary means Viſible in them, and yet by Comparing the Nature and Properties of this *Gum*, with that of the *Gums* of other *Vegetables*, we cannot doubt but this *Gum-Rubarb* is the *Juice* of thoſe *Veins*, as well as we are aſſured, the *Gum* of other Vegetables to be of Theirs, by the ſame *Comparative Anatomy*. Laſtly, we think, that even *Muſhromes* (that ſeemingly Inferiour and Imperfect Order of *Vegetables*) are not Exempt and Deſtitute of theſe *Veins*, ſome of them yielding a *Milky Juice*, Hot and Fiery, not unlike ſome of the *Sparge*-kind, or *Euphorbium*;

The *Primary Uſe* of theſe *Veins* is, in my Opinion, to carry the *Succus nutritius* of Plants; Becauſe, where they are not, there is no *Vegetation*; as it is ſeen if an *Engrafted Branch*, or *Arm*, be Bared and ſtripped off the Clay, *&c.*

in

in *June*, all the Course of *Vegetation* will appear to have been made only by the *Bark*, and not by the *Wood*, that is, in the Place only where these *Veins* are. *A Secondary Use* is the Rich Furniture of our Shops: For from these *Veins* only it is, that all our *Vegetable Drugs* are Extracted, and an infinite more might be had by a Diligent Inquiry, and some Easy means which *I* have not unsuccessfully put in Practice.

To the foregoing Observations I shall here add others of Later Notice: as the *Skin* of a *Plant* may be *Cut* sheer off with Part of the *Spongy Parenchyma*, and no signs of *Milky Juice* follow, that is, no Breach of a *Vein*. Again, we have *Stript* the *Plant* of its *Skin*, by Pulling it up by the *Roots*, and exposing it to the Wet Weather, until it became Flaccid as a Wet Thong, without any Injury to the *Veins*, which yet upon *Incision* would Freshly *Bleed*. These Experiments, make against the General Opinion of *One* only *Sap*, Loosely Pervading the *Whole Plant*, like *Water* in a *Sponge*. n. 90. p. 5132.

In the *Transverse Cuts* of *Plants*, we see as it were a Certain Order and Number of the *Bloody Orifices* of Dissected *Veins*.

We observe also in a *Leaf*, which we take to be the Simplest part of a *Plant*.

1. That the *Veins* keep Company with the *Ribbs* and *Nerves* (as we vulgarly call them,) and are Distributed into all the Parts of the *Leaf*, according to the Subdivisions of those *Nervous Lineaments*, and are Disposed with them into a certain Net-work; whether by *Inosculations* or Bare *Contact* only, we pretend not to Determine.

2. That in a *Transverse Cut* of a *Leaf*, the Midle *Fibre*, or *Nerve*, for Example, seems to yield One Big *Drop* of a *Milky Juice*, Springing as it were from One *Vein*; yet the *Microscope* plainly shews us, that there are Many *Veins* which contribute to the making up of that *Drop*.

3. That if a *Fibre*, or *Nerve*, be carefully taken out of the *Leaf*, the *Veins* will appear in it, like so many small *Hairs*, or *Pipes*, Running along, and striping the *Nerve*.

4. That those many *Veins* are all of an Equal Bigness, for ought we have yet discerned to the Contrary.

5. That though we seem to be more Certain of the *Ramifications* of the *Fibres*, wherein those *Veins* are, yet we are not so, that those *Veins* do any where Grow *Less* and *Smaller*; though Probably it may be so. That which makes us Doubt it, is the exceeding *Smallness* of these *Veins* already; even where we might probably expect them to be *Trunk Veins*, and of the Largest size: And being there also in very great Numbers, and Running in Direct Lines along the *Fibre*, we guess that One or More of them may be Distributed and fall off on either Hand, with the Subdivisions of the *Fibres*, and not suffer any *Diminution* in their *Bulk*.

6. That we cannot Discern any where, throughout the whole Plant *Larger* or more Capacious *Veins*, than those we see adhering to the *Fibres* of the *Leaves*; which do also Appear, from Comparing the *Bleeding Orifices* in a Transverse Cut. I have found it a Difficult and Laborious Task to Trace, and Unravel them, throughout the whole *Plant*.

Our

Our Opinion is, that theſe *Veins* do ſtill keep Company with their reſpective *Fibres*. And as all the *Fibres* of the *Leaf* are joined in the *Stalk* of the Leaf, and that Stalk explicated in *Cloathing* the *Twig* or *Stem* of the *Plant*, (which we take to be the Reaſon of the Orderly breaking forth of the *Leaves*,) ſo do we think of the *Veins*, their Perpetual Companions.

And as we have ſaid, the *Fibres* of the *Leaves* are joined in the *Twig*; ſo are thoſe of the *Twigs* in the *Branches*; thoſe of the *Branches* in the *Trunk* or *Body* of the *Tree*. The like alſo in an Inverted Order we ſeem to obſerve in the ſeveral *Coats* and *Ramifications* of the *Root*. This the ſeveral *Circles* of *Bleeding Orifices* in Tranſverſe Cuts, ſeem to Confirm.

But moreover in the *roots* of *Plants*, if a Simple *Coat* be Separated and Expoſed betwixt your Eye and the Light, the *Veins* appear to be ſtrangely Entangled and implicate, and not in the ſame ſimple Order as in the *Leaves*. The like we think of the *Bark* of the *Bodies* of Trees which we cannot diſtinguiſh from the *roots* of *Plants*: Though there is indeed, ſomething (at leaſt at Certain Seaſons of the Year) in the *Root*, which is not to be found in any Part of the *Plant* beſides.

From what hath been ſaid, it may well be Doubted, whether there is any *Sinus*, or *Common Trunk*, into which all the *Veins* are Gathered: But rather, that there are a Multitude of *Equally big Veins*, each exiſting a-part by it ſelf. We indeed have found it very Difficult, ſo to exhauſt the *Plant* of its *Milky Juyce* as to Kill it, though we have given it very many *Inciſions* to that purpoſe. Diverſe other Inſtances there are, which favour the *Diſcontinuance* of the *Veins*, and the little Relation and Intercourſe they have with one another; as one *Branch* of a Tree having fair and well grown *Fruit*, before the other *Branches* of the ſame Tree and Fruit *Bloſſom*, or have *Leaves*; from the different Situation and other Circumſtances of *Culture*; the Indefinite and perpetual Growth of a *Tree*; the *Cyon* governing, *&c.*

The Subſtance of theſe *Veins* ſeems to be as truly *Membranous*, as the *Veins* of *Animals*. A *Leaf* will not Give way and be Extended, but the *Veins* in a *Leaf*, if freed of all the *Woody Fibres*, will be ſtretched out to One Third Part at leaſt, and Vigorouſly Reſtore themſelves again, juſt like a *Vein*, *Gut*, or any other *Membranous Ductus* of an *Animal*. Again, theſe *Membranous Pipes* are exceeding Thin and Tranſparent, becauſe they ſuddenly Diſappear, and Subſide after their being Exhauſted of their *Juyce*; and particularly, in that we ſee the *Liquor*, they hold, quite through them; no otherwiſe than the *blood* through our *Veins*: or (in *Chelidonium majus*, for Example) a *Tincture* of *Saffron* in *Criſtalline Pipes*.

In the Keeneſt *Froſt*, which happened the Other *VVinter*, we Diſſected the *Frozen Leaves* of the *Garden Spurge*. Here we obſerved, that all the *Juyce* (beſides that which theſe *Veins* hold) was, indeed, *Frozen* into perfect hard *Ice*, and to be Expreſſed out in the Figure of the *Containing Pores*; but the *Milky Juyce* was as *Liquid* as ever, but not ſo Brisk as in Open Weather. This Experiment we take to be good Proof of the Perfection of this *Milky Juyce*, and that it hath within it ſelf ſo Great a Degree of *Fermentation*, that it preſerves it ſelf, and conſequently the whole *Plant* from the

Injuries

Injuries of the *Weather*; that is, the *Plant* owes its *Life* to it. Thus we have ſeen *Inſects* (as *Hexapode worms*, *&c.* lie *Frozen* upon the *Snow* into very Lumps of *Ice*, and yet put under a *Glaſs*, and expoſed to the Warmth of the *Fire*, they quickly Recovered their *Legs* and Vigour to eſcape; which we think could not be, unleſs the *Vital Liquor* of their *Veins*, as in this Inſtance of *Plants*, had been untouched, and little concern'd in the *Froſt*. Further, we hence alſo urge the Different Uſes as well as Natures of theſe *Juices*, and look upon the *Frozen Icicle*, or that Copious Dilute and Limpid *Sap*, as *Alimental*, the *Milky* and *Not Frozen Juice*, as the only proper *Venal*.

As to the *Motion* of theſe *Juices*, theſe Things are certain:

1. That the *Milky Juyce* always *Moves* and Springs briskly upon the *Opening* of a *Vein*: The *Limpid Sap*, but at certain Seaſons, as it were by Accident, and not (as I judge) from any *Vital Principle*, or *Fermentation* of its Own.

2. The *Venal Juice* hath a manifeſt *Inteſtine Motion*, or *Fermentation*, within it ſelf. Witneſs (beſide what hath been juſt now ſaid of it) its Contributing (and the Long Continuance of) that *Motion* to the moſt Inſenſible of *Liquors*; and likewiſe its Thick and Troubled *Bleeding*, like the Riſing of *Yeaſt*, which yet in a few Hours after Drawing, falls, and the *Juice* becomes *Tranſparent*, as the *Gum* of the *Virginian Rhus*, *&c.*

We think indeed, (according to the Knowledge we yet have of the *Parts* of *Plants*) that theſe *Juices move* by a far different Contrivance of Parts from that of *Animals*; not yet here Diſcovering any Uniting of *Veins* into one *Common Trunk*, or *Pulſation*, no ſenſible *Stop* by *Ligature*, no *Difference* in *Veins*, *&c.* All which Difficulties, notwithſtanding, may, I hope, in time be Happily Overcome, and the *Analogy* betwixt *Plants* and *Animals*, be in all things elſe, as well as in the *Motion* of their *Juice* fully Cleared.

There ſeem to be in *Plants* manifeſt *Acts* of *Senſe*: We inſtance in the ſudden *Shrinking* of ſome *Plants*; the frequent *Cloſing* and *Opening* of *Flowers*; the Critical *Erecting* of the *Heads* of *Poppies* from a *Pendulous Poſture*; and particularly the *Vermicular Motion* of the *Veins* when Expoſed to the *Air*. Again, the *Veins* of *Plants* may indeed be different, though at preſent we cannot tell wherein they are ſo; the *Arteries* within our *Heads* are hardly to be known by the Eye from the *Veins*. Further, there are natural and Spontaneous *Excretions* or venting of Superfluous Moiſture in *Plants*, Viſible and Conſtant, in the *Crown Imperial*, *Rorella*, *Pinguicula*, *&c.* As to the *Ligature*, as it hath been hitherto applied by us, it is not to be relyed on for the Diſcovery of this *Motion*; the *Veins* only of *Plants*, being the Parts probably *Diſtendable*.

Laſtly, We muſt either take that away from the Other Reaſons given of the Neceſſity of the *Circulation* of the *Blood* in *Animals*, *viz.* The Hindring of its Breaking and Clodding; or we muſt grant the ſame *Motion* to the *Venal Juice* in *Plants*. We have Undeniable Experiments to ſhew, that the *Venal Juice* of *Plants* and the *Blood* of *Animals* agree in this, That they Both, when they are once drawn from their Reſpective *Veins*, do forthwith

Break

Break and Coagulate; and that the *Serum* in the One, as well as in the Other, becomes a *Stiff-Gelly* by a little ſtanding. And this Variety of Experiments hath Taught us, that Probably more Uſeful *Preparations*, and certainly a Truer *Analyſis* and *Separation* of the Parts of *Vegetable Drugs*, may be Effected, whilſt they are in *Bleeding* and *Liquid*, than after they are once become *Concrete*, and have loſt their *Natural Fermentation*.

By Dr. Wallis. n. 95. p. 6060.

2. The *Veins* of *Plants*, which Mr. *Liſter* Obſerves not to be *Ramified*, but rather *Bundles* of them *Divaricated*, repreſent the *Nerves*, which (as Dr. *Willis* obſerv'd) go together in that which ſeems the *Common Trunk*, like a *Bunch* of *Threads*, which after *Separate*, and are variouſly *Divaricated*, and theſe *Nerves* being Cut, Shrink up as the *Veins* of *Plants*) as much, or more than do the *Veins* or *Arteries* of *Animals*.

De Cerebro c. 15. 19.

Dr. *Willis* Obſerves alſo, that there are two Sorts of *Nerves*: One ariſing from the *Cerebrum*, Subſervient to *Voluntary Motions*, which properly belong to the *Functions* of *Senſe*; the other from the *Cerebellum*, ſubſervient to the *Involuntary Motions*, which chiefly belong to the *Functions* of *Vegetation*. And to theſe latter ſeem Reducible thoſe *Acts* of *Senſe*, which Mr. *Liſter* ſpeaks of, in *Plants*.

The Nature and Differences of the Juices *of* Plants; *by Dr.* Liſter. n. 224. p. 365.

LXIV. We obſerve that Moſtly, *Juices* of Plants *Coagulate*, whether they be ſuch as are Drawn from the *Wounds* of a Plant; or ſuch as do *Spontaneouſly Exſudate*: And yet even that *Exudation* ſeems to be often Accidental too, that is, by *Cancer*, or ſome Other ſuch like Chance.

And yet I am Uncertain what to think of the ſmall *Purple Blebs* and *Veins* to be Obſerved, more or leſs, on all the *Hypericum* Kind, and on the *Threds* of the *Flower*, and the *Hairs* which cover the *Leaves* of *Rorella* in like manner. I doubt much, whether this may properly be call'd an *Exudated* and *Coagulated Juice*, or no? Our Obſervations of thoſe of this Tribe, are what follow.

Purple Juice.

The Small *Green Leaves*, next encompaſſing the *Yellow Flowers* of *Androſæmum Hypericoides Ger.* are ſet with very ſmall Round *Blebs*, full of a *Purple Juice*; as are likewiſe, but with Two or Three only, the very Points or Tops of the *Yellow Leaves* themſelves: Yet the *Stalk* Cut, doth not to the Eye diſcover any ſuch Diſtinct *Veſſels*, carrying that *Purple Liquor*, which makes me ſuſpect it is ſeperated by *Coagulation* from the reſt of the *Juice*, and reſerved in thoſe ſmall *Bags*.

Hypericum Ger. The *Purple Juice* yielding *Blebs*, in this *Point* are upon the Edgings, on the Out-ſide of all the *Leaves* Alſo the *Stalk*, tho' *Round*, hath a Double Edge, on each Side One; and the *Blebs* or *Bags*, tho' but Thinly, are yet obſervable on theſe very Riſing Edges too of the *Stalks*. As for the *Yellow Flowers* themſelves, the Outmoſt *Green Leaves*, next and immediately encompaſſing them, have but a few *Purple Stripes*, but the *Yellow Leaves* or *Flowers*, are Edged with ſmall *Purple Bags* on the One Side, and Striped with *Purple Juice* yielding *Veins* on the other. *Laſtly*, On the very Tops of each *Thread* in the *Flower*, is one Single *Purple-Bag*.

Hypericum

Hypericum Aſcyron dictum, Caule Quadrangulo, J. B. In like manner, all the Edges on the outſide of all the *Leaves*, from one end of the *Stalk* to the other, of this *Plant*, are very Thick ſet with *Purple Bags*. Alſo in the *Flower*, all the *Threads* have One Single *Bag* on the Top; but the *Flowers* or *Yellow Leaves*, and the *Green* Ones encompaſſing them, have very few *Purple* Spots or Streaks viſible.

Hypericum Pulchrum Tragi, J. B. Only the *Yellow Flower-Leaves*, and thoſe *Green* ones which next encompaſſes them, are thick Edged with *Purple Blebs*.

Diverſe parts of the ſame *Plant* have diverſe Faculties, *V. C. P. A.* I add, that diverſe Parts of the ſame *Plant*, yield from the ſame *Veins* different Coloured *Juices*. *v. g.* The *Milk* in the *Root* of *Spondilium Ger.* is of a *Brimſtone Colour*; but in the *Stalk*, *White*.

Amonſt thoſe *Juices* that *Coagulate* and are *Clammy*, ſome there are which readily *Break* with a *Whey*.

In the middle of *July*, I drew and Gathered of the *Milk* of *Lactuca Sylveſtris coſta Spinoſa, C. B.* which it freely and plentifully affords. It ſprings out of the *Wound* Thick as Cream, and Ropes, and is White; and yet the *Milk* which came out of the *Wounds*, made towards the Top of the *Plant*, was plainly Streaked or Mixt with a *Purple Juice*, as though one had daſhed or ſprinkled *Cream* with a few Drops of *Claret*. And indeed the *Skin* of the *Plant* thereabouts was *Purpliſh* alſo, perhaps with *Veins*. Again in the Shell I drew it, it turned ſtill *Yellower* and Thicker, and by and by *Curdled*, that is the White and Thick *Caſeous Part* did ſeparate from a Thin *Purple Whey*. So the *Blood* alſo of *Animals*, whilſt Warm, remains Liquid and Alike: But ſo ſoon as Cold it Cakes, and has a *Serum* or *Whey* Separated from it. Alſo the *Caſeous* part of the *Milk* of *Animals* is Glutinous and Stringy. Further, this *Serum* came freely from the Other, by Squeezing betwixt my Fingers; and the *Curds* I waſhed in Spring Water, which became immediately like Rags and Tough, (draw this *Milk* immediately, or let it fall off the *Plant*, into a Shell of fair Water, or other *Menſtruum*; as *Vinegar*, *S. V. Spirit* of *Vitriol*, or *Sulphur*, &c.) and remained ſtill White and Dry. As for the *Purple Whey*, after a Days Inſolation, it ſtifned and became Hard, and was eaſily formed into *Cakes*; which *Cakes* were yet very Brittle, and would eaſily Crumble into Powder. About *December* following, I broke one of the *Cakes*, made of the *Caſeous* part of the *Milk* of this *Plant*; it then proved very Brittle, and ſhined, upon *Breaking*, like *Roſin*: It was then of a Dark *Brown* Colour; moreover it *Burned* with a Laſting Flame, like *Roſin* or *Wax*; and that being *Melted* by Heat, it would draw out into Long Tough Strings, like *Birdlime*. On the contrary, the *Purpliſh Powder*, which was the *Whey*, if put into the Flame or a Candle, would ſcarce *Burn* with a Flame at all, but ſoon be turned into a Coal. Laſtly, the *Purple Powder* did Taſte very Bitter; whereas the *Caſeous* part was *Inſipid* as *Wax*.

The *Milk* which the *Trachelium* Kind plentifully yields is very thick, and preſently *Curdles*; the *Serous* part, or *Whey* being of a *Brown* Colour. Theſe

Juices ſmell *Sowr*, ſomething like the Slices of Green *Apples*, which have been long Cut.

The Thin *Milk* of *Tithymalus Helioſcopius Ger.* Springs freely and plentifully; it is very *Clammy* upon the Fingers; it is very *White* in Drawing; it turns upon a Lancet, of a *Dark Blewiſh:* and indeed, it is both of the Colour and Conſiſtence of Blue Skim'd Milk; made up with Wheat Flower into Cakes, it ſhews it ſelf *Greaſie* or *Oily*, and ſcarce ever Dries. It very hardly *Breaks* or *Coagulates*. I kept ſome of it pure and unmixt, in little Eſſence Bottles, ſtopp'd lightly with Cork only; in theſe it *Broke* in proceſs of time, and the *Curds* were eaſily to be formed into Cakes; which Cakes *Burned* with a Laſting Flame, and being *Melted*, Drew forth into Strings like *Wax*; the *Whey* was *Clear* and like fair Water. This *Broken Milk* in all my Bottles was very Corrupt and Stinking: But the *Cakes* I made up of this Juice, with *Wheat Flower*, and a little *Gum Arabick*, Dryed well, and kept Sweet.

Juices caking *and not letting go their* Whey.

Other *Clammy Juices* there are, which do not let go a *Whey* when they *Coagulate*, but *Cake* altogether.

I made Cakes of the Sole or Unmixt *Juice* of *Sonchus Lævis & Aſper*, without any Addition, and it parted not with any *Whey*.

Papaver Rheas Ger. Bleeds freely a *White Juice*, and the *Heads* or *Seed-Veſſels*, when the *Flower* is gone, do yet Bleed. I obſerved, that in Gathering it into *Shells*, it preſently turned its *white* Colour into a *Yellow* one, inclining to an *Orange*. At firſt ſpringing it Roaped, or was but little *Clammy*, and ſeemed to be very Liquid and Dilute; yet it did not part with any *Whey*, but grew *Stiff* ſoon, and is very *Reſinous* and *Oily*.

Note. The *Milks* or *Juices* of *Plants* ſeem to be Compounded, and mixt of Liquors, of Different and perhaps Contrary Qualities: So that it is probable, if the *Caſeous* part ſhall be *Narcotick*; for Example, the *Whey* may not be ſo; or the One may be Hurtful, and the other a Good and Uſeful Medicament.

Tragopogon Flore luteo, J. B. Yields a *Juice*, which upon the Firſt Springing from the *Wound*, is *white* and Thick, but immediately it turns *Yellow*, and then *Redder* and *Redder*; it is of no Unpleaſant Taſte; it is ſomething *Glutinous*, and very *Oily*, and parts not with much, if with Any *Whey*, and therefore it is eaſily formed into *Cakes* alone.

Convolvulus major, J. B. Bleeds freely a *white Juice*, as I experienced in the middle *of Auguſt*; not only the *Stalk* and *Leaves*, but the *white Flowers* alſo in proportion, Bleed as plentifully as any part elſe. This *Milk* is very Sharp.

Saffron Coloured Juice.

There is alſo a *Juice* of a *Saffron Colour*, which *Chelidonium majus Ger.* wounded, freely affords; this *Juice* breaks not with a *Whey*, but is eaſily formed into *Cakes*, and ſtiffens in the Sun; it is thick, and of the Conſiſtence of Cream, upon the Springing forth of it, from the *Wound*.

There is another very *Clammy Juice*, which is of a *Golden*, or *Yellow Colour*, upon Drawing; and this the *Seed Veſſels* of *Centaurium Luteum Perfoliatum, C. B.* in *July*, and after, even wherein the *Seed* therein contained

are

are turned Black and Ripe, yield plentifully and freely enough. (Theſe *Juices*, which the *Heads* or *Seed Veſſels* of Plants afford, may be thought of the ſame Nature with thoſe *Juices* which the *Pulp* of *Fruits* afford; the *Pulps* of *Fruits*, and theſe *Exterior Veſſels* being parts Equivalent; that is, *Apples*, for Example, are nothing elſe but the *Seed veſſels* of their *Kernels*;) It is *Liquid* upon firſt Drawing, and after a while it Thickens, parting with No *Whey*; (*N. B.* I call this *Coagulating* too) and this is of the Colour of *Amber*; it ſticks to ones Fingers, and pulls forth into Threads like *Bird-Lime*; it would never become Harder than very ſoft *Wax*, and that by being Dryed in the Shade only, for if never ſo little expoſed to the Heat of the *Sun* and *Fire*, it ſtraightway became exceeding Soft. But as for the *Cakes* *I* made up of it and Wheat Flower, them *I* found in my Cabinet in Winter very Hard and Firm, and the Unmixt *Cakes* ſtill ſoft. Theſe *Burn* with no Unpleaſant Smell; they Emit a Laſting Flame; they ſtill keep their *Amber Colour*, and draw out in Threads, in Burning like *Wax*.

To this we may add the the *Yellow Juice* which the Wounds of *Angelica Sativa Park* yield; it will not harden by *Inſolation*, or Long Keeping (for *I* have had an Eſſence Bottle of it by me this two Years) yet I perceive it Stiffens and will Draw into Threads.

The next ſort of *Coagulate* and *Clammy Juices*, we have taken notice of are *Gums*; and ſome of them ſeem long to abide *Liquid*, and perhaps *Inflamable*; Others there are which grow *Hard*, and are not to be kindled into a *Flame*. They are eaſily to be diſſolved in Fountain Water, (the *Gum* of *Rhubarb* and the *Leaves*, For Example) and do Sparkle when put into a *Flame*: Which two Natures Argue a *Serous* or Watriſh Part in them. Again, put into a *Flame*, they *Melt* and becomc as it were *Liquid* and *Ductible*; which ſhews the *Caſeous* Part in them. And becauſe they will not *Flame*, it is an Argument of their Leanneſs and Scarcity of *Oil*. All three put together, plainly Evince, *Gums* to be *Coagulate Juices*. Gums.

In *Auguſt I* have obſerved the Cluſters, both Green and Ripe, of *Periclymenum*, *Ger.* very Leaky; which upon Nearer and Heedful Inſpection I found to be a Thin *Clammy Juice*, or *Liquid Gum*, which fell down upon the *Leaves*, and keeps its *Liquid* form there.

Here the *Purple Juice* ſeems to be a *Whey* ſeparated from the *Liquid Gum*: But, I am of Opinion, it's a Diſtinct Liquor.

Again the *Red Threads* of *Rorella* End, or are Topped, with little *Bags*; which being Compreſſed do yield a *Purple Juice* (as we above noted in the *Hypericum*) and thoſe ſmall *Buttons* on the very Tops of thoſe *Threads*, are encompaſſed with ſmall Tranſparent Pearls or Drops of a *Liquid Gum*. They abide in this form the Hotteſt Summers Day like *Dew*, whence alſo the *Plant* has its Name; and upon the Leaſt Touch Cleave to your Fingers, and Draw out into Long Threads like *Bird-Lime*.

In like manner a *Liquid Gum* (but that it ſtands not upon ſo Long Threads, and is much Thicker bedewed) you may obſerve upon *Pinguicula*. *Note well*, That the ſmall *Drops* and *Threads*, or *Hairs*, in either of theſe

Two *Plants*, are to be ſeen upon the Uppermoſt or Inmoſt ſide of the *Leaf*; and the Utmoſt and Undermoſt is Smooth or Void of them; which is ſomething contrary to all other *Plants I* have Obſerved.

Methought *I* obſerved about *Mid-Auguſt*, the *Chats* of the *Alder* to be *Gummy*. Perhaps it did Exudate from the *Plant* it ſelf; as *I* gueſs the *Honey-Fall*, or *Gummy Dew* to be obſerved upon the Leaves of the *Oak*, &c. are Nothing Elſe.

Hard-Gums. The *American*, or *Indian Rhubarb*, Sown in our Gardens, is the Only *Plant* that *I* have Met with, or ever Saw, which Yielded a *Gum*; and yet becauſe it is of the very Kind with our Common *Sorrels* and *Lapathums*, *I* believe it not Impoſſible, that even from our own Store, *Herb-Gums* might Someways or Other be had. *I* ſay, that off the *Stalk*, or indeed off the *Leaves* of the *Indian Rhubarb*, *I* have gathered an *Ounce* at a time in *June*, of very *White*, and *Clear*, and *Hard-Gum*; in both Thoſe Years *I* obſerved it to *Flower* with us, as 1670. and in that Year it did Not, 1669. It exudates from all Parts of the *Stalk* and *Ribs*, on (*Note well*) the Underſide of the *Leaf* it ſelf. *I* Gatheed ſome in the Form of Good Big Drops; Others as though the *Stalk* had been Beſmeared with it; Others ſhot into Long and Twiſted Wires, or Icicles. Moreover *I* obſerved, that the *Cankered* Orifices or Places where the *Gum* had burſt forth, might be followed into the *Stalk* with a Knife; and that through the *Skin*, in Certain Places, *I* could ſee that the *Juice* within the *Plant* was turned *Gummy*, and looked Clear like Ice.

Cat. Pl. Ang. App. p. 325, 334. It is the Experiment of Mr. *Fiſher*, that the Clear and Defecated *Juices* of moſt *Plants*, have more or leſs *Redneſs* in them. Again, That the *Dryed Root* of *Acetoſa* (a Plant of the Family with *Rhubarb*, which may Well be Called *The Indian Sorrel*, or *Sower Docken*) Boiled, doth Dye Water with a fair *Red Colour*. And *I* have obſerved, that the Unripe Seeds of *Rhubarb*, yield a very Fair and Deep *Purple*, I mean the *Husk* of them. Conſider what hath been ſaid above of *Rorella*, and the *Hypericum* Kind, concerning their *Purple-Juice yielding Blebs*. *Note* alſo here to this Purpoſe what we have ſet down above, that *Rhubarb*, and *Sorrel*, &c. do when they Decay turn *Red*.

The *Juice* Extracted from the *Roots* of our *Engliſh Rhubarb*, by a Tincture of Fair Water Steamed away, is Nothing elſe but a Lean *Uninflamable Gum*; and though it Differ in Colour (perhaps from the yet *Woody* Parts in it, as being of a Deep *Liver Colour*) from the Exudating *Gum*; yet in Other Natures, as this of being *Uninflamable*, *Ductible* in the Flame of a Candle, *&c.* it Agrees with it. *I* may not omit, that the Repeated *Cuts I* gave the *Stalk*, on purpoſe to have the *Gum* that way, failed my Expectation. This *Gum* is Sweet or rather of no Taſt at all.

To this Purpoſe *I* Remember in Summer time to have ſeen, even the *Juice* of *Apples* ſpontaneouſly Gellied in *Languedoc*, and the *Apples* to look Clear and Hard like *Ice*, Whence they call that ſort of *Apple Pome Gellée*, or the *Frozen Apple*: Though indeed, it be nothing elſe but the *Breaking* or *Coagulating* of the *Juice* in ſome Spots of it; for it is Rare to ſee one of them all over ſo.

We

We may here give a probable Reaſon, why a Gentle *Infuſion* or *Maceration* of *Rhubarb*, is a very ſure *Purge*; but the *Subſtance* or Powder of *Rhubarb*, or a *Decoction* thereof, will have a Quite Contrary Effect, and *Bind*. We may I ſay, think that the Sharp and Tart *Juice* in *Rhubarb*, wherein its *Purging* Faculty lies, is by a Gentle *Infuſion* ſo Extracted, that it turns not to *Gum* in our *Stomach*; For I cannot think, that the *Sower Juice* of *Rhubarb*, is a ſpecifically Diſtinct Liquor from the *Gum*, which *I* believe to be only an Accidental *Coagulation*

Green Plumbs or *Sloes* do often break forth with a *Gum*, which is Clear and Tranſparent: and it ſeems to Haſten, if not Ripen, at leſt the Red Colour. I have *Cut* them, to the end that *I* might have Gathered *Gum* in the *Wounds*: which indeed *I* did, but yet long after, when the *Wounds* ſeem'd to be *Canker'd*, and that but in a ſmall Quantity to what they voluntarily ſpend.

Lauro ceraſus, a Beautiful *Winter-Green*, which we have adopted to adorn our *Courts Walls* with, yields a *Clear Gum* very plentifully: It is very *White* and very *Clear*.

There are Other Sort of *Juices*, which will not of themſelves, that *I* have obſerved, Exudate out of the *Wounds* of their reſpective *Plants*.

Lime or Stringy Juices.

I Wrenched and *Wounded* the *Holly* the latter end of *March*, and yet after ſome days of Warm and Open Weather, I could not perceive the leaſt Stirring of *Juice*: The latter end of *May*, the *Bark* begins to be full of *Lime*, which you may Try, by Preſſing a Piece of it between your Fingers, and when you would take them off, the *Juice* or *Lime* Draws out into *Hairs*, and follows your Fingers; Cleaving to them like ſmall Threads.

Bird-Lime. Cat. Plant. Ang.

This *Lime* or *Juice* is Separated or taken out of the *Bark* thus; Peel off the *Bark* the Months of *May*, *June*, or *July*; for it then Comes eaſily Away, and moſt abounds with *Juice*: Boil the *Bark* in Fair Water, until it be ſo Tender, that the utmoſt Thin Grey *Bark*, or *Membrane*, Peel eaſily off: lay it ſo Peel'd, and Cover it Over with *Green Nettles* or *Tern*, or ſuch like, *S S S.* in a Cellar for about 10. Days, where it will Ferment or Rot, and become Mouldy: Take them out, and Beat them well in a Mortar to a *Paſte*, and Roll them up into Small Hand-Balls; and in a Running Spring waſh them Clean, from all the *Woody* or Sticky Parts; which is Effected by Pulling and Teaſing them. But *Note well*, that Great Care is to be taken in the *Waſhing* of the *Balls*: for beſides that they muſt, if poſſible, be forthwith waſhed, the *Lime* will all get from you, except you ſo order the matter, by engaging it with your Fingers that it Entangle. You would Imagine, that upon Breaking one of the Balls, that there was little or no *Lime* in them, ſo freely they Moulder and Crumble. After it is once Engaged throughly, it will endure waſhing; and the Clearer you take away the woody Parts, the Better it is.

In cutting the Tender Tops of *Elder*, the latter end of *May*, there will a *Stringy Juice* follow your Knife, and Draw out in *Threads*, ſomewhat like *Bird Lime*, or the *Juice* of *Holly*: It ſeems to be in certain *Veins* juſt within the *Circle* of Teeth or Wood.

Further

Oily Juices. Further the Diſſected *Veins* of many *Plants* afford us *Oil*; that is ſuch a *Juice* which being Rubbed betwixt one's Fingers, is not at all *Clammy*, but makes them Greaſy and Glib. Some of it Stiffens not, as far as I have yet Experienced: yet *I* believe it to be *Coagulate* and Mixt

VVe will Inſtance in the *Juice* of *Helenium, ſive Enulo Campana, J.B.* You may take it off with a Clean Knife, whereon it looks like *Oyl* mixt with *Water*; that is, the Thin or Dilute *Juice* of the *Plant*, Springing up out of the *Wound*, together with the *Oil.* The like Experiment may be made upon *Cicuta.* The *Juice* of *Angelica Sativa Park.* I found Altered, after a Year's keeping, and grown very *Limy.*

Tapſus Barbatus Ger. If you ſtrip off the *Leaves* in *June*, it ſeems to yield an *Oily Juice*, but very much Thinned with the *Watery* One. It Springs freely enough; it is of a *Dark-Green* Colour, and I took it in wheat Flower and made it up in *Cakes.*

Alſo the *Fruits* of many *Plants* afford *Oils*, as *Olivæ, Bacci Lauri, Hederæ Juniperi Cornus Fæminæ*, &c.

The *Pulp* of Moſt *Seeds* ſeem to abound with this *Oily Juice*, and at ſometime before their Maturity, it is Liquid and Viſible in them, in the Form of a *Milk.*

Helleborus niger Syl. Adulterinus, etiam Hyeme Virens, J. B. The *Seeds* of this *Plant*, the latter end of *May*, is very *Milky*, and by Inſolation is eaſily formed into *Cakes*, which are yet very *Oily*, and being long Kept, I have expoſed to the *Flame* of a Candle which they received and Burnt freely; Sparkling not very much, and not then neither being *Clammy* at all. One thing *I* muſt not omit, that this *Milk* or *Juice* of the *Seeds*, is of a very Fiery and Stinging Nature: for when *I* Cut the *Seeds* out of the *Green-Pods*, they ſtruck my Eyes, no Otherwiſe than *Onion* is wont to do. Moreover the Tops of my Fingers, which were wetted with this *Juice* did Boaken and Ake, as when after Extream Cold, one has the *Hot-Ach* in them: and that Pain Continued in them for ſeveral Days, and at length the Skin of my Fingers End Peeled off.

Diacodium Album, is a Medicament of the *Seeds* of *Poppey.*

Roſins. There are Other *Oily Juices* which after *Coagulation* Harden and are called *Roſin*: and ſuch our *Ivy* yields abundantly. Hither alſo may be referred the *Juice* of *Juniperus Vulgaris Baccis Parvis Purpureis, J. B.* which is a *Hard Fat Juice* and not much *Gummy.*

In the Chops of *Ivy* made in *March*, there did Exudate a Thick matter like *Barm*; *Yellowiſh* and *Greaſie*: It *Melted* like *Oil* betwixt my Fingers, not having the leaſt *Clammineſs* then perceivable. In Proceſs of Time it *Hardned* and *Cruſted* on the *Wounds* like Courſe Brown *Sugar.* It Burns with a Laſting Flame, and Smells very ſtrong.

Alſo on the Top-moſt *Leaves* of *Lactuca Syl. Coſta Spinoſa, C. B.* In *July* many ſmall Drops or Pearls of an *Oily Juice*, Coagulated and Hardned *Roſin* like, are Plain to be Diſcerned, eſpecially with a ſingle *Microſcope*: They are of an *Amber-Colour* and *Tranſparent*; eaſily to be wiped off,

as

as being an *Oily Juice* Exudated. And I am of the Mind, that even the *Blew Flower* of *Ripe Plumbs* is nothing elſe, but a Fine *Reſinous Coagulation* of the *Tranſudated Juice.*

On the Underſide of the *Leaves*, and all over the *Stalk* of *Bonus Henricus*, *J. B.* do ſtick infinite ſmall Tranſparent *Pearles:* Thoſe clear *Drops* are *Hard* to the Touch, and feel like Greaſy Sand; not *Clammy*, and therefore it was well called *Unctuoſe* by *C. B.* and we put this Spontaneouſly Exudated *Juice*, amongſt the *Reſinous Coagulations.*

The *Juices* of *Plants* are alſo Varied and Diſtinguiſhed by *Fermentation.* And not only the *Juices* of *Fruits* are to be *Wrought*, or ſet a *Working*; as of the *Apple*, *Pear*, *Briar*, *Grape*, *&c.* as is well known: But there is an Artificial Change, *viz. Malting*, to be made even in the *Seeds* of *Plants* ſo as to make them ſpend Freely, or Let go their *Juices*, and Communicate them to Common Water, and receive a *Ferment.* Alſo the *Juice* of the Roots *Glycyrrhiſa* will *Ferment.* Alſo the *Juice* of the *Cane*, as *Sugar.* Again the *Tapped Juices* of *Vegetables* (wherein my Obſervations are Limited) are ſuſceptible of a *Ferment.* As for inſtance;

The 21. of *Apr.* 1665. about 8 in the Morning I bored a Hole in the Body of a Fair and Large *Birch*, and put in a *Cork* with a *Quill* in the Middle, after a Moment or two it began to Drop, but yet very Softly: Some 3. Hours after I returned, and it had filled a Pint Glaſs, and then it Dropped exceeding Faſt, *viz.* every *Pulſe* a Drop. This *Liquor* is not Unpleaſant to the Taſte, and not Thick or Troubled: Yet it looks as though ſome few Drops of *Milk* were Spilt in a Baſon of Fountain Water. There are many Ways of *Fermenting* or ſetting this Juice a *Working*, that is, of keeping it from *Coagulating.*

The *Maple*, both that which is Miſcalled the *Sycamore*, and the *Leſſer*, *Bleed* a *Fermentable Juice* Copiouſly, in the Breaking up, of *Hard Froſts.*

Alſo the *Willow*, *Wallnut*, *Poplar*, *Whicking*, are all ſaid to *Bleed* in their Seaſons a *Vinous Juice.*

To *Extract* the *Juice* of *Vegetables*, as *Opium* for Example (as is uſual in the Beſt Preparations and Methods of making *Laudanum*) with *Spirit of Wine*, is not probably to Separate any One part of that *Coagulate Juice* from the Other, as the *Serum* or *Whey*, (for Example) from the *Caſeous* part of the *Juice*, but only to Depurate or Defecate the *Opium:* For *S. V.* ſays Mr. *Boyle* will diſſolve *Gum Lacc. Benzoin*, and the *Reſinous* parts of *Jallap*, and even of *Guajacum*, which are *Coagulations* and Mixt *Juices*; and the ſame we may think of the *Juices* that are Extracted by *S. V.* from other *Herbs* that they are Mixt.

Alſo, thoſe otherways of Roaſting and Drying *Juices*, upon Plates over a Gentle Fire, until they will Rub to Powder, gives no great Satisfaction to me, that the *Narcoſis* of *Opium*, for Example, is gone or Separated, becauſe the Dryed *Juice* leſs offends the Noſe; that is, *Smells* not ſo ſtrong.

The *Whey* of *Lact. Vol.* will be only Diſſolved in Cold Water, the *Curds* Wholly refuſing to Mix with it. So that Simple Water, perhaps is the beſt *Menſtruum*, and Really *Separates*, what *S. V.* only *Depurates.*

LXV. That

Herbs of the ſame Make *and* Claſs *for the Generality have the like*, Virtue; *by Mr.* Ja. Petiver. n. 255. p. 289.

LXV. That *Plants* of the ſame *Figure* or *Likeneſs*, have for the Generality much the ſame *Virtues* and Uſe, will not be thought an Improbable Conjecture, if we conſider that the *Organs* and *Structure* of all *Plants* of the ſame Family, or *Claſs*, muſt have much the ſame *Veſſels* and *Ductus*'s to Conſummate that Regular Formation, and Conſequently the *Juices* Circulated and Strained thro' them, cannot be very *Heterogeneous*; and that as for the Moſt part, the Scent and Taſt have great Affinity, ſo of Courſe their Virtue likewiſe cannot be very Diſſonant.

1. As for inſtance, the *Tribe* of *Umbelliferous Herbs*. It's the Property of theſe *Herbs* to have the Poſition of their *Flower-Branches* to proceed from one *Baſis* or *Center*, which expand themſelves into an *Umbel*, whoſe *Flowers* conſiſt of 5 Irregular or rather Unequal, (that is, Differing in Shape and Bigneſs) *Pentapetaloſe Leaves*, from whence their *Seed* are Produced, which are *Naked* or *Double*, or by their Splitting, ſeem ſo. This *Genus* I generally obſerve to be endowed with a *Carminative* Taſt and Smell; they are Powerful Expellers of Wind, and are therefore Good in all *Flatulent* Diſeaſes, and of Great Uſe in the *Chollick*, *&c.* To inſtance a Few, for Example, as *Anniſe*, *Caraway*, *Cummin*, *Angelica*, *Smallage*, *Parſly*, *Lovage*, *&c.* The Greateſt Virtue of theſe *Plants* lies in the *Seed*, and Next in the *Roots*, and in the *Leaves* of ſome Few.

2. The *Plantæ Galeatæ* and *Verticillatæ* are a *Family* of *Plants* which bear their *Flowers* in *Rundels* or *Whorles*, at more or leſs Diſtances round the Stalk, whoſe *Monopetaloſe* Flowers, if we may ſo Call them being ſuch at the Bottom, being *Tubuloſe*, Contrary to the Laſt, are generally Divided into 5 Unequal Segments, as the *Umbels*; but with this Diſtinction, that the two greater *Petala* or *Flower-Leaves* in this *Tribe* are ſometimes above, and other times below, whereas the Other are conſtantly the ſame, that is, always lye in the ſame Place, being Expanded on a Flat or Plain Surface. The *Flowers* of our *Verticillated Plants*, from the Different Poſition of their *Petala*, are therefore Diſtinguiſht under the *Floræ Galeatæ*, *ſeu Labiatæ*. The *Calyx*, or the *Caſe* to the Lower or *Tubuloſe* Part of Each *Flower*, ſerves alſo for it's *Seed Veſſel:* In the Bottom of which is Contained, in all I have yet obſerved, 4 *Seeds* ſet Cloſe together upon a Plain, which Nature lets Fall out when Ripe, the *Husk* being always Open, and commonly Divided into 5 Points, Adequating the *Segments* of Each *Flower*. The Soveraign *Balm* of theſe Herbs, Chiefly conſiſts in the *Leaves*, and *Husks*, rather than the *Flowers*. My Reaſon for giving this preference to the *Husks* of this *Tribe*, before the *Flowers* (contrary to all Authors) are, becauſe I commonly obſerve the *Calyces* are the Chiefeſt, if not the Only Part, on which I find its *Viſcous* or *Sulphureous* Particles to adhere; This you may very Eaſily Perceive, not only by its much Stronger and Penetrating ſmell, but by the *Clammineſs* of this, far beyond the other Parts, as is very apparent particularly in the Husks of *Sage* and *Clary*: And if with *Spirit* of *Wine* you make a *Diſtillation* of theſe alone, you will find them much Stronger than from a Greater Quantity of *Flowers* only; which being of Finer and more Volatile Parts, are only Capable

of

of retaining what the Vicinity of the Stronger and Thicker Texture which the *Calyces* are compoſed of, and can without Prejudice eaſily communicate to them.

I look upon the Generality of this *Tribe*, to be a Degree *Warmer* than the Laſt; and their *Heat* conſequently to approach Nearer to the *Aromata* or *Spices*, than the *Carminatives*; and the Effects thereof to be more peculiarly appropriated to ſuch *Nervous* Diſeaſes, as are more Intenſe, and the *Umbelliferæ* cannot ſo quickly reach, *viz.* *Apoplexies*, *Epilepſies*, *Palſies &c.* in which Caſes our *Lavender*, *Roſemary*, *Sage*, *Stæchas*, and ſome others, are *Simples* which all our Antient Phyſitians (in theſe Stubborn Diſeaſes) have very much Applauded. And we ought not to forget *Mint*, *Bawm*, *Pennyroyal*, *Savory*, *Time*, *Hyſſop*, *Marjerom*, *Baſil*, *Origanum*, *Dittany* of *Crete*, *Marum* or common *Maſtick-Time*, with *Marum Syriacum*, and ſome Other.

3. We Proceed next to thoſe Herbs which have a *Tetrapetaloſe Regular Flower*; (by *Regular I* mean, ſuch as have 4 Equal *Petala* in each *Flower.*) Theſe, in Relation to their *Seed Veſſels*, are ſubdivided under two Heads, *viz.* *Siliquoſæ*, and *Capſulatæ*; being ſuch as have their *Seeds* contained in Long, or Short Receptacles, as *Podds*, or *Capſules*. The moſt Eſſential Virtue and Uſe of the Herbs of this *Claſs*, I obſerve are more particularly in the *Leaves* and *Seed*; and next them the *Roots*: And if any Parts are Slighted, its the *Flowers* and *Podds*.

The *Leaves* are more particularly uſed in the *Water* and *Garden Creſſes*, *Sea* and *Garden Scurvy-Graſs*, *Hedge-Muſtard*, *Iberis* or *Sciatica Creſſes*, *Lepidium*, *Piperitis Officinarum*, *Cardamine*, *Burſa Paſtoris*, *&c.* To which may be added our *Cabbage*, *Coleworts*, *Savoys*, *Sprouts*, *&c.* which are of this *Tribe* alſo.

Others of this *Family*, that are more peculiarly Eminent for the Virtue contained in their *Seed*, are the Common *Muſtard*, and *Rape*, the *Thlaſpi Dioſcoridis* or *Treacle Muſtard*, the *Eruca* or *Rocket*, and *Sophia Chyrurgorum* or *Flixweed*; the *Seed* of which Laſt, I am informed, hath for ſome Years paſt been uſed by ſeveral People, in the *North* of *England*, for the *Stone* and *Gravel*, with very good Succeſs.

We come now to the *Roots*. Two or Three of which, have gained no ſmall Repute, as well in Diet as Phyſick, *viz.* the *Radiſhes*, both *Garden* and *Spaniſh*, (which is the Large *Black-rooted*) as alſo the *Wild* or *Horſe-Radiſh*: and to theſe the *Round* and *Long-rooted Turnep* muſt be added.

Moſt of this *Tribe I* find, tho' they are very *Hot* like the two Laſt, *viz.* the *Umbelliferæ* and *Verticillatæ*, yet they Exert their Power in a much Different manner; to wit, by a *Diuretick Volatile Salt*; and are found moſt Prevalent, and Effectual in *Chronick* Diſeaſes; as the *Scurvy*, *Dropſy*, *Gout*, *Jaundice*, and other Ill Habits of the Body, where the Blood is Vitiated, rather in its Particles; than Irregular Motion; Carrying of its Impurity, by a *Diuretick Diſcraſis*, or Diſcharge of the Offending *Heterogeneous Salts* therein Contained; and Conſequently by *Purification*, Diſpoſing of it to a Better, or more *Sane* Diſpoſition.

The Separated Bark *of a Tree* Reunited *to the Tree; by Dr.* Chr. Merret. n. 25. p. 453.

LXVI. In the Midſt of *March*, *An.* 1664. *I* made a Section of the *Rinds* of *Aſh*; and of the Tree, falſly call'd *Sycamore*. The firſt Section of Each of the *Rinds* was Square, whereof 3 ſides were *Cut*, the *4th. Uncut*. The Succeſs was, that the Whole *Bark* did *Unite*, by Binding it with Pack-Thred, leaving a Scar in Each of the ſides *Cut*.

Then *I* Cut off, and *Separated* entirely from the *Tree*, ſeveral Parts of the *Bark*, ſome ſhallower, leaving part of the *Bark* on; Others, to the very *Wood* it ſelf; both in the *Trunk* and *Branches*, from an inch ſquare to leſs Dimenſions; and ſome of them *I* bound cloſe with Pack-thred: All which were *Separated*, a new *Rind* ſucceeding in their Place. Some *I* Covered over, beyond the Place of *Inciſion*, with *Diachylon Plaiſter*, and Tied them Faſt with Pack-thred. All which, thus Bound and *Plaiſtered*, did within the ſpace of 3 Weeks, Firmly *Unite* to the *Tree*; not without ſome Shrivelling of the Outward Skin of the *Bark*, and alſo with ſome Shrinking in Each ſide, where the *Inciſion* was made; where alſo appear'd in each of the interſtices a *Scar*. But Tying the ſame about *Michaelmas*, and in the *Winter* ſeaſon, at neither of theſe times any *Union* could be made of the *Bark* to the *Tree*; *I* ſuppoſe it was becauſe the *Sap* Mounted not ſo Vigorouſly, and in ſuch Plenty, as in the *Spring* ſeaſon.

Some *Branches* of the forementioned *Trees* were *Decorticated* round: and where no *Union* was, there certainly followed a *Withering* of the *Branch* beyond the Place, where the *Section* was made.

I alſo *Separated* a *Twig* from the Branch, by Cutting of it ſloping, for the better faſtning of it to the *Branch* again. This *Twig I* exactly fitted to the *Branch*, from whence 'twas Cut, in the ſame Poſture it before Grew in: *I* firmly Bound it, and covered it with *Diachylon-Plaiſter*. The Succeſs was, that in 3 Days time, the *Twig*, that was Cut off, *Withered*.

Obſervations concerning the Barking *of* Trees; *by S.* Malpighi. n. 161. p. 645.

LXVII. *Nutritii Succi Plantarum* Motum exploraturus, in multiplicibus variiſque *Arboribus Corticem* Vinculo, vel Circumciſione, avulſa ejuſdem Annulari portione, Tentavi: & *Plantæ* Superior Portio, ultra *Scil. Sectionem* perpetuo intumuit, debitumque ſortita eſt Augmentum, inferior vero nullum adepta incrementum, ſolas interdum dedit *Gemmas*. Hanc eandem *Sectionem* in Humiliori *Trunci* parte, & in *Radicibus* ipſis excitavi, & perpetuo *Superior Trunci* vel *Radicum* pars inſigniter intumuit, & ab hac *Radiculæ* copioſe emanarunt; *Inferior* vero, reliquaque *Radicis* Portio frequenter gracileſcendo, tandem Contabuit. Quare confirmari videtur *Nutritii Succi Refluus Motus* ab Extremis *Ramis* ad ultimas uſque *Radices*: unde intercepto Alimento, Compreſſione, vel Laceratione *Vaſorum*, Remotiores *Plantæ* partes, ſolito non gaudent Alimento; *Tumorque* ex Relabente *Succo* excitatur. Propagatur autem à *Foliis* ipſis uſque ad *Radicum* Extremos Apices. Quapropter Florum-Cultores ſoluto in *Gyrum Cortice*, Tenellum *Ramum* à Paterno emancipant Trunco, circum-affuſâ Madida Terra, in qua erumpentes Novæ *Radiculæ* ſupra *Sectionem* Vegetare incipiunt: Alimentum enim inferiora verſus propulſum, vel exp. effum, non ſolum prope *Corticis Sectionem* Stagnando *Tumorem* excitat,

excitat, ſed foras irruendo in Radiculas abſumitur; unde ſui juris factus *Surculus*, Paterno tandem diſſociatur Trunco. Non raro in *Radicibus* prope *Flumina*, quarum portio obtruncata Aperto gaudet Aere, ab ultimis Libri finibus *Gemmæ*, *Radicum* loco, erumpunt, quæ in *Ramos* ſurſum attolluntur.

Experiments of the Barking *of* Trees; *by Mr.* Tho. Brotherton. n. 187. p. 307.

LXVIII. 1. *An.* 1671. A *Crab-Tree*, about 4 inches in Diameter was *Hackt* Round with a Hatchet, ſo as to Cut pretty Deep into the *Wood*; beſides the Cutting off of the *Bark*, for about 4 inches Wide. After which it was the ſame year obſerved to encreaſe, *Above* the ſaid *Hacking*, very conſiderably, and to ſhoot in length of Wood about one *Foot*: The *Next* year, it increaſed conſiderably, and ſhot in length about 9 *Inches*: but the 3*d* year it *Dy'd* to the very Root.

Much the like was obſerved in another, part of whoſe *Bark* was Eaten off by a *Canker*, that the *Lower* part ſtood, without increaſing, and by Degrees the *Wood* Rotted and Mortified: But the *Upper* Part Encreaſed to the 3*d* Year, when it *Dyed* alſo.

Fig. 174.

A *Scotch-Firr* of 3 Years Growth, having a *Ring* of the *Bark* Cut off, of the Breadth of 3 *Inches*, near the Bottom of the *Stem* or Stalk, below the Uppermoſt *Knot* or *Joynt*, was Obſerved to Grow and ſhoot out its *Top* about half a Yard, and the parts all about the *Ring* to increaſe very much in Thickneſs, much more than it would have done, if the Section had not been Made. But all that part of the *Stock*, between the ſaid *Ring* and the *Knot*, Next *Below* it, increaſed not at all: But that part which was *Below* the Next *Knot*, increaſed ſomewhat, yet not ſo much as if the ſaid *Ring* of the *Bark*, had not been Cut off. The 2*d*. Year it alſo Encreaſed conſiderably, but not ſo much as the *Firſt*: but the 3*d*. year it *Dyed*.

A *Branch* of a Tree had a *Ring* cut off from it, *Apr.* 1. 1686, and the part *Above* the Section increaſed, and Grew till the 17*th* of *October* following when it was Cut off from the *Tree*. In this ſpace of Time the part *Below* the *Ring* increaſed not at all, but ſtood at a Stay; but the part *About* the *Ring* ſhot out a New *Joynt* between a *Foot* and *half* a *Yard*, and increaſed in Thickneſs for the Whole length of it, and in all its parts, twice as much as it would have done, if it had not been Cut; as was apparent by a like *Branch* on the Oppoſite ſide of the *Knot*, which was not Cut nor Barked Round in the ſame Manner; the *Bark* alſo of the part *Above* the Section, ſwell'd or Grew *Downwards*, over the *Woody* part, (which was Bare) above half an *Inch* in Breadth.

The Uſual Time for making this Section, was either in *March*, or the Beginning of *April*.

Tryal was made upon ſome young *Trees*, Cutting a *Helical Swath*, of the *Bark*, about *half* an *Inch* in breadth, by leaving a like *Helical Swath* of *Bark* to Communicate between the Upper and Under Part. In this Tryal, the Difference of Growth ſucceeded not, but the remaining *Swath*

of the *Bark* ſwelled *Downwards*, and by the End of the Year, Covered the *Bared* Part of the *Wood*.

The like Event, almoſt, followed upon making an *Indented Section* Round, of about *half* an *Inch* in Breadth; the *Upper Bark* quickly Swelling *Downward*, and Joyning again with the *Lower*.

It was alſo Obſervable, that as the *Upper Bark* Grew *Downwards*, ſo it Increaſed alſo in *Thickneſs*: whereas the *Bark Below* the Section, *Thickned* not at All.

A *Scoth Firr* of 3 Years Growth (which ſhoots forth every Year, both from the *Body* and the *Branches* a new *Joynt* and Circumambient *Sprouts*, to a determinate Length) was *Barked* with 3 *Rings*, of about $1\frac{1}{2}$ *Inch* broad, each about the Middle of the *Internodia* or Parts of the *Stock* between the *Joynts*. In a Year this *Stock*, which was about the bigneſs of a Quill, *Below* the *Ring* to the next *Joynt* continued of the ſame Bigneſs, but *Above* the *Ring* it Increaſed and Grew to the bigneſs of One's Finger: and from the *New Joynt* ſhot out New *Limbs* and *Stock* about a Quarter of a *Yard*, which was ſomewhat Bigger, than if there had been no *Ring* made. The *Branches* increaſed likewiſe Proportionably, by Swelling in Bigneſs, and from a *New joynt* ſhooting out New *Body* and *Limbs*, at the Top or Body. And the *Body* of the Tree *Below* the Joynt to the 2*d*. *Ring*, increaſed More than if the *Ring* had not been made: But the Part of the Stock *Below* the *Ring* to the next *Joynt*, increaſed not at all. The like ſhooting and increaſing, was obſerved in the 2*d*. Limbs *Joynt* and Stock *Below*, it between which and the *Loweſt Joynt*, it increaſed not.

On One of the *Lowermoſt Branches* of a Young *Scotch Firr*, of 2 *Years* Old, was made a *Ring Section* between the *Body* and *Firſt Knot* of the *Limb*. The following Year, That Part of the Limb *Above* the *Ring*, increaſed twice or thrice as much as the Correſponding Parts of the Other Limbs, from the ſame *Knot*: but the Part *Below* the *Section* to the *Body*, increaſed not at all.

Fig. 175. A Young *Hazell* was Cut into the Body with a deed *Gaſh*, and the Parts of the Body, *Above* and *Below* Cleft Upwards and Downwards: and the Splinters *a*. and *b*. by Wedges, were kept off from Touching each other, or the reſt of the *Body*. The following Year the Splinter *Above* the *Gaſh*, was Grown very much but the Splinter *Below* ſtood at a ſtay and Grew not: but the reſt of the *Body* Grew as if there had been no *Gaſh* made.

Four young *Poplar Trees*, all of *Equal* Bigneſs, Growth, Situation, and Soyl, as near as could be found, were thus Order'd. The *Firſt* had *All* its *Branches* and *Top* Cut off. The *Second* had *All* its *Branches* Pruned off, but it was left with a ſmall *Head* at the *Top*. The *Third* had the *Branches* Cut off *Halfway*, and Thoſe of the *Upper half* left Growing. The *Fourth* was left Growing without being *at all* Prun'd or Lopped. In the following Years, the *firſt* ſhot out many *Twigs* round about, but the *Body* increaſed but little in Height or Bigneſs. The *Second* ſhot out likewiſe many *Twigs* where it had been Pruned, and the *Top Branches* and *Top* alſo increaſed Conſiderably; and the Body alſo increaſed much more in Height and Bigneſs than did the Former. The *Third* increaſed yet much more in *All* its Parts than the *Second*. But the *Third* increaſed in *Limbs*,

Limbs, Height, and Bigneſs, *Moſt* of *All*; ſwelling in Bigneſs, and ſtretching in Height, and ſpreading in its Boughs, much more than the *Third*; and in about 10 Years, was more than 4 times as Big as the *Firſt*.

In the *Great Froſt*, 1684, of 25 *Poplars* that had been *pruned*, 19 were Kill'd by it; and the remaining were very Weak, and hardly able to Recover, and Increaſed very little in the following Years. Theſe *Poplars* were about 30 *Foot* high, and had only a *Small Head* Left at the Top Unlopped, of about 4 or 5 *Foot*, and were *prun'd* the Spring before the *Great Froſt*. Divers alſo of thoſe which had been *pruned* two Summers before the Froſt, were kill'd by it: But none of thoſe which had not been *prun'd* at all, were Hurt by it. And both in *Lancaſhire* and *Cheſhire*, Trees of 60 *Foot* in Height, that had been *pruned*, and had only a *Small Top* left, were alſo *Kill'd* by the ſaid *Froſt*: Whereas thoſe Trees of the ſame Kind and Height, which ſtood near to them, but had *not* been *pruned*, continued to *Flouriſh*, and ſuffered No Harm thereby. Several of thoſe *Branches* of about an *Inch* Diameter, and *Trees*, that had been *Barked* round, (as above) the Spring before the *Great Froſt*, Outlived the Violence of the ſame, and the preceding Winter.

Of the Growth *of* Trees. *ib.* p. 311.

Where theſe *Prunings* had been tryed upon Trees 20 *Foot* high, the Difference of their Increaſe was ſenſible the following Summer; but in 7 or 8 *Years* Time, the Difference is Prodigious; the *Unprun'd* Trees Growing ſeveral Times bigger than the *prun'd*, both in *Body* and *Branches*.

When the *Top Branches* would ſhoot out and Grow 2 *Foot*, or more in length, the lower Branches would not ſhoot above 4 *Inches*: And in the Branches of the *Scotch Firr*, the Joints *Above* the *Rings* Barked round, would Encreaſe and Grow much Bigger in 3 Years, than they would in 5 Years, if the ſaid *Rings* were not cut off.

A very large *Pinaſter* about 2 *Foot* and an *half* in Diameter, and of a Height proportionable (*viz.* of about 20 *Yards*; the loweſt Boughs of which, were about 30 *Foot* above the Ground) did Spread and Flouriſh on every Side *Alike*, though it had no *Root* at all towards 3 *Quarters* of its Situation, but only toward *one Quarter*, into which it ſpread its *Roots* very far and Large; Divers of them reaching about 70 or 80 *Foot* from the Body of the Tree: The Reaſon of which Spreading was occaſioned by its being Planted juſt within the Square Angle of the Corner of a Deep, Thick and ſtrong Stone Wall, which was as a kind of Banking or Wharfing againſt a River that ran by it.

Upon Conſideration of theſe, and divers other Obſervations, and Experiments, I am of Opinion. 1. That the *Sap* (moſt of it, if not all) *Aſcends* in the Veſſels of the *Lignous* Part of the Tree, and not in the *Cortical* part, nor Between the *Cortical* and *Lignous* Parts. 2. That the *Increaſe* and Growth of a Tree in Thickneſs is by the *Deſcent* of the *Sap*, and not by the *Aſcent*. And if there were no *Deſcent*, a Tree would Increaſe but very little if at all. 3. That there is a Continual *Circulation* of the *Sap*, All the *Summer* Seaſon, and during ſuch time as the *Sap* is *Stirring*; and not a *Deſcent* at *Michaelmas* only, as ſome have held.

2. To

By R. H. ib. p. 313.

2. To me it ſeems very Probable, that the *Bodies* of *Plants*, as well as thoſe of Moving *Animals*, are Nouriſht and Increaſed by a *Double* Food; the *One* an *Impregnated Water*, and the *Other* an *Impregnated Air*; and that without a Convenient Supply of theſe *Two*, the *Vegetable* cannot Subſiſt, at leaſt not Increaſe. Theſe do mutually Mix and Coaleſce, and Parts of the *Air* Convert to *Water*, and parts of *Water* Convert to *Air*. And as ſome of this Latter are Rarified and Freed from their Chains, and become Spiritual and Airy, ſo others of the Forementioned are Clogg'd and Fetter'd and become Debaſed. To this Purpoſe all *Plants* as well as *Animals*, have a *Two fold* kind of *Roots*, *One* that Branches and ſpreads into the *Earth*, and *Another* that Spreads and Shoots into the *Air*: *Both* kinds of *Roots* ſerve to Receive and Carry their Proper Nouriſhment to the *Body* of the *Plant*, and *Both* ſerve alſo to Convey and Carry off the *Uſeleſs* Recrements; *Uſeleſs*, I mean, any further *Within* the Body of the *Plant*, though *Uſeful* to it when they are *Separated*, and *Without* it; the *One* for Seaſoning the *Earth* and *Water* wherein it is Planted, and the *Other* for Seaſoning and Preparing the *Air*.

The Communication of the Parts of the Tree *with the Parts of the* Fruit; *by Dr.* J. Beal. n. 43. p. 860. n. 46. p. 919. *Vid. Sup.* §. LX. 6.

LXIX. I had an Excellent *Summer-Apple* containing Abundance of very Pleaſing Juice; it was of that kind, which never grows Large. The *Body* by the Burthen of the *Fruit* always wreathed towards the Ground; the Branches were all Curl'd, and full of Knots at every Turning, and theſe Branches Apt to Grow, if a good *Knot* be ſet in the Ground, as ſoon as 'tis Cut off, eſpecially about *Candlemaſs*. This Tree was *Hollow*, and very near all the *Timber* extremely *Rotten*, from the top of the Stem to the Root; and every Sprig, how ſmall ſoever, appear'd *Cork-Colour'd* and *Rotten* at the *Heart* of the Timber. And ſo it was generally all over the *Roots*; and 'tis like it had been ſo many Years before. Yet the Tree *Bore* Abundantly, with Alternative Reſts every Second or Third Year. The *Fruit* had ſcarce any *Core*; the *Kernels* were very Small, Thin, and Empty; nevertheleſs the *Branches* from the *Knots*, Grew well Enough to Repleniſh a Nurſery for me. This Seems to Intimate the *Correſpondence* between the *Pithy* Part, *Heart* or *Timber*, and the *Seeds*. And more to Confirm this; a Young Tree grew like a *Sucker* from the Only *Sound* Root of the aforeſaid *Apple Tree*. This Tree grew Straiter than others of the ſame Kind Uſually do; of which I conceive the Cauſe to be this: *Suckers* are commonly *Barren* a pretty long time; and this Continued *Barren* till the Stem was ſtrong enough to bear the *Fruit* which Loaded the *Branches*. But that which makes to our Purpoſe, is this: All the *Fruit* of this Young Tree, had *Full* and *Sound Kernels*; and though it was the ſame *Fruit*, Growing from the *Root* of the *Same Tree*, yet it ſeem'd not altogether ſo Tender, Delicious, and Juicy, at the *Fruit* of the *Old Tree*; nor yet was the Tree ſo *Fruitful*. The *Sap* in the *Old* Tree was leſs Diverted, it ſeems, to ſuſtain the Life of the *Timber*, which was now Conſum'd, and thereby, was wholly appropriated for the *Leaf*, *Bloſſom*, and the *Pulp* of the *Fruit*. For I do not Undertake, that the *Sap* yields no Relief to Sustain the *Life* and Growth of the *Timber* Ordinarily, and whilſt the *Timber* is *Entire*: But I rather Conceive, that there is a *more immediate* and *Peculiar Relation*, between the Sap and *Pulpous Fruit*; and the Like between the *Timber*,

or Whole Stock, and the *Root* of the Tree, to transmit the *Same Spirit* and *Nature* to the *Seed*, of what kind soever it be.

Some are of Opinion, that there passes into the *Timber* no part of meer *Earth*, to Sustain the *Life* and Growth of the *Plant*; but it only feeds on the *Succulent* Part, *Ascending* by the *Roots*; and on the *Air*, and the *Moisture* which the Dews of Heaven, the Rainy Seasons, and the Air afford. And if we Consider, that some Lofty Trees Grow upon the Rocks, where little or no *Earth* can be found; as also, how largely the *Oak* and *Pear Tree* Grows and Spreads; and how many Years the One bears *Acorns*, the Other *Pears*; sometimes to the Quantity of yielding 5 or 6 *Hogsheads* Yearly (as I have known them do;) and, in Comparison, how little *Waste* of *Earth* about the *Roots* Appears; we may find more Cause to Attribute this Large Expence of Materials to the Perpetual Supply of *Moisture*, than of much *Earth*. I will give you an Experiment, which may seem to Determine the Point, though I yet suspend my Judgment.

I took the Largest of *Kentish Codlins*, *Pearmains*, *Pepins*, and *Deuxans*; I Withered them (which may be soon done many ways,) and then I Cut them in the Middle, quite through the Midst of the *Kernels*, having carried them some Days in my Pocket, all that saw them took them to be very *VVood*, and they were indeed like very Close *Cork*. And some Philosophical Persons (though I affirmed no Falshood, but conceal'd the whole Matter,) did upon the View, spread it abroad, that *I* had the Art of *Converting* All *Fruit* into *Wood*; *Pulp* and *Kernels* and all was *Wood*. The same may be done upon *Pears*, *Cucumbers*, *Turneps*, and all the *Grains* and *Vegetable Seeds*, that are stuck in them, and are Cherished by a Supply of *Marly* Water; thus I have had the *Blades* of *VVheat* and the *Halme* of *Pease* Grow out of them to the length of a Foot; and then, by hanging it in a Closet, all becomes Turned into *VVood*; and in some time After, all is Turned into *Dust* and *Earth*. And as we are *VVell* Taught by Mr. *Boyle*, that Pure *Liquids* may be Converted into *Earth*: So These *Terrestrial* Parts of the *Fruit* may be, from the *Liquors* thither Collected, and Derived from the Mass of the *Earth*.

But to return to the Clearing of the *Affinities* above Claimed; I instance in *Barberry Roots*, Perforated by me, which bore *Berries* that had no *Stones* at all: And in Hollow'd *Apple-Trees* the *Kernels* will be very Thin, and empty Skins, and Uncapable of Growth. Gardeners tell me, that if you take the Hard Stick out of the *Root* of *Parsly*, it will bear no kind of *Seed*. But it may be Objected, that a very *Hollow Oak* and an *Hollow Elm* do bear *pregnant Seed*. I Answer, that an *Elm* is all *Timber* to the *Bark*; and an *Oak*, when 'tis All *Putrid* at the *Heart*, yet may have firm *VVood* enough to Convey the *Spirit* of the *Root* into the *Acorn*; and the *Roots* may be *Sound*, when the *Body* of the Tree is much Decayed by Rain beating in at the Lopp'd Tops, or by other Passages through the *Bark*. We see that *Beans*, *VVheat*, and other *Grains*, grow kindly, if the *Eye* and Parts next adjoining be Whole, though the *Beans* be full of Great Holes in other Parts, or the Main Body of the *Wheat* be Cut off with Sciffars. However, let the Objection give us the More Caution; that, if we Design to have *Fruit without Stones*, the *Perforation* be the Bolder and the more Compleat.

And

And to proceed Further; ſome Trees are *Leſs Fruitful*, or altogether *Barren* by the Exceſſive Growth and Firmneſs of the *Timber:* And theſe are Recover'd by Croſs-Deep *Hackings* through the *Bark*, and ſuch injuries done to the *Timber*, both in the *Stem* and *Main Roots*; and they Cleave the *Roots*, and put a Stone in the Cleft, that it may not Cloſe again too Haſtily. If this Violence be not Done both to the *Stem* and *Roots*, the Remedy may Fail. We ſee alſo, that *Vines* are leſs *Fruitful*, when they are Permitted to Run out into many *Woody Branches*.

To ſhew alſo the *Proximity* between the *Sap* of the *Bark*, and the *Pulp* of the *Fruit*, I did in the Summer time make *Reſts* for Water on the Body of the *Kentiſh Codlin-Trees*, and cauſed Water to be Frequently Poured into thoſe Cavities. The Effect was this; the *Apples* Grew to an Extraordinary *Bigneſs*, and were very *Inſipid:* and many of them had parts in appearance much like the *Pulp* of *Limons*. Some I ſuffered to Hang on the Tree, as Long as they Would, and thoſe became Full of Spots of the Colour of *Cork*, or like the Rottenneſs of an *Apple*.

I Omit the Reſt, and Haſten to Redouble a Remark of the great uſe which may be made of the Chiefeſt Experiment. The *Graft* carries the Maſtery from the *Stock* for the *Pulp* of the *Fruit*; ſo that we have little Hope of much Change by Meer *Graftings*, how oft ſoever iterated. But if after Many, and Strange, and Choice *Engraftings*, you ſet the *Kernel*, *Stone*, or *Seed*, of the *Grafted Fruit* in a Kind Mould, you may then expect ſome *New* or *Mingled* Kind of Plant, as *Semi-Apricocks*, *&c.* And thus the *Almond* and *Peach* may by many *Changes* in the *Graftings*, and by *Intineration* of the *Stones* of the *Peaches*, and of the *Shells* of the *Almonds*, and by *Terebrations* of the *Stem* and *Root*, here and there, *Alter* their Guiſes ſo that the *Coat* of the *Almond* may Approach to the *Pulp* of the *Peach*; and the *Kernel* of a *Peach* be enlarged to a kind of *Almond*. And great ſtore of Better Contrivances may from Hence take Riſe.

Obſervations concerning; Vegetation; *by Dr.* J. Beal. n. 56. p. 1131.

LXX. It is very difficult to determine whether *Salt* or *Water* be the Nearer and more Original Principle of all *Mixt* Bodies: or the more Copious, more Active, or more influencing, in this or that Body. But this we have before our Eyes, that, *Birch* and *Alder* Feed more kindly on a *Thin* Uliginous Moiſture; the *Elme*, *Pine*, *Firr*, *Pitch*, and *Cypreſs*, chuſe a *Stronger* Liquor: Yet theſe and many more of the Wideſt Difference, are ſometimes ſeen to draw their whole Suſtenance, Bulk, and Ornaments, whether Annual or Perennial, from the *Liquors* they find in the ſame piece of *Ground*, and from the *Ambient Air*, and *Dews*; when as yet by our beſt diligence we cannot Diſtinguiſh the *Liquors* or *Salts* cloſely Approaching their ſeveral *Roots*. And we may *Change* all the *Earth* totally from the *Roots* of Trees, whoſe Barks, Sap, Fruit and Seed have very much Differing *Salts*, and are of very Different Kinds: and yet ſee each Tree proſper the better by the *Exchange*. Hence we may ſuſpect, that the very *Contextures* of their Bodies, from the Firſt Spirting of their *Seed*, and as they are Formed Gradually from the Inviſible Principles or Spirit and Vigour of their *Seeds*, however ſmall and imperceptible, are the *Natural Limbecs*, where the common *Rain-Water* and *Air*, are Digeſted

Digeſted into very much *Differing* Leaves, Fruit, Seed, Reſins, Gums, Cooling Juleps, *&c.* perhaps as the Cow's Belly Converts the common Juice of all ſorts of *Graſs* into *Milk*; or as the *Bee* ferments the *Dew* of all *Flowers* into *Honey* and *Wax*.

We ſee alſo, that an Handful of *Moſs*, ſometimes above a Span long, and reſembling *Vegetables*, grows out of a ſmall *Oyſter-ſhell*, without *Earth*, *Dirt* or *Sand*, for the relief of the *Root*; *Trees* out of bare *Rocks*; and the Annual *Attire* of *Harts* and *Bucks*, out of their *Bony-Heads*. Whence we may eaſily apprehend, how the *Seeds* in their time, and afterwards the *Roots*, *Stems*, and *Leaves* of *Trees*, may be the Proper *Strainers* to Generate the *Peculiar Saps* and *Juices*; and perhaps to Ferment and Boyl the *Liquors* into their ſeveral *Salts* It may paſs for a Reſemblance, if not for an Inſtance, that the *Juice* of ſome *Sweet Pears* may be Dryed into a very Sweet *Sugar*; and the *Juice* of ſome other *Pears* is ſo fierce, that at the very opening of the *Rind* with the Teeth, it doth almoſt Suffocate, as if it would Kill dead immediately; and yet this *Juice* by Time and ſeaſonable Maturation becomes *Sweet*, *Winy* and *Luſcious*. And we hear of diverſe *Exotick Fruits* that will Kill outright, and that ſo quick as may Challenge the Fierceſt *Menſtruum* of an Expert *Chymiſt*. Now as the *Horns* of a *Stag* have their whole Growth and Virtue from the protruding *Blood* and *Spirits* of the *Animal*; the *Moſs* (as by the *Microſcope* appears, when Withered) from the *Inward Shell* of the *Oiſter* and the *Marine Water*: So in *Plants*, the *Sap* may by Heats and Coolers, and other Changes in Summer, Autumn, and Winter, by *Winds*, and Compreſſing *Air*, be Hardned into *Timber*, *Seeds*, and their *Stones* and *Kernels*. All ſeems to be but *Sap* at the firſt Draught, or little elſe beſides Pure *Air* and *Water*, till theſe be Concreted into Peculiar *Salts* by more curious *Strainers*, and by more Subtile *Boylers* than *Art* hath hitherto deviſed. And this was my Aim in a former Paper, where by a ſlight and Curſory Alluſion, I compared the *Motion* of *Sap* in *Vegetables* to the *Deſcent* of *Liquors* in an *Alembick*: I had no thought of ſquaring the Compariſon to agree in all Circumſtances. Neither had I any Phanſy, that the *Sap* in Winter *Deſcended* to the *Root*, ſince I ſaw an *Apple Tree*, that yielded 4 or 5 *Hogſheads* of Strong *Cyder* yearly, and a *Pear-Tree* that yielded more *Perry*; yet both growing on a *Dry* Ground, where they could get no other *Liquor* than what the *Clouds* and the *Air* afforded. Yet I conceive, that theſe Trees have an Intercourſe of Peculiar *Spirits* ſome way linked together, and vigorouſly Cooperating, from the very *Fibres* of the *Loweſt Roots* to the *Top-Leaves*.

Vid. Sup. §. LX. 1.

LXXI. The *Ancients* Generally Intituled the *Earth* to the *Production* of the *Animals*, *Vegetables* and *Other Bodies* Upon and about it: But ſeveral of the *Moderns*, and ſome of very Great Name too, both Here and Abroad, have given their *Votes* in behalf of *Water*. My Lord *Bacon* is of Opinion, *That for Nouriſhment of Vegetables, the* Water *is almoſt All in All; and that the* Earth *doth but keep the Plant Upright, and Save it from Over-Heat and Over Cold*. Others there are who are ſtill more Expreſs; and

Some Thoughts and Experiments concerning Vegetation; *by Dr.* J. Woodward. n. 253. p. 193.

Assert *Water* to be the *Only Principle* or Ingredient of all Natural Things. They Suppose, that, by I cannot tell what *Process* of Nature, *Water* is *Transmuted* into *Stones*, into *Plants*, and, in brief, All other Substances Whatever. *Helmont* particularly, and his Followers, are very Positive in this; and offer some Experiments to render it Credible; and Mr *Boyle* discovers a great *Propensity* to the same Thoughts and Opinion they had

The Experiments they insist upon are chiefly Two; the *First* is, that *Mint* and several *Other Plants* Prosper and Thrive very greatly in *Water*. The *Other* is this; they take a Certain Quantity of *Earth*, and Bake it in an Oven; then they Weigh it, and put it into an Earthen Pot; having well *water'd* this *Earth*, they make choice of some Fit *Plant*, which being first Carefully *weighed*, they Set in it. There they let it grow, continuing to *water* it for some time, till 'tis much Advanced in Bigness. Then they take it Up, and tho' the *Bulk* and *weight* of the *Plant* be much Greater than when First Set, yet upon Baking the *Earth*, and *weighing* it, as at first, they find it Little or not at all *Diminished* in Weight; and therefore Conclude, 'tis not the *Earth*, but *VVater* that *Nourishes*, and tis Turned into the *Substance* of the *Plant*.

I must Confess, I cannot see how This Experiment can ever be made with the Nicety and Justness that is Requisite. However Nothing like what these Gentlemen would Infer, can possibly be Concluded from it; unless *VVater*, which they so Plentifully bestow upon the *Plant*, in this Experiment, be *Pure*, *Homogeneous*, and *not Charged* with any *Terrestrial Mixture*: for if it be, the *Plant* after all, may Owe its *Growth* and *Encrease* intirely to *That*.

Some *VVaters* are indeed so very *Clear* and *Transparent*, that one would not easily Suspect any *Terrestrial Matter* were Latent in them: Yet that is far short of a Proof, that in Reality there is *None*. For they may be highly Saturated with such Matter, tho' the *Eye* be not presently able to Descry or Discern it. If *Pure* and Absolutely *Refined Silver* be Perfectly Dissolved in *Spirit* of *Nitre*, or *Aquafortis*, that is *Rectified* and thoroughly *Fine*, it does not *Darken* the *Menstruum*, or render it less *Pellucid* than before.

But, after all, I never met with any *VVater*, that however Fresh, and newly taken out of the *Spring*, did not exhibit, even to the *naked Eye*, Great Numbers of exceeding Small *Terrestrial Particles*; Disseminated through All Parts of it. *Thicker* and *Grosser VVater* exhibits them still in Greater Plenty.

These are of Two General *Kinds*. The *One a Vegetable Terrestrial Matter*, Consisting of very Different *Corpuscles*; some whereof are Proper for the *Formation* and *Increment* of *One* sort of *Plant*, and some of *Another*; as also Some for the *Nourishment* of *One Part* of the *Same Plant*, and some *Another*. The *Other Kind* of Particles sustain'd in *VVater*, are of a *Mineral Nature*. In some Springs we find *Common-Salt*, in Others *Vitriol*, in Others *Alum*, *Nitre*, *Sparr*, *Ochre*, *&c.* Nay frequently Several of these, or Other *Minerals*, all in the *Same* Spring. All *VVater* whatever is much Charged with the *Vegetable Matter*; this being Fine, Light, and easily Moveable. As for the

Mineral,

Mineral, the *Water* of *Springs* contains more of it, than that of *Rivers*; eſpecially when at Diſtance from their *Sources*: and that of *Rivers*, more than the *Water* that falls in *Rain*.

If any One (who deſires Further Satisfaction herein) put *Water* into a Clear *Glaſs Viol*, ſtopping it cloſe, to keep Duſt, and other Exterior Matter Out, and letting it ſtand without ſtirring it, for ſome Days: He'll then find a Conſiderable Quantity of *Terreſtrial Matter* in the *Water*, however *Pure* and free it might appear when Firſt put into the *Viol*. He'll in a very ſhort time Obſerve, as *I* have frequently done, the *Corpuſcles*, that were at Firſt, while the *Water* was *Agitated* and kept in *Motion*, *Separate* and hardly *Viſible*, by Degrees as the *Water* permits by its becoming more Still and at Reſt, *Aſſembling* and *Combining* together; By that means Forming ſomewhat Larger and more Conſpicuous *Moleculæ*. Afterwards he may behold theſe Joining, and Fixing each to other; by that means forming Large Thin *Maſſes*, appearing like *Nubeculæ*, or *Clouds* in the *Water*; which grow more Thick and Opaque, by the Continual Appulſe and Accretion of Freſh Matter. If the ſaid Matter be Chiefly of the *Vegetable Kind*, 'twill be ſuſtained in the *Water*; and Diſcover at length, a *Green Colour*; becoming ſtill more of That Colour, I mean an Higher and more Saturate *Green*, as the Matter Thickens and Encreaſes. But if there be any Conſiderable Quantity of *meer Mineral Matter* in the *Water*, This being of a Greater *Specifick Gravity* than the *Vegetable*, as the Particles of it *Unite* and Combine in ſuch Number, till they form a *Molecula*, the *Impetus* of whoſe *Gravity* Surpaſſes That of the Reſiſtance of the *Water*, Subſides a great deal of it, to the Bottom. Nor does it only fall down *It ſelf*, but frequently Intangling with the *Vegetable Nubeculæ*, Forces them down along with it.

Upon the whole, 'tis Palpable and beyond reaſonable Conteſt, that *Water* contains in it a very Conſiderable Quantity of *Terreſtrial Matter*.

Now the Queſtion is, to which of Theſe, the *Water* or the *Earthy Matter* ſuſtained in it, *Vegetables* owe their *Growth* and *Augment*.

For Deciding of which, *I* conceive the following Experiments may afford ſome Light: And *I* can ſafely ſay, they were made with due Care and Exactneſs.

An. 1691. I choſe ſeveral *Glaſs Viols*, that were all, as near as poſſible, of the Same Shape and Bigneſs. After *I* had put what *Water I* thought Fit into every one of them, and taken an Account of the *weight* of it, *I* Strained and Tyed over the *Orifice* of each *Viol*, a Piece of *Parchment*, having an *Hole* in the Middle of it, Large enough to admit the *Stem* of the *Plant I* deſigned to *Set* in the *Viol*; without the Confining or Straightning it ſo, as to Impede its *Growth*. My Intention in this, was to prevent the Encloſed *Water* from *Evaporating* or *Aſcending* by any other Way than only thorough the *Plant* that is to be Set therein. Then *I* made choice of ſeveral Spriggs of *Mint*, and other *Plants*, that were, as near as I could

poſſibly Judge, alike *Freſh*, *Sound*, and *Lively*. Having taken the *Weight* of Each, I placed it in a *Viol*, ordered as above: and as the *Plant* Imbibed, and Drew off the *Water*, *I* took care to add more of the ſame from time to time; keeping an Account of the *Weight* of all *I* added. Each of the *Glaſſes* were, for Better *Diſtinction*, and the more Eaſy keeping a *Regiſter* of all Circumſtances, *Noted* with a Different *Mark* or *Letter*, *A*, *B*, *C*, *&c.* and all ſet in a Row, in the ſame Window, in ſuch manner that all might partake alike of *Air*, *Light*, and *Sun*. Thus they continued from *July* 20*th* to *Oct.* 5*th*. Which was juſt 77. *Days*. Then *I* took them Out, *Weighed* the *Water* in Each *Viol*, and the *Plant* likewiſe, adding to its *Weight* that of all the *Leaves* that had fallen Off, during the time that it ſtood thus. And laſtly, I *Computed* how much each *Plant* had *Gained*: and how much *Water* was *Spent* upon it: The Particulars are as follows.

Diſtinction of the Glaſſes.	*The ſeveral Sorts of Plants and Water.*	*Weight of the Plant. when put in*	*when taken out.*	*Weight Gained in 77 Days*	*Expence of Water.*	*The Proportion of the Encreaſe of the Plant to the Expence of W.*
A.	Common *Spear-Mint* ſet in *Spring Water.*	gr. 27	gr. 42	gr. 15	gr 2558	1, *to* 170$\frac{8}{15}$.
B.	Common *Spear-Mint*, in *Rain-Water.*	28$\frac{1}{4}$	45$\frac{3}{4}$	17$\frac{2}{2}$	3004	1, *to* 171$\frac{23}{35}$.
C.	Common *Spear Mint*, *in Thames Water.*	28	54	26	2493	1, *to* 95$\frac{23}{26}$.
D.	Common *Solanum*, or *Night Shade*, *in Spring Water.*	49	106	57	3708	1, *to* 65$\frac{3}{57}$.
E.	*Lathyris*, *ſeu Cataputia Gerh. in Spring Water.*	98	101$\frac{1}{2}$	3$\frac{1}{2}$	2501	1, *to* 714$\frac{4}{7}$.

The *Common Solanum* in the Viol *D.* had ſeveral *Buds* upon it when firſt *Set* in the *Water*: Theſe in ſome Days, became fair *Flowers*, which were at Length ſucceeded by *Berries*.

Two other *Viols F.* and *G.* were Filled; the former with *Rain*, the other with *Spring Water*, at the ſame Time as thoſe above mentioned were: and ſtood as long as they did. But they had Neither of them any *Plant*; my Deſign in theſe being only to inform my ſelf, whether any *Water Exhaled* out of the *Glaſſes*, otherwiſe than thorow the *Bodies* of the *Plants*. The *Orifices* of theſe

two

two Glaſſes were covered with *Parchment*; each Piece of it being *Perforated* with an Hole of the ſame bigneſs with thoſe of the *Viols* above. In this I ſuſpended a Bit of Stick, about the Thickneſs of the *Stem* of one of the aforeſaid *Plants*, but not reaching down to the ſurface of the included *Water*. *I* put them in thus, that the *Water* in thoſe, might not have more ſcope to *Evaporate*, than that in the Other *Viols* Thus they ſtood the whole 77. *Days*, in the ſame *Window* with the *Reſt*: When, upon Examination, *I* found *None* of the *Water* in theſe, Waſted or gone off. Tho' *I* obſerved, both in theſe, and the *Reſt*, eſpecially after Hot Weather, ſmall *Drops* of *Water*, not unlike *Dew*, adhering to the inſides of the *Glaſſes*; that part of them *I* mean, that was above the *Surface* of the encloſed *Water*.

The *Water* in theſe two Glaſſes, that had *no Plants* in them, at the end of the Experiment, exhibited a *Larger* Quantity of *Terreſtrial Matter*, than that in any of thoſe that had the *Plants* in them did; The *Sediment* at the Bottom of the *Viols* was *Greater*; and the *Nubeculæ*, diffuſed through the *Body* of the *Water*, *Thicker*. And of that which was in the Others, ſome of it proceeded from certain ſmall *Leaves*, that had fallen from that part of the *Stems* of the *Plants* that was *within* the *Water*, wherein they Rotted and Diſſolved.

The *Terreſtrial Matter* in the *Rain-Water* was Finer than that in the *Spring Water*.

An. 1692. *I Repeated* the Experiment. The *Plants* were all *Spear Mint*, the moſt Kindly, Freſh, Sprightly ſhoots *I* could Chooſe. The *Viols* were ſet, in a Line, in a *South-Window*; where they ſtood from *Jun.* 2. to *Jul.* 28. which was juſt 56. *Days*.

Diſtinction of the Viols.	*The ſeveral Sorts of Water*	*Weight of the Plant when put in.*	*Weight of the Plant when taken out.*	*Weight Gained in 56 Days.*	*Expence of Water.*	*Proportion of the Growth of the Plant to the Expence of Water.*
		gr.	*gr.*	*gr.*	*gr.*	
H.	*Hyde Park Conduit Water.*	127	255	128	14190	1, *to* 110 $\frac{110}{128}$
I.	*Hyde Park Conduit Water.*	110	249	139	13140	1, *to* 94 $\frac{74}{139}$
K.	*Hyde-Park Conduit Water in which was Diſſolv'd an Ounce and an half of Common Garden Earth.*	76	244	168	10731	1, *to* 63 $\frac{147}{168}$
L.	*Hyde-Park Water, with the ſame Quantity of Garden-Mould as in the Former.*	92	376	284	14950	1, *to* 52 $\frac{182}{284}$
M.	*Hyde-Park Water Diſtilled off, with a Gentle Still.*	114	155	41	8803	1, *to* 214 $\frac{29}{41}$
N.	*Reſidue of the Water which remained in the Still after that in M. was Diſtilled off.*	81	175	94	4344	1, *to* 46 $\frac{20}{94}$

The

The *Plant* which was ſet in *H.* was all along a very *Kindly Plant*: And had run up to above 2. *Foot* in Height. It had ſhot but *One* Conſiderable *Collateral Branch*: but had ſent forth *Many* and Long *Roots*, from which, Sprung very Numerous tho' ſmall, and ſhort *Leſſer Fibres*. Theſe *Leſſer Roots* came out of the *Larger*, on two Oppoſite ſides, for the moſt part: So that each *Root*, with its *Fibrillæ*, appeared not unlike a ſmall *Feather*. To theſe *Fibrillæ* adhered pretty much *Terreſtrial Matter*. In the *Water* which was at laſt *Thick* and *Turbid*, was a *Green Subſtance* reſembling a Fine Thin *Conferva*.

The *Plant* in *I.* was as *Kindly* as the Former, but had ſhot no *Collateral Branches*. Its *Roots*, the *Water*, and the *Green Subſtance*, all much as in the Former.

The *Plant* in *K.* tho' it had the Misfortune to be Annoyed with many ſmall *Inſects*, that happened to fix upon it, yet had ſhot very Conſiderable *Collateral Branches*: and at leaſt as many *Roots*, as either that in *H.* or *I.* which had a much Greater Quantity of *Terreſtrial Matter*, adhering to the Extremities of them. The ſame *Green Subſtance* here, that was in the two Preceding.

The *Plant* in *L.* was far more *Flouriſhing* than any of the Precedent; had ſeveral very Conſiderable *Collateral Branches* and very Numerous *Roots*; to which *Terreſtrial Matter* adhered very Copiouſly. The *Earth* in both theſe Glaſſes, *K.* and *L.* was very ſenſibly and Conſiderably *Waſted*, and *Leſs* than when *Firſt* put in. The ſame ſort of *Green Subſtance* Here, as in thoſe above.

The *Plant* in *M.* was pretty *Kindly*; and had two ſmall *Collateral Branches*, and ſeveral *Roots*, tho' not ſo many as that in *H.* or *I.* but as much *Terreſtrial Matter* adhering to them, as thoſe had. The *Water* was pretty *Thick*, having very numerous ſmall *Terreſtrial Particles* ſwiming in it, and ſome *Sediment* at the *Bottom* of the *Glaſs*. This *Glaſs* had none of the *Green matter* above mentioned in it.

The *Water* in *N.* was very *Turbid*, and as *High-Coloured*, (*Reddiſh*) as Ordinary *Beer*; the *Plant* in it was very *Lively*; and had ſent out 6 *Collateral Branches*, and ſeveral *Roots*.

O. Hyde Park Conduit-Water, in which was Diſſolved a *Drachm* of *Nitre*.

The *Mint* ſet in this, ſuddenly began to *Wither* and *Decay*; and *Dyed* in a Few Days. As likewiſe did two more *Sprigs*, that were ſet in it, ſucceſſively. In *Another Glaſs*, *I Diſſolved* an *Ounce* of good *Garden Mould*, and a *Drachm* of *Nitre*, and in a *Third*, *half* an *Ounce* of *Wood-Aſhes*, and a *Drachm* of *Nitre*, but the *Plants* in theſe ſucceeded no better than in the Former.

P. Hyde-Park Conduit-Water. In this *I* fixed a *Glaſs Tube* about 10. *Inches* long, the Bore about $\frac{1}{2}$ of an *Inch* in Diameter, fill'd with very *Fine* and *White Sand*, which *I* kept from falling Down, out of the *Tube* into the *Viol*, by tying a thin piece of *Silk*, over that End of the *Tube* that was Downwards. Upon immerſion of the Lower End of it into the *Water*, this

by

by little and little *Aſcended* quite to the Upper Orifice of the *Tube*. And yet, in all the 56 *Days* which it ſtood thus, a very Inconſiderable Quantity of *Water* had *Gone off*; *viz.* ſcarcely 20 *Grains*; though the *Sand* continued *Moiſt* up to the Top, till the very Laſt. The *Water* had imparted a *Green Tincture* to the *Sand*, quite to the very Top of the *Tube*. And in the *Viol*, it had *Precipitated* a *Greeniſh Sediment*, mixt with *Black*. To the *Bottom* and *Sides* of the *Tube*, as far as 'twas *immerſed* in the *Water*, adhered pretty much of the *Green Subſtance* Deſcribed above.

Q. R. S, &c. Several *Plants* ſet in *Viols*, Ordered in like manner as thoſe above, in *Oct.* and the following *Colder* Months. Theſe *Throve* not near ſo much, nor did the *Water Aſcend* in nigh the Quantity, it did in the *Hotter* ſeaſons, in which the before recited Trials were made.

Some Reflections on the foregoing Experiments. ib. p. 207.

1. *In Plants of the ſame Kind, the Leſs they are in Bulk, the Smaller the Quantity of the Fluid Maſs in which they are Set, is Drawn off; the* Diſpendium *of it, where the Maſs is of Equal Thickneſs, being pretty nearly Proportioned to the* Bulk *of the* Plant. Thus that in the Glaſs Marked *A.* which Weighed only 27. *Gr.* Drew off but 2558. *Grains* of the *Fluid*: And that in *B.* which Weighed only $28\frac{1}{4}$ took up but 3004. *Gr.* whereas that in *H.* which Weighed 127. *Gr.* ſpent 14190. *Gr.* of the *Liquid Maſs*.

The *VVater* ſeems to *Aſcend* up the *Veſſels* of *Plants* in much the ſame manner as up a *Filtre:* And 'tis no Great Wonder, that a Larger *Filtre* ſhould Draw off more *Water* than a Leſſer; or that a *Plant* that has more and Larger *Veſſels* ſhould take up a Greater Share of the *Fluid*, in which 'tis *Set*, than one that has Fewer and ſmaller Ones, Can.

2. *The much Greateſt part of the Fluid Maſs that is thus Drawn off, and Conveyed into Plants, does not Settle or Abide there: But Paſſes through the Pores of them, and Exhales up into the Atmoſphere.* That the *VVater* in theſe Experiments, *Aſcended* only through the *Veſſels* of the *Plants* is Certain. The Glaſſes *F.* and *G.* that had no *Plants* in them, tho' Diſpoſed of in like Manner as the Reſt, remain'd, at the End of the Experiment, as at Firſt: And *None* of the *VVater* was Gone off. And that the Greateſt Part of it Flies off from the *Plant* into the *Atmoſphere*, is as Certain. The Leaſt *Proportion* of *VVater Expended*, was to the *Augment* of the *Plant*, as 46. or 50. to 1. And in ſome the Weight of the *VVater Drawn* off, was 100. 200. nay, in *One* above 700 times as much as the *Plant* had received of *Addition*.

This ſo Continual an *Emiſſion* and *Detachment* of *VVater*, in ſo Great Plenty from the Parts of *Plants*, affords us a Manifeſt Reaſon why Countries that *Abound* with *Trees* and the *Larger Vegetables* eſpecially, ſhould be very Obnoxious to *Damps*, Great *Humidity* in the *Air*, and more Frequent *Rains*, than Others, that are more *Open* and *Free*. The Great *Moiſture* in the *Air*, was a Mighty inconvenience, and Annoyance to thoſe who Firſt ſetled in *America*; which at that time was much Overgrown with *VVoods* and *Groves*: But as theſe were *Burnt* and *Deſtroyed*, to make way for *Habitation* and

Culture

Culture of the *Earth*, the *Air* Mended, and *Clear'd* up apace; Changing into a Temper much more *Dry* and *Serene* than before.

Nor does this *Humidity* go off *Pure* and *Alone*: but uſually bears forth with it many parts of the Same Nature, with Thoſe whereof the *Plant*, through which it paſſes, Conſiſts. The *Craſſer* indeed are not ſo eaſily *Born up* into the *Atmoſphere*; but are uſually Depoſited on the *Surface* of the *Flowers*, *Leaves* and other *Parts* of the *Plants*: Hence comes our *Manna's*, our *Honies*, and other *Gummous Exudations* of *Vegetables*. But the *Finer* and *Lighter Parts*, are with Greater Eaſe ſent up into the *Atmoſphere*. Thence they are Conveyed to our *Organs* of *Smell*, by the *Air* we draw in *Reſpiration*; and are *Pleaſant* or *Offenſive*, *Beneficent* or *Injurious* to us, according to the Nature of the *Plants* from whence they Ariſe. And ſince theſe owe their Riſe to the *VVater* that *Aſcends* out of the *Earth*, through the Bodies of *Plants*, we cannot be far to ſeek for the Cauſe why they are more *Numerous* in the *Air*, and we find a *Greater Quantity* of *Odours* exhaling from *Vegetables*, in *VVarm Humid* Seaſons, than in any Others whatever.

3. *A Great Part of the Terreſtrial Matter, that is Mixt with the VVater, Aſcends up into the Plants as well as the VVater.* There was much more *Terreſtrial Matter* at the End of the Experiment, in the *VVater* of the *Glaſſes F.* and G. that had *No Plants* in them, than in thoſe that had *Plants*. The *Garden Mould* Diſſolved in the *Glaſſes K.* and *L.* was Conſiderably *Diminiſhed*, and Carried off. Nay the *Terreſtrial* and *Vegetable Matter* was born up in the *Tubes* filled with *Sand*, *Cotton*, *&c.* in that Quantity as to be Evident even to ſenſe.

If I may be permitted to Look abroad a while, towards our *Shores* and Parts within the Verge of the *Sea*, theſe will preſent us with a Large Scene of *Plants* that, along with the *Vegetable*, take up into them Meer *Mineral Matter* alſo, in a great abundance. Such are our *Sea Purſlains*, the ſeveral ſorts of *Alga's*, of *Sampires*, and other *Marine Plants*. Theſe contain *Common Sea-Salt*, which is all one with the *Foſſile*, in ſuch Plenty, as not only to be Plainly Diſtinguiſh'd on the *Palate*, but may be Drawn forth of them, in Conſiderable *Quantity*.

How Apt, and how much Diſpoſed this *Vegetable Matter*, being ſo very *Fine* and *Light*, is to Attend *VVater* in all its *Motions*, and follow it into each of its *Receſſes*, is Manifeſt, not only from the inſtances above Alledged, but Many Others *Percolate* it with all the Care imaginable; *Filter* it with never ſo many *Filtrations*; yet ſome *Terreſtrial Matter* will remain. 'Tis true the *Fluid* will be *Thinner* every time than other, and more *Diſengaged* of the ſaid *Matter*: but never *wholly Free* and *Clear*.

I have *Filtred VVater* thorow ſeveral Sheets of *Thick Paper*; and after that, through very *Cloſe Fine Cloth*, 12 times Doubled; Nay I have done this Over and Over: and yet a Conſiderable Quantity of this *Matter*, Diſcover'd it ſelf in the *Water* after All. 'Tis true *Filtring* and *Diſtilling* of *VVater* intercepts, and makes it Quit *Some* of the *Earthy Matter* it was before Impregnated withal, but then that which Continues with the *Water* after this, is *Fine*

and

and *Light*, and ſuch conſequently, as is in a peculiar Manner fit for the *Growth*, and *Nouriſhment* of *Vegetables*. And this is the Caſe of *Rain Water*. The Quantity of *Terreſtrial Matter* it bears up into the *Atmoſphere* is not Great: But that which it does bear up, is mainly of that *Light* Kind of *Vegetable Matter*; and that too, perfectly Diſſolved, and Reduced to Single *Corpuſcles*; all fit to enter the *Tubules* and *Veſſels* of *Plants*. On which Account 'tis, that This *Water* is ſo very *Fertile* and *Prolifique*. But the *Mineral Matter*, is a great deal of it, not only *Groſs* and *Ponderous*, but *Scabrous* and *Inflexible*: and ſo not Diſpoſed to enter the *Pores* of the *Roots*. And a great many of the *Simple Vegetable Particles* by Degrees *Unite*, and Form, Some of them, ſmall *Clods* or *Moleculæ*; ſuch as thoſe mentioned in *H. K* and *L*. Sticking to the *Extremities* of the *Roots* of Thoſe *Plants*; Others of them Intangle in a Looſer Manner, and form the *Nubeculæ*, and *Green Bodies* ſo Commonly Obſerved in *Stagnant Water*. Theſe alſo, when thus *Conjoyned*, are too Big to enter the *Pores*, or Aſcend up the *Veſſels* of *Plants*; which *Singly* they might have done. They who are Converſant in *Agriculture*, will eaſily Subſcribe to This. They are well aware that, be their *Earth* never ſo *Rich*, ſo *Good*, and ſo Fit for the Production of *Corn*, or Other *Vegetables*, Little will Come of it, unleſs the Parts be *Separated*, and *Looſe*. 'Tis on this Account, they beſtow the Pains they do in *Culture* of it: in *Digging*, *Plowing*, *Harrowing*, and *Breaking* of the *Clodded Lumps* of *Earth*. 'Tis the ſame Way, that *Sea-Salt*, *Nitre*, and Other *Salts*, Promote *Vegetation*. They *Looſen* the *Earth*, and *Separate* the *Concreted Parts* of it: by that means *Fitting* and Diſpoſing them to be *Aſſumed* by the *Water*; and Carried up into the *Seed* or *Plant*, for its *Formation* and *Augment*. There's no Man but muſt Obſerve, how apt All Sorts of *Salts* are to be Wrought upon by *Moiſture*; how eaſily they *Liquate* and *Run* with it: and when theſe are *Drawn off*, and have deſerted the *Lumps* wherewith they were Incorporated, Thoſe muſt *Moulder* immediately, and Fall Aſunder of Courſe. The *Hardeſt Stone* we meet with, if it happen, as frequently it does, to have any ſort of *Salt* intermixt with the *Sand* of which it Conſiſts, upon being expoſed to a *Humid Air*, in a ſhort time *Diſſolves* and *Crumbles* all to Pieces: and much More will *Clodded Earth*, or *Clay*, which is not of near ſo Compact and Solid a Conſtitution as *Stone* is. The ſame Way likewiſe is *Lime* ſerviceable in this Affair: It is well known, how apt it is to be put into *Ferment*, and *Commotion* by *Water*, Nor can ſuch *Commotion* ever happen, when *Lime* is mix'd with *Earth*, however *Hard* and *Clodded* That may be, without *Opening* and *Looſening* of it.

4. *The* Plant *is more or leſs Nouriſhed and Augmented in Proportion as the Water in which it Stands, contains a Greater or Smaller Quantity of* Proper Terreſtrial Matter *in it*. The Truth of this *Propoſition*, is ſo eminently Diſcernible through the Whole *Proceſs* of theſe *Tryals*, that *I* think No Doubt can be made of it. The *Mint* in the *Glaſs C*. was of much the *Same Bulk* and *Weight* with Thoſe in *A*. and *B*. But the *Water*, in

which that was, being *River Water*, which was apparently Stor'd *more copiously* with *Terreſtrial Matter* than the *Spring* or *Rain Water*, wherein they ſtood were, it had *Thriven* to almoſt *Double* the *Bulk* that Either of them had: and with a *Leſs Expence* of *Water* too. So likewiſe the *Mint* in *L.* in whoſe *Water* was *Diſſolved* a Small Quantity of Good *Garden Mould*, tho' it had the Diſadvantage to be *Leſs* when *firſt Set*, than either of the *Mints* in *H.* or *I.* whoſe *Water* was the very Same with This in *L.* but had *None* of that *Earth* mix'd with it: yet in a ſhort time, the *Plant* not only *Overtook*, but much *Outſtripp'd* Thoſe, and at the End of the Experiment, was very Conſiderably *Bigger* and *Heavier* than Either of them. In like manner, the *Mint* in *N.* tho' *Leſs* at the Beginning than that in *M.* being Set in that *Thick*, *Turbid*, *Feculent Water*, that remained behind, after that, wherein *M.* was placed, was *Still'd* off, had in fine more than *Doubled* its *Original weight* and *Bulk*: and Received above *Twice* the *Additional Encreaſe* than that in *M.* which Stood in the Thinner *Diſtill'd water*, had done; and, which is not leſs Conſiderable, had not *Drawn off Half* the Quantity of *Water* that *That* had.

Why in the Beginning of this Article, *I* Limit the *Proportion* of the *Augment* of the *Plant* to the Quantity of *Proper Terreſtrial Matter* in the *Water*, is becauſe *All*, even the *Vegetable Matter*, to ſay Nothing of the *Mineral*, is not *Proper* for the *Nouriſhment* of *Every Plant*. There may be, and Doubtleſs are, ſome parts in *Different Species* of *Plants*, that may be much *Alike*, and ſo owe their Supply to the *Same Common Matter*: but 'tis plain, *All* cannot. And there are other Parts ſo *Differing*, that 'tis no ways Credible they ſhould be Formed *All* out of the *Same* Sort of *Corpuſcles*. So far from it, that there want not *Good Indications*, as we ſhall See by and by, that *Every Kind* of *Vegetable* Requires a *Peculiar* and *Specifick Matter* for its *Formation* and *Nouriſhment*. Yea, *Each Part* of the *Same Vegetable* does ſo: and there are very *Many* and *Different Ingredients* go to the *Compoſition* of the *Same Individual Plant*. If therefore the *Soil*, wherein any *Vegetable* or *Seed* is *Planted*, contains *All* or *Moſt* of Theſe *Ingredients*, and Thoſe in *Due Quantity*, 'twill *Grow* and *Thrive*: otherwiſe, 'twill *Not*. If there be not as many *Sorts* of *Corpuſcles* as are Requiſite for the *Conſtitution* of the *Main* and *more Eſſential Parts* of the *Plant*, 'twill not *Proſper* at all. If there be *Theſe*, and not in *Sufficient Plenty*, 'twill *Starve*, and *Never* arrive to its *Natural Stature*. Or if there be Any the *Leſs Neceſſary* and *Eſſential Corpuſcles wanting*, there will be ſome *Failure* in the *Plant*; 'twill be *Defective* in *Taſte*, in *Smell*, in *Colour*, or ſome other way.

But tho' a *Tract* of *Land* may happen *Not* to Contain *Matter Proper* for the *Conſtitution* of ſome One Peculiar Kind of *Plant*, Yet it may for ſeveral Others; and thoſe much Differing amongſt themſelves. The *Vegetative Particles* are Commixt and Blended in the *Earth*, with all the *Diverſity* and *Variety*, as well as all the *Uncertainty* Conceivable.

It is not Poſſible to Imagine how One, Uniform, Homogeneous *Matter*, having its Principles or Original Parts, *All* of the ſame Subſtance, Conſtituti-

on,

on, Magnitude, Figure and Gravity, ſhould ever Conſtitute *Bodies* ſo egregiouſly *Unlike* in All thoſe Reſpects, as *Vegetables* of *Different Kinds* are: nay even as the *Different Parts* of the *Same Vegetable*. That One ſhould carry a *Reſinous*, Another a *Milky*, a Third a *Yellow*, a Fourth a *Red Juice* in it's *Veins*; One afford a *Fragrant*, another an *Offenſive Smell*; One be *ſweet* to the *Taſte*, Another *Bitter*, *Acid*, *Acerb*, *Auſtere*, &c that One ſhould be *nouriſhing*, another *Poyſonous*; one *Purging*, another *Aſtringent*: in brief, that there ſhould be that *Vaſt Difference* in them, in their Several *Conſtitutions*, *Makes*, *Properties*, and *Effects*, and yet All ariſe from the very ſame ſort of *Matter*, would be very *ſtrange*.

The *Cataputia* in the Glaſs *E* received but very *Little Encreaſe*; only $3\frac{1}{2}$ *gr.* all the while it ſtood, tho' 2501 *Gr.* of *VVater* were *ſpent* upon it. I will not ſay the Reaſon was becauſe That *VVater* did not contain in it *Matter Fit* and *Proper* for the *nouriſhment* of that *Peculiar* and *Remarkable Plant*. No, it may be the *Water* was not a *Proper Medium* for it to Grow in: and we know there are very many *Plants* that will not *Thrive* in it. Too much of that *Liquor*, in ſome *Plants*, may probably Hurry the *Terreſtrial Matter* thorow their *Veſſels* too Faſt for them to *Arreſt* and lay Hold of it. Be that as it will, 'tis moſt Certain there are *Peculiar ſoils* that Suit *Peculiar Plants*. In *England*, *Cherries* are obſerved to Succeed beſt in *Kent*; *Apples* in *Herefordſhire*, *Saffron* in *Cambridgſhire*, *Woad* in *two* or *three* of our *Midland Counties*; and *Teazles* in *Somerſetſhire*. This is an Obſervation that hath held in all Parts of the World. But that *Soil* that is *Once Proper* and *Fit* for the Production of ſome *One ſort* of *vegetables*, does not *Ever* Continue to be ſo. No, in Tract of Time it Looſes that *Property*: but ſooner in ſome Lands, and later in Others. If *VVheat* for Example be Sown upon a Tract of Land that is *Proper* for that *Grain*, the *Firſt Crop* will Succeed very Well; and perhaps the *Second*, and the *Third*; as long as the *Ground* is in *Heart*, as the Farmers ſpeak: But in a Few Years 'twill Produce No More, if Sowed with That *Corn*. Some *other Grain* indeed it may, as *Barley*; and after this has been ſown ſo Often, that the Land can bring forth No More of the ſame, it may Afterwards yield Good *Oats*; and perhaps *Peaſe* after them. At length 'twill become *Barren*; the *vegetative Matter*, that at Firſt it abounded withal, being *educed forth* of it, by Thoſe *Succeſſive Crops*, and moſt of it *born Off*; *Each Sort* of *Grain* taking forth that *Peculiar Matter* that is *Proper* for its Own *Nouriſhment*.

After all which, that very *Tract of Land* may be brought to produce Another *Series* of the *Same Vegetables*: but Never 'till it is *Supply'd*, with a *New Fund* of *Matter*, of Like ſort with That it, at Firſt Contained. This *Supply* is made ſeveral Ways; By the Grounds *Lying Fallow* ſome time, 'till the *Rain* has poured down a *Freſh Stock* upon it; Or by the *Tiller's* Care in *Manuring* it.

And for Further Evidence, that This *Supply* is, in reality, of Like ſort, we need only Reflect a while upon Thoſe *Manures* that are found, by Conſtant Experience, beſt to Promote Vegetation,

and the *Fruitfulneſs* of the *Earth*. Theſe are Chiefly, either *Parts* of *Vegetables*, or of *Animals*; which indeed, either Derive their own *Nouriſhment*, *immediately* from *Vegetable Bodies*, or from *Other Animals* that do ſo In particular the *Blood*, *Urine*, and *Excrements* of *Animals*; ſhavings of *Horns* and of *Hoofs*; *Hair*, *VVool*, *Feathers*; *Calcined Shells*; *Lees* of *VVine* and of *Beer*; *Aſhes* of all ſorts of *Vegetable Bodies*; *Leaves*, *Straw*, *Roots*, and *Stubble*, *Turned* into the *Earth* by *Plowing* or Otherwiſe to *Rot* and *Diſſolve* there: Theſe *I* ſay, are our *Beſt Manures*, and being *Vegetable Subſtances*, when *Refunded* Back again into the *Earth*, ſerve for the *Formation* of other *Like* Bodies.

We meet with ſtill further Confirmations of the ſame things in our *Gardens*. The *Trees*, *Shrubs*, and *Herbs*, Cultivated in theſe, after they have *Continued* in one Station, till they have Derived thence the Greater Part of the *Matter* fit for their *Augment*, will *Decay* and *Degenerate*, unleſs either *Freſh Earth*, or ſome *Fit Manure*, be applied unto them. 'Tis true, they may Maintain themſelves there for ſome time, by ſending forth *Roots*, further and further to a great Extent all Round, to fetch in more *Remote Proviſion*: But at Laſt all will Fail, and they muſt Either have a *Freſh Supply* Brought to them, or they themſelves be Removed and *Tranſplanted* to ſome Place Better Furniſhed, with *Matter* for their *Subſiſtence*. And Accordingly *Gardiners* Obſerve, that *Plants* that have Stood a Great While in a Place have *Longer Roots* than Uſual; Part of which they Cut off when they *Tranſplant* them to a *Freſh Soil*, as now not of any further Uſe to them.

All theſe inſtances, to paſs over a Great many Others that might be alledged, Point forth a *Particular Terreſtrial Matter*, and not *Water* only for the *Subject* to which *Plants* Owe their *Increaſe*. Were it *VVater* Only, there would be no need of *Manures*, or of *Tranſplanting* them from Place to Place. The *Rain*, falls in all Places alike; in this *Field*, and in that, indifferently; in One Side of an *Orchard* or *Garden* as well as another; Nor could there be any Reaſon, Why a *Tract* of *Land* ſhould yield *VVheat One Year*, and *Not* the *Next*; ſince the *Rain* ſhowers down alike in Each.

5 *Vegetables are not Formed of VVater; but of a certain Peculiar Terreſtrial Matter.* The *Plant* in *E.* drew up into it 2501. *Gr.* of the *Fluid Maſs*; and yet had Received but 3. *gr.* and a *half* of *Encreaſe* from all that. The *Mint* in *L* tho' it had at *Firſt* the Diſadvantage to be much leſs than that in *I* Yet being Set in *Water* wherewith *Earth* was Plentifully Mixed, and that in *I* only in *Water* without any ſuch *Additional Earth*, it had Vaſtly outgrown the Other, Weighing at leaſt 145 *Gr.* More than that did, and ſo having *Gained* above *Twice* as much as that had. In like manner that in *K.* tho' it was a great deal leſs when put in than that in *I.* and alſo was Impaired and Offended by *Inſects*, yet being Planted in *Water* wherein *Earth* was *Diſſolved*, whereas the *Water* in which *I.* ſtood had None, it not only *Overtook* but Conſiderably *Surpaſſed* the Other; Weighing at leaſt 29. *Gr.* More than that in *I.* and yet had not *Expended* ſo much *Water* as that, by above 2400 *Gr.* The *Plant* in *N* tho' at Firſt a great deal leſs than that in *M.* Yet being ſet in the *Foul Craſs Water* that was Left in the

Still

Still, after that in which *M.* was ſet was Drawn off, in Conc'uſion had *Gained* in Weight above *Double* what that in the *Finer* and *Thinner Water* had. The *Proportion* of the *Augment* of that *Plant* that *Throve Moſt*, was to the *Fluid Maſs Spent* upon it, but as 1. to 46, In others it was as 1. to 60. 100. 200. Nay in the *Cataputia* 'twas but as 1. to 714. The *Mint* in *B.* took up 39 *Gr.* of *Water* a Day, One Day with another; which was much more than the *Whole Weight* of the *Plant* Originally, and yet, with all this it *Gained* not One *Fourth* of a *Grain* a Day in *Weight* Thoſe that in *H.* took up 253 *Gr.* a Day of the *Fluid*; which was near *Twice* as much as its *Original Weight*, it Weighing when firſt ſet in the *Water* but 127 *Gr.* And after all the *Daily Increaſe* of the *Plant* was no more than $2\frac{2}{7}$ *grains.*

6. *Spring and Rain Water Contain pretty near an Equal Charge of Vegetable Matter: River Water more than Either of them.* The *Plants* in the *Glaſſes A. B.* and *C.* were at *Firſt* of much the *Same Size* and *Weight.* At the End of the Experiment, the *Mint* in *A.* had *Gained* 15. *Gr.* out of 2558 *Gr.* of *Spring-Water*; that in *B.* $17\frac{1}{2}$ *gr.* out of 3004 *gr.* of *Rain-Water*, but that in *C.* had got 26. *Gr.* out of only 2493. *Gr.* of *River-Water.* So that theſe *Proportions* will hold for the *Main:* Yet I make no Doubt, but the *Water* that Falls in *Rain* at ſometimes, contains a Greater Share of *Terreſtrial Matter*, than that which Falls at Others. A more Powerful and intenſe *Heat* muſt needs Hurry up a Larger Quantity of that *Matter* along with the *Humid Vapours* that form *Rain*, than one more Feeble and Remiſs ever poſſibly Can. The *Water* of *One Spring* may flow forth, with an Higher Charge of *This Matter*, than that of *Another*: This Depending partly upon the *Quickneſs* of the *Ebullition* of the *Water*, and partly upon the *Quantity* of *that Matter*, latent in the *Strata*, through Which the *Fluid* paſſes, and the Greater or Leſs *Laxity* of thoſe *Strata.* For the ſame Reaſon, the *Water* of *One River* may abound with it more than that of *Another.* Nay the *Same River*, when much *Agitated* and in *Commotion*, muſt bear up more of it, than when it Moves with Leſs *Rapidity* and *Violence.* That there is a Great Quantity of this *Matter* in *Rivers*, and that it Contribute Vaſtly to the *Ordinary Fertility* of the *Earth*, we have an illuſtrious inſtance in the *Nile*, the *Ganges*, and other Rivers, that *Yearly Overflow* the Neighbouring *Plains.* Their *Banks* ſhew the *Faireſt* and *Largeſt Crops* of any in the Whole World. They are even *Loaded* with the *Multitude* of their *Productions*: and thoſe who have not ſeen them, will hardly be induced to Believe the *Mighty Returns* thoſe Tracts Make, in Compariſon of Others that have not the Benefit of like *Inundations.*

7. *Water ſerves only for a Vehicle to the Terreſtrial Matter, which Forms Vegetables; and does not it ſelf make any Addition unto them.* Where the *Proper Terreſtrial Matter* is *wanting*, the *Plant* is not *Augmented*, tho' never ſo Much *Water* Aſcend into it. The *Cataputia* in *E.* took up *More Water* than the *Mint* in *C.* and yet had grown but very Little, having received only $3\frac{1}{2}$ *Gr.* of *Additional Weight:* Whereas the Other had received no leſs than 26. *Gr.* The Mint in *I* was Planted in the ſame *Sort* of *Water* as that in *K.*

was;

was; only the Latter had *Earth Diſſolved* in the *Water*; and yet that Drew off 12140 *Gr.* of the *Water*, *Gaining* it ſelf no more than 139 *Gr.* in *VVeight*: Whereas the other took up but 10731. *Gr.* of *VVater*, and was *Augmented* 168. *Gr.* in *VVeight*. Conſequently, that ſpent 2409 *Gr.* more of the *VVater* than this in *K.* did: and yet, was not ſo much increaſed in *VVeight* as this by 29. *Gr.* The *Mint* in *M.* ſtood in the very ſame Kind of *VVnter* as that in *N.* did. But the *VVater* in *M.* having much Leſs *Terreſtrial Matter* in it, than that in *N.* had, the *Plant* bore up 8803. *gr.* of it *gaining* it ſelf only 41. *gr.* the While: Whereas that in *N.* Drew off no more than 4344. *gr.* and yet was *Augmented* 94. *gr*, ſo that it Spent 4459. *gr.* of *VVater* More than that did: And Yet was not it ſelf ſo much increaſed in *VVeight* as that was, by 53. *gr.* This is both a very *Fair*, and a very *Concluſive* inſtance.

'Tis Evident therefore, that *VVater* is not the *Matter* that *Compoſes Vegetable Bodies*: But 'tis the *Agent* that *Conveys* that *Matter* to them; that *Introduces*, and *Diſtributes* it to the ſeveral Parts for their *Nouriſhment*. That therefore there is that *Plentiful* Proviſion and Vaſt Abundance of it, Supplied to all the Parts of the *Earth*, is a Mark of a *Natural Providence*, Superintending over the *Globe* we inhabit.

This *Fluid* is Capacitated for the Office here aſſigned it, ſeveral Ways: By the *Figure* of its *Parts*; Which, as appears from many Experiments, is Exactly and *Mathematically Spherical*; the *Surfaces* being perfectly *Polite*, and without any of the leaſt Inequalities. It is evident *Corpuſcles* of ſuch a *Figure* are eaſily ſuſceptible of *Motion*, yea far above any others whatever: and Conſequently the moſt Capable of *Moving* and *Conveighing Other Matter* that is not ſo *Active* and *Voluble*. Then, the *Intervals* of *Bodies* of that *Figure* are, with reſpect to their *Bulk*, of all others the Largeſt; and ſo the moſt fitted to Receive and Entertain *Foreign Matter* in them. Beſides, as far as the Tryals hitherto made inform us, the *Conſtituent Corpuſcles* of *VVater* are Each, Singly Conſidered, *abſolutely Solid*; And do not yield to the Greateſt *External Force*. This Secures their *Figure* againſt any *Alteration*; and the *Intervals* of the *Corpuſcles* muſt be always *Alike*. By the *Latter* it will be ever Diſpoſed to *receive Matter* into it; and by the *Former*, when once *received* to *Bear* it on along with it. *VVater* is further Capacitated to be a *Vehicle* to this *Matter*, by the *Tenuity*, and Fineneſs of the *Corpuſcles* of which it Conſiſts, We hardly know *Any Fluid* in *All Nature*, except *Fire*, whoſe *Conſtituent Parts* are ſo exceeding Subtile and Small, as thoſe of *VVater* are. They'l Paſs *Pores* and *Interſtices*, that neither *Air*, nor any Other *Fluid*, will. This Enables them to enter the *Fineſt Tubes* and *Veſſels* of *Plants*, and to introduce the *Terreſtrial Matter*, Conveying it to all Parts of them; whilſt Each, by means of *Organs* it is Endowed with for the Purpoſe, Intercepts and and aſſumes into it ſelf ſuch *Particles* as are Suitable to its Own *Nature*; Letting the reſt Paſs on, through the *Common Ducts*. Nay, we have, almoſt every where, *Mechanical Inſtances* of much the *Same Tenor*: 'Tis Obvious to every one, how Eaſily and Suddenly *Humi-*

dity,

dity, or the *Corpuscles* of *Water* sustained in the *Air*, *Pervade* and *Insinuate* themselves into *Cords*, however tightly Twisted; into *Leather*, *Parchment*, *Vegetable Bodies*, *Wood*, and the like. This it is that *Fits* them for *Hygrometers*: And to *Measure* and Determine the different *Quantities* of *Moisture* in the *Air*, in Different Places and Seasons. How freely *Water* Passes, and Carries with it *Terrestrial Matter*, through *Filtres*, *Colatures*, *Distillations &c.* hath been intimated already.

8. *Water is not Capable of performing this Office to Plants, unless Assisted by a Due Quantity of Heat: And this must Concur, or Vegetation will not Succeed.* The *Plants* that were set in the *Glasses Q. R. S &c.* in *October*, and the following *Colder Months*, had not near the *Quantity* of *water* sent up into them, or so Great an *Additional Encrease* by much, as those that were Set in *June*, *July*, and the *Hotter*. That the *Concourse* is of *Heat*, in this Work is really *Necessary*, appears, not only from the Expetiments before us, but from *All Nature*: From our *Fields* and *Forrests*, our *Gardens* and our *Orchards*. We see in *Autumn*, as the *Sun's Power* grows gradually less and less, so its *Effects* on *Plants* is Remitted, and their *Vegetation* slackens by little and little. Its Failure is first Discernible in *Trees*. These are raised highest above the Earth; and Require a more *Intense Heat* to *Elevate* the *Water*, Charged with their *Nourishment*, to the *Tops* and *Extremities* of them: So that for want of fresh *Support*, and *Nutriment*, they shed their *Leaves*, unless secured by a very *Firm* and *Hardy Constitution* indeed, as our *Ever Greens* Are. Next the *Shrubs* part with theirs; and then the *Herbs* and *Lower Tribes*: The *Heat* being at length, not sufficient to *Supply*, even These, tho' so near the *Earth*, the *Fund* of their *Nourishment*. As the *Heat* returns the succeeding *Spring*, they All *Recruit* again; and are furnished with *Fresh Supplies* and *Verdure*. But *First*, those which are *Lowest* and *Nearest* the *Earth*, *Herbs*, and they that require a Lesser Degree of *Heat* to Raise the *water* with its *Earthy Charge* into them; *Then* the *Shrubs*, and *Higher Vegetables*, in their Turns; and *lastly* the *Trees*. As the *Heat* Increases, it Grows too *Powerful*, and Hurries the *Matter* with too Great *Rapidity* thorow the *Finer*, and more *Tender Plants*. These therefore *Go off* and *Decay*; and Others that are more *Hardy*, and *Vigorous*, and require a *Greater Share* of *Heat*, Succeed in *their Order*.

The same is Observable in *Distant Climates*. The *Hotter Countries* yield Ordinarily, the *Largest* and *Tallest Trees*; and Those too, in Much *Greater Variety* than the *Colder* ever do. Even those *Plants* that are *Common to both*, attain to a much *greater Bulk*, in the *Southern* than in the *Northern Climes*. Nay, there are some *Regions* so *Bleak* and *Chill*, that they Raise *No Vegetables at all*, to any *Considerable Size*. This we learn from *Greenland*, from *Iseland*, and Other Places of like *Cold Site* and *Condition*. In these, *No Tree* ever Appears; and the very *Shrubs* they afford are *Few*, *Little* and *Low*. Again, in the *warmer Climates*, and such as do furnish forth *Trees*, and the *Larger Vegetables*, if there happen a *Remission* and *Diminution* of the *Usual Heat*, their Productions will be *Impeded* and *Diminished* in *Proportion*. Our *Late Colder Summers* have given us Proof Enough of this. For though

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the *Heat* we have had was ſufficient, to Raiſe the *vegetative Matter* in the *lower Plants*; into our *Corn*, our *Wheat*, *Barley*, *Peaſe* and the Like; and we have had Plenty of *Strawberries*, *Rasberries*, *Currans*, *Goosberries*, and the *Fruits* of ſuch other *Vegetables*, as are *Low* and *Near the Earth*; yea, and a moderate Store of *Cherries*, *Mulberries*, *Plumbs*, *Filberts*, and ſome Other that Grow at a ſomewhat *Greater Height*: Yet our *Apples*, our *Pears*, *Wall-nuts*, and the Production of the *Taller Trees*, have been *Fewer*, and Thoſe not ſo *Kindly*, ſo *thoroughly ripen'd*, and brought to that *Perfection*, they were in the former more *Benign* and *warm Seaſons*. Nay even the *Lower Fruits* and *Grains* have had *Some Share* in the *Common Calamity*; and fallen ſhort, both in *Number* and *Goodneſs*, of what the *Hotter* and *Kinder Seaſons* were wont to ſhew us. As to our *Grapes*, *Apricots*, *Peaches*, *Nectarins*, and *Figs*, being *Tranſplanted* Hither out of *Hotter Climes*, 'tis the Leſs Wonder we have *of Late* had ſo *General a Failure* of them.

Nor is it the *Sun*, or the *Ordinary Emiſſion* of the *Subterranean Heat*, only, that Promotes *Vegetation*, but any other indifferently, according to its *Power* and *Degree*. This we are taught by our *Stoves*, *Hot Beds*, and the like. *All Heat* is of *Like Kind*; and wherever is the *Same Cauſe*, there will be Conſtantly the *Same Effect*.

There's a *Procedure* in *Every Part* of *Nature*, that is *perfectly Regular* and *Geometrical*, if we can but find it out; and the Further our *Searches* Carry us, the more ſhall we have Occaſion to *Admire* this, and the better 'twill *Compenſate* our *Induſtry*.

Ground Fertiliz'd by Froſt; *by Dr.* J. Beale. n. 56. p. 1140.

LXXII. I do often ask *Gardeners*, and Skilful *Husbandmen*, whether all ſorts of Land are more *Fertiliz'd*, or more Speedily, by the *Solar* Influence in our Climate, or by *Froſts*; and they generally anſwer, that *Froſt* and *Snow* make the Quicker Diſpatch amongſt us, and the more General and Richer *Fertility*.

Ground improved by Brine; *by Dr.* Jackſon. n. 54. p. 1079.

LXXIII. All the Ground (at *Nantwych*) where *Salt* or *Brine* is ſpilt, is when dug up, Excellent *Muck* for *Grazing-Ground*; and even the *Bricks* that are throughly Tinged with it, are very good *Muck*, and will Diſſolve with other *Muck*, and *Fertilize Land* conſiderably (eſpecially *Grazing Ground*) for at leaſt 4 *Years*.

Improvements with Salt; *by Dr.* J. Beale. n. 56. p. 1135.

LXXIV. In the *Weſt* of *England*, ſome Husbandmen make uſe of *Brackiſh Sand*, and do find a good Reward when they be at the Charges of Carrying it far, for the Enriching of their Inheritances: whilſt other Ruſticks will not be intreated to Accept of the *Brine* they have in the midſt of their own Grounds. Certainly the *Saline Steams* are carried by the Air and Wind much farther from *Salt* it ſelf in *Heaps* or *Veſſels*, than from the *Sea-water*; from whence the *Dews*, which ariſe in Vapours, do deſcend as *Sweet* and *Pure* as the *Dew*, which Aſcends from the *Earth*; and the *Rain* ſhews no Difference. And I gave you once an Experimental Proof, that either the *Saline Steams*, which Aſcend from a *Heap* of *Salt*, do *Pierce* through very thick

Thick Stone-Wall: Or (which I did much rather conceive,) they *generate* more *Salt*, to a great depth of Thickneſs, in the *Lime* and *Mortar* of the Walls.

Improvements in Cornwall, *with* Sea-Sand; *by Dr.* Dan. Cox. n. 113. p. 295.

LXXV. The *Sea-ſand* made uſe of in the *Agriculture* of *Cornwall* is commonly at or near the *Sea-ſhore*; which, to diſtinguiſh from what is Uſeleſs, know, That the *Waſh* of the *Sea* Rolls and Tumbles *Stones* and *Shells*, *&c.* one over another; whoſe grating makes this *Sand*. If the matter be *ſhelfy*, (as we call it) that is, the Grating of *Stones*, it is of ſmall Value: But if it be notably *Shelly*, then it is what we deſire. And of this *ſhelly Sand* are Three *Colours* in our *County*; about *Plymouth* and the *Southern* Coaſt, the *Sand* is *Blewiſh*, or *Gray*, like Aſhes: which I conceive to be from the Breaking of *Muſcles* chiefly, and *Oyſter ſhells*, mixed with it. *Weſtward*, near the *Lands-end*, the *Sand* is very *White*; and in *Scilly*, *Gliſtering*: This I think comes from the Mouldring of *Moor-ſtones*, or a kind of *Free ſtone* mingled with very *White Shells*, ſuch as are call'd (when the *Fiſh* is preſerved) *Scallops*. On the *North Sea* about *Padſtow*, and *Eaſtwards* to *Lundie*, the *Sand* is Rich, and of a *Brown-Reddiſh Yellowiſh Colour*, and is moſtly of the Broken *Shells* of *Cockles*; which I gueſs to be of that Colour there, from the Waſh of *Severn*, which falls very Dirty into the *Severn Sea*; and perhaps that Accretion of the *Shells* may be *Tinged* thereby. This we know, That though there be little or no *Sea-Fiſh* near the Mouth of the *Severn*, becauſe of the Muddineſs thereof; and therefore *Fiſh* is carried to be ſold as far as from *Loo* on the *South-ſea* to *Barnſtable* on the *North*; yet Lower down in the *North-Sea*, though there be not ſo *Much*, yet that which there is, is *Fatter* and *Better* than that which is Taken in the *South Sea*.

Now beſides Theſe *Colours* of *Sands*, there is alſo a Difference in the Bigneſs of the *Grain*; Even in the ſame Harbour of *Plimouth*, in ſome *Caves* 'tis very *Small*, in others *Greater Grain'd*. 'Tis ſaid, that the *ſmall* is beſt for the *Tenant* who only takes to *Tillage* for 4 *Years*: becauſe it works ſooner, and Yields its ſpeedy Return. The *Larger Grain'd* (they ſay) is better for the *Landlord*, and the *Land*, becauſe it abides longer in the Ground, and makes the *Paſture* afterwards the Better.

In *Falmouth Haven*, near *St. Mauſe Caſtle*, there is a ſort of *Sand*, or rather *Coralline*, that lies a Foot under the *Ouſe*; which *Ouſe* being removed and the Bed Opened, this *Sand* is taken up by a *Dredge*, and is uſed about *Truroe*, *Probus*, *&c.*

Weſt of the *Mount* in *Portcuthnoe-Cove* is a Large *Shelly Sand*: In *White-ſand-Bay*, and about St. *Ives*, it is very *White* and *Small*. *Vid. Cap.* III. §. XLI.

About *Minver*, *Perinſand*, and *Lelant*, the *Sands* are Blown up by the Wind, and *Drown* abundance of Good *Land*; ſome Houſes, yea, and ſome Churches and Chappels are even *Buried* with it; nor has any Art been hitherto thought of, to prevent its *Devaſtation*.

Now of all theſe *Sands* the Beſt are accounted, as to *Colour*, firſt the *Redaiſh*, next the *Blew*, then the *White*; as to *Kinds*, the moſt *ſhelly* and the

Coralline are Beſt, and that which is taken up from *under* the *Salt water* either by *Dredges*, or being left open by the *Ebbing* of the *Tide*. The *Blown Sand* is accounted of *No Uſe*. And generally, if *Sand* be well *Drained* of the *Salt-water*, ſo that it may be more conveniently carried, 'tis *Better* than that which has lain long *Drying* in the *Sun* and *Wind*, which take off much of its *Vertue*.

Theſe *Uſeful Sands* are carried by *Lighters* as far up into the Country as the *Tides* will ſerve to that *Purpoſe*, and there they are Caſt on *Shoar*; from whence they are fetched in ſome Places by *VVheels*, but in moſt (by reaſon of the Hilline's, Narrowneſs, and Badneſs of the *Ways*) on *Horſeback*; one Horſe carrying about 13 or 14 *Gallons*. *Seven* or *Eight* of theſe Horſes tail'd together, are call'd a *Train*, which One Man drives to 9 or 10 *Miles* from the *Sand-place*; where each *Seime* (or *Horſe-load*) with the *Carriage*, comes to about 8 *d.* or 9 *d.* in ſome Places, though not ſo much in Others. For where it is *Dredged* out of the *Sea*, it Coſts 12 *s.* or 13 *s.* the *Lighter* (containing *Sixſcore Seime*) at the *Landing-Key*, or *Sand-Place*: But where 'tis *Loaded* from the *Dry Beach* after the *Ebb*, it is not above 4 *s.* the *Lighter*; and all this Charge of *Lighterage* is beſides the *Land-Carriage*. This *Land-Carriage* I have computed to amount, in the whole County, to about 32000 *l. per Ann.*

When this *Sand* is brought Home, it is ſpread on the *Ground* intended for *Wheat*; or uſually in the *Firſt Crop* of *four*, whatever be the *Grain*. For after 4 *Crops*, 'tis our Cuſtom to leave our Land to *Paſture* for 6 or 7 *Years* before we *Till* it again. And indeed the *Graſs* will be ſo Good, immediately after *Tillage*, that we commonly *Mow* it the *Firſt Year*. This is called *Mowing of Gratton*.

The *Corniſh Acre* is 8 *Score Yards* of 18 *Foot* to the *Yard*; in one of which *Acres*, good Husbands beſtow, according to the nearneſs or diſtance: Near the *Sand* 300 *Sacks* (that is *Horſe Seime* or *Burthen*;) where Men go 3 *Turn* a day about 200; where 2 *Turn* 150; and where but *one Turn*, 80, or 100. And ſo Proportionably in greater Diſtance, even to 20 or 30 *Sacks* on an *Acre*, rather than None.

The Effect is uſually where much *Sand* is uſed, the *Seed* is Much, and the *Straw* Little. I have ſeen in ſuch a Place *Good Barly*, where the *Ear* has been even Equal in length with the *Straw* it grew on. But where Leſs *Sand* is uſed, there is Much *Straw*, and but little, and that *Hungry Grain*.

After the *Corn* is off, the *Graſs* becomes moſtly a *White Clovery*; with ſome *Purple*, if the Land be *Deeper*. And this *Graſs* of well *Sanded* Ground, though it be but *Short*, yet as to *Feeding*, giving good *Creams*, Plenty of *Milk*, and all other Good Purpoſes, it far exceeds the *Longer Graſs*, where leſs *Sand* is uſed. Yea, *Garden Herbs* and *Fruits*, in thoſe Places, are more, and thoſe better in their kind. In thoſe well *Sanded* Places, alſo little or no *Snow* lies; there is a Continual *Winter Spring*; an *Early Harveſt*, (a *Month* or 6 *Weeks* before what is within 6 or 7 *Miles* off the Place;) yea ſuch a Vaſt

Difference

Difference of the *Air* is found in ſo little a Diſtance, that a Man may in an Afternoon Travel as it were out of *Spain* into the *Orchades*.

We have in this *County* almoſt all kinds of *Soils*, and *Sand* agrees very well with Each of them.

There is the ſame ſort of *ſhelly Sand* in moſt of the Coaſts of *England*, which lies wholly neglected. In the *Thames* about *Erith* is taken up a ſort of *Sand* not much unlike *Plymouth Sand*, made uſe of only by *Brick makers*: But one of them told me, that by the ſides of his *Sand-heap* the *Graſs* did better ſpring than elſewhere, and turned to a *Clover-Graſs*.

'Tis well known that *Sandwich Carrots* and *Peaſe* are well eſteemed, and they grow there, where the *Sea Sand* has a little Over-blown and mixed with the *Soil*.

A Sandy Soil Manured with Clay; by Dr. Liſter. n. 225. p. 413.

LXXVI. There are ſome Towns in the *North-Riding* of *Yorkſhire*, ſtanding upon a *Light Sandy* Soil, *viz. Tollethorp*, *Tollerton &c.* which do all of them *Manure* much of their Ground by *Clay*. This *Clay* is dug hard by, in the Declivity of a Hill. After having bared away two *Yards* deep of *Sand*, they ſink a ſquare Pit 6 *Yards* Deep, and 8 or 10 *Yards* Square. The *Clay* is of a *Blewiſh-brown Colour*, not *Sandy* at All, but Cloſe and *Fat*, and very Ponderous; it *Burns* well for *Bricks*. They lay 100 *Load* of *Clay* upon an *Acre* of Ground. They dig it at *Midſummer*, and only in a *Dry Summer*. They obſerve that for 3 or 4 *Years* it continues yet in *Clods* upon the Land; and that the *firſt Year* the Land ſo *Manured*, bears Rank, Ill-coloured and Broad Grained *Barley*; but afterwards a Plump Round Corn like *Wheat*. This *Clay Manuring* will by certain Experience Laſt 42 *Years* in the Ground; and that of *Tollethorp* 48 Years: And then the Ground muſt be *Clayed* again.

This *Sandy* Ground, unleſs *Clayed*, will Bear nothing but *Rye*, whatever other *Manure* or *Lime* your *Compoſt* be; but once *Clayed*, it will bear *Oats*, *Barley*, *Peaſe*, *&c.*

Improvements by Marling; by Mr. Tho. Wright. n. 37. 725.

LXXVII. The greateſt Improvement of our Husbandry in *Suffolk*, hath been by *Marling*: For 50 *Load* of *Marle* to an *Acre* of Dry, Barren, *Lingy Heath* make, (as they ſay) a very Great Improvement both for *Corn*, *Turneps*, *Clover-Graſs*, *Nonſuch*, and *Cole-ſeed*. Of the 3 *firſt*, I ſuppoſe, I need to ſay nothing: But of the *two Laſt*, (which are late Experiments) I have received a very good Account from ſome *Northfolk* Gentlemen; One of whom, the laſt Year, had of 7 *Acre* of *Non-ſuch*, or *Hopp-Clover*; 70 *Combs* of *Seed*, beſides a great Crop of good *Hay*, which was twice as much worth as the Beſt Crop of *Wheat* in this Country. 'Tis Sown (as the *Common-Clover*) with *Corn*; and when it once Takes, it will hold 4 times as long in the Ground. About a *Buſhel* and an *half* Soweth an *Acre*: and the *Seed* is now brought to 12 *s.* the *Comb* (for 4 *Buſhels*) which was lately at 40 *s.* The ſame Gentleman had the laſt Year 10 *Combs per Acre* of *Cole-Seed* upon a very *Dry Heath*, (only Improved by *Marling*.

 LXXVIII. There

Improving and Draining the Bogs & Loughs *in* Ireland; *by Mr.* Will. King, n. 170. p. 948.

LXXVIII. There are few Places in our *Northern* World, but have been Famous for *Bogs*, as well as *Ireland*; every Barbarous, Ill-inhabited Country has them. I take the *Loca Paluſtria*, or *Paludes*, whither the Ancient *Galls*, *Germans*, and *Britains*, Retired, when Beaten, to be the very Same We call *Bogs*; And one ſhall find, thoſe Places in *Italy*, that were Barbarous, ſuch as *Liguria*, were Infeſted with them; and therefore I believe the True Cauſe of *Bogs* is want of *Induſtry*. There are many *Bogs* of Late Standing in *Ireland*; when O *Donal* and *Tirone* came to the Relief of *Kingſale*, they Waſted the Country, eſpecially as they came through *Connaught*, which by the Means of the *Earl* of *Clanrichard*, was generally Loyal: and there is a great Tract of Ground now a *Bog* that was then *Plowed Land*; and there remains the Manſion Houſe of my Lord ——— in the midſt of it.

Origine of Bogs.

But to ſhew how *want* of *Induſtry* Cauſes *Bogs*, it muſt be remembred, that the *Springs* (with which *Ireland* abounds) are generally Dry or near Dry in the *Summer time*, and the *Graſs* and *Weeds* grow Thick about the Places where they Burſt Out. In the *Winter* they Swell, and Run, and Soften and Looſen all the Earth about them: now that *Swerd* or *Scurff* of the *Earth*, that conſiſts of the Roots of Graſs, being Lifted up and made Fuzzy by the Water in the *Winter*, (as I have at the Head of ſome *Springs* ſeen it lift up a *Foot* or *two*,) is Dried in the *Spring*: and doth not fall together, but Wither in a Tuft, and New Graſs Springs through it; which the next *Winter* is again Lift up. And ſo the Spring is More and More Stopt, and the *Scurff* grows Thicker and Thicker, till at firſt it make that which we call a *Quaking Bog*: and as it Grows Higher and Dryer, and the *Graſs Roots*, and other *Vegetables* become more Putrid, together with the *Mud* and *Slime* of the *Water*, it acquires a *Blackneſs*, and Grows into that which we call a *Turf Bog*: I believe when the *Vegetables* Rot, the *Saline Particles* are generally Waſhed away with the Water, as being apt to be Diluted in it: But the *Oily*, or *Surphureal*, are thoſe that chiefly remain, and Swim on the *Water*; and this is that which gives *Turf* its *Inflammability*.

To make this appear, 'tis to be Obſerved.

1. That in *Ireland* our *Higheſt Mountains* are covered with *Bogs*, as well as the *Plains*; becauſe our *Mountains* abound more with *Springs* than can be Imagined.

Now no Body Living on our *Mountains*, and no Care being taken to Clear the *Springs*, the whole *Mountains* are over run with *Bogs*.

2. It is to be obſerved that *Ireland* doth abound in *Moſſe* more than, I believe, any other Kingdom.

Now this *Moſs* is of Divers *Kinds*, and that which Grows in *Bogs* is Remarkable; your Light *Spungy Turf* is nothing but a *Congeries* of the Threds of this *Moſs*, as I have frequently obſerved, before it be ſufficiently *Rotten* (and then the *Turf* looks *White* and is *Light*:) I have ſeen it in ſuch Quantities,

tities, and so Tough, that the *Turf-Spades*, could not Cut it: in the *North* of *Ireland*, they call it *Old-wives Tow*, being not much unlike *Flax* The *Turf-Holes*, in Time, grow up with it again: and all the little Gutters in *Bogs* are generally filled with it. And truly *I* chiefly impute the *Red*, or *Turf Bog* to it: and from it even the Hardned *Turf* when broken, is Stringy; though there plainly appear in it Parts of Other *vegetables*. And *I* am almost (from some Observations,) tempted to believe, that the *Seed* of this *Bog moss*, when it falls on Dry and Parched Ground, begets the *Heath*. However the *Moss* is so Fuzzy and quick growing a *vegetable*, that it mightily *Stops* the *Springs*; and contributes to Thicken the *Scurf*, especially in *Red-Bogs*, where only *I* remember to have observed it.

3. It is to be observed, that the Bottom of *Bogs* is generally a kind of *white Clay*, or rather *Sandy Marle:* a little Water makes it exceeding *Soft*, and when it is Dry it is all *Dust*. So that the *Roots* of the *Grass* do not stick fast in it: but a little Wet Loosens them, and the *Water* easily gets in between the Surface of the Earth and them, and Lifts up the Surface, as a *Dropsy* doth the Skin.

4. 'Tis to be observed, that *Bogs* are generally *Higher* than the *Land* about them, and *Highest* in the *Middle*; the Chief *Springs* that Cause them being Commonly about the *Middle*, from whence they Dilate themselves by Degrees. If you cut a Deep Trench through a *Bog*, you will find the *Original Spring*, and Vast Quantities of Water will run away, and the *Bog* Subside; The *Bog* at *Castle Forbes*, (as *I* was informed,) Subsided 30 *Foot*. *I* could hardly believe that: but found by Computation, that it could not be much Less than *Half* of it.

I must confess there are *Quaking Bogs* Caused otherwise; when a Stream, or Spring, runs thro' a Flat, if the Passage be not Tended, it fills with Weeds in *Summer*, Trees fall a cross it and Dam it up: then in *Winter*, the Water Stagnates farther and farther Every Year, till the Whole Flat be Covered. Then there grows up a Course Kind of *Grass*, peculiar to these *Bogs*: this *Grass* grows in *Tufts*, and their Roots consolidate together, and yearly Grow Higher; in so much that *I* have seen of them to the Height of a Man.

This *Grass* Rots in *Winter*, and falls on the *Tufts*, and the *Seed* with it, which Springs up next Year: and so still makes an Addition. Sometimes the Tops of *Flags* and *Grass* are inter-woven on the Surface of the *Water*, and this becomes by Degrees Thicker, till it lye like a Cover on the Water: then Herbs take Root in it, and by a *Plexus* of the *Roots* it becomes very strong, so as to bear a Man. *I* have gone on *Bogs* that would Rise, before and behind, and sink where *I* stood to a Considerable Depth; Under which was *Clear Water*.

The *Inconveniencies* of These *Bogs* are very Great.

1. A Considerable Part of the Kingdom is rendered Useless by them; they keep People at a Distance from One Another, and consequently hinder them in their Affairs, and Weaken them: for it is Certain, that if suppose a Thousand Men Live on 4 *Contiguous Acres*, they *Inconveniencies of Bogs.*

they can both better Assist, and Defend one another, than if they Liv'd on 4 *not Contiguous*.

2. The Land which generally should be our *Meadows*, and Finest Evenest *Plains* are Covered with *Bogs*. This *I* observed through all *Connough*, but more especially in *Longford*, and likewise in *VVest Meath*, and in the *North* of *Ireland*.

3. The *Bogs* are a great Destruction to *Cattle*, the chief Commodity of *Ireland*. In the *Spring* time, when the Cattle are Weak and Hungry, the *Edges* of the *Bogs* have commonly *Grass*: and the Cattle Venturing in to get it, fall into Pits or Sloughs, and are either Drowned, or (if they are found,) spoilt in the Pulling out.

4. They are a Shelter and Refuge to *Torys*, and *Thieves*, who can hardly Live without them.

5. The *Fogs* and *vapours* that Rise from them are commonly Putrid, Stinking and very *Unwholsome*. For the *Rain*, that falls on them, will not sink into them; there being hardly any Substance of its softness, more impenetrable by Water, than *Turf*: and therefore *Rain water* stands on them, and in their Pits; it Corrupts there, and is all Exhaled by the Sun, very little of it Running away, which must of Necessity Affect the *Air*.

6. They *Corrupt* our *water*, both as to its *Colour*, and *Taste*: for the *Colour* of the Water that stands in the Pits, or lyes on the surface of the *Bog*, is *Tinctured* by the *Reddish Black colour* of the *Turf*; and when a shower comes, that makes these Pits to overflow, the Water that runs over *Tinctures* all it meets, and gives both its *Colour* and *stink*, to a great many of our *Rivers*.

Advantages.

1. The *Natives* nevertheless had heretofore some *Advantage* by the *Woods*, and *Bogs*. By them they were Preserved from the *Conquest* of the *English*, and *I* believe it is a little Remembrance of this that makes them still *Build* near *Bogs*. It was an advantage then to them to have their Country Unpassable, and the fewer Strangers came near them, they Lived the easier: for they had no *Inns*; every House where you came, was your *Inn* and you said no more, but put off your *Broges* and sat down by the Fire.

2. They are also now of some Use to us. For most of *Ireland* have their *Firing* from them: *Turf* is accounted a Tolerable sweet Fire; and we having very impolitically Destroyed our *Wood*, and not as yet found *Stone-Coal*, save in Few Places, we could hardly Live without some *Bogs*. *I* have seen *Turf* Charked: and then it serves to *Work Iron*, and as *I* have been informed, will serve to make it in a *Bloomery* or *Iron work*. *Turf charked I* reckon the sweetest and wholsomest Fire that can be; fitter for a Chamber and consumptive People, than either *Wood*, *Stone-Coal* or *Char-coal*.

3. A *Turf Bog Preserves* things strangely; a *Corps* will lye intire in one, for several Years. *I* have seen a piece of *Leather* pretty Fresh, Dug out of a *Turf Bog*, that had never in the *Memory of Man*, Been Dug before. *Butter* has been found, that had lain above

20. *Years*: And tho' not fit to be Eaten, yet it ſerved well enough to *Greaze* Wool.

Trees are found intire in them; and thoſe *Birch*, or *Alder*, that are very ſubject to Rot. The *Trees* are ſuppoſed by the ignorant vulgar to have lyen there ever ſince the *Flood*: but the Truth is, they fell on the Surface of the Earth, and the *Bog*, as I ſhewed above, ſwelling by Degrees, at laſt Covered them; and being of an *Oily Vegetable Subſtance*, it, like a *Balſam*, Preſerves them. Theſe *Trees* Burn very well, and ſerve for Torches in the Night. I have ſeen of the *Trees* Half ſunk into the *Bogs*, and not Quite Covered.

The Inconveniencies Remedy'd by Draining.

All the Inconveniencies of our *Bogs*, may be Remedy'd, and they may be made Uſeful to us, by *Draining*: for I never obſerved *One Bog* without a *Fall*, ſufficient to *Drain* it, nor do I believe there is Any. But the Great and Weighty Objection againſt this *Improvement* is the *Charge*; an *Acre* of *Good Land* in moſt parts of *Ireland*, is about 4 *s. per Annum*, and the *Purchaſe* 14. or 15. *Years*, and therefore 3. *l.* will *Purchaſe* an *Acre* of *Good Land* and it is very Doubtful with Moſt, whether that Sum will *Reduce* a *Bog*. This Reaſoning paſſes Current, and is the Great Obſtacle and impediment of this Work: But if theſe things Following were done, and Conſidered, I verily believe, it would be Remov'd.

1. An *Act of Parliament* ſhould be made, that who did not in ſuch a Time make ſome Progreſs in *Draining* their *Bogs*, ſhould Part with them to Others that Would: and Allow a *Paſſage* to them thro' their Lands.

2. 'Tis to be Conſidered, that in *Quaking Bogs* One *Trench* Drains Many *Acres*: And when Dry, it is Generally *Meadow*, or the beſt *Grazing Ground*.

3. Every *Red-Bog* has about it a Deep, Marſhy, Sloughy Ground, which they call the *Bounds* of the *Bog*. One Deep *Trench* Round the *Bog* keeps out the *Cattle*, and turns the *Bounds* into Good *Meadow*.

4. I Remember a *Red-Bog* of 60. *Acres* which a Gentleman *Reduced* to Good *Grazing Ground*, worth 3 *s.* an *Acre*, for 25 *l.* which is leſs than 3 *Years* Purchaſe.

5. Gentlemen ought to Conſider, that what they lay out this Way, goeth by *Degrees*, and they are not *Senſible* of it; it goeth among the *Tennants*, and enables them to pay their Rent the Better; 'tis a Work of *Charity*, and employs Hands; and Conduces to both the Ornament and General Profit of the *Kingdom*.

6. To make the *Red-Bogs* fit for *Grazing*, Theſe *Rules* may be Obſerved.

1. A *Deep Trench* muſt be made Round the *Bog*. This not Only *Reduces* the *Bounds* of the *Bog* as before, but goes a great way to *Dry* the *Bog* it ſelf. It ſerves likewiſe as a *Common Sink*, into which all your *Drains* vent themſelves.

2. Obſerve which way the *Little Sloughs* Run in the *Bog*, and be ſure to *Cut* your *Drains* a croſs them.

3. The

3. The *First Drains* on the *Bog*, ought not to be above 2. or 3 *Foot* Deep, or Wide: For the *Bog* is so Soft that *Deep Trenches* will not stand but Fill up Again. When the *Surface* of the *Bog*, is *Cut* in *Little Trenches*, suppose at 20. 30. 40. *Perch* Distance, it will be so Dryed, that *Cattle* may *Graze* on it all *Summer*.

4. A Year or two after the *Little Trenches* are made, and the *Bog* a little Dry, they are to be made 6 *Foot* Wide, and as Deep as the *Softness* of the *Bog* will Permit. And this will Certainly make the *Bog* Useful for *Grazing*. A *Year* or *Two* after this, you may attempt to *Cut* One or Two of the *Trenches* to the *Bottom* of the *Bog*; for till that be Done, I do not reckon the *Bog* Secured.

5. A Gentleman ought to oblige all his Tenants, to *Cut* their *Turf* in these *Trenches*: and likewise *Cut* his own so.

6. Where a *Bog* is *Pitted*, he is to Cut a Passage from one *Pit* to the next for the Water, and so make a Communication to the Common *Drain*: and if his *Pits* be once Dryed there will grow *Grass* or *Heath* at the Bottom, fit for *Grazing*, and they will be a shelter for Cattle in Storms.

7. When his *Bog* is Dryed, it is thereby made Better *Turf*, and then he is to set out a part of it for that Use, and to Oblige them to Cut it *Clear* away: And the *Bog* being removed, the Bottom will make a good *Meadow*.

8. He may Cut off the Surface of the *Bog* and *Burn* it: Or else Bring *Earth* and lay on it. *Sanding* or rather *Gravelling* is a great *Improvement* in this Country; the Land so *Manured* will bring Corn 12 or 14. *Years*. They say *Gravelling* is bad for *Grass*: But the contrary is apparent; especially in *Bogs*. I have observed by the Way side, where the Ways pass thro' *Bogs*, if a little *Earth* hath fallen on the *Bog*, as some times there doth fall a little of that which they bring to mend the High-way, it has turned the *Bog* into a *Green-Sod*, with a very fine *Scutch Grass* on it: And *I* doubt not but the same Charges, that *Sands* or *Gravels Land*, would Reduce a *Dryed Bog*, even to be *Arable*.

Improvements of Loughs.

The Natural *Improvements* of *Loughs*, or *Lakes*, is first to *Drain*, them as Low as we can; and then turn the Residue of the Water into *Fish Ponds*: by Planting a few Trees about them, and ordering them thus, they may be made both *Useful*, and *Ornamental*.

And Turloughs.

As to those Places we call *Turloughs*, *quasi Terreni Lacus*, or *Land-Lakes*, they answer the Name very well; being *Lakes* One part of the *Year* of Considerable Depth, and very Smooth *Fields* the Rest. There are in these *Lakes Holes* out of which the Water *Riseth* in *Winter*, and *Goeth away* towards *Summer*: Many Hundred *Acres* being Drowned by them, and those the most Pleasant and Profitable Land in the Country. The *Soil* is commonly a *Marle*, which by its Stifness hinders the Water from Turning it into a *Bog*: and immediately when the *Water* is *gone*, it Hardens so that you ride thro' an Even *Grassy Field*. These, if they could be *Drained*, would be fit for any Use; would make *Meadow*; or Bear any *Grain*, but especially *Rape*, which

Vid. Sup. Cap. II. §. XIX.

is

is very Profitable. They are Chiefly in *Connaught:* and their *Cauſe* is Obvious enough. It is a *Stony Hilly* Countrey, and the *Hills* have *Cavities* in them through which the *Water* Paſſes; it is Common to have a *Rivulet Sink* on one ſide of a Hill, and Riſe a *Mile* or *half* a *Mile* from the Place. The *Brooks* are Generally Dry in Summer; the Water that ſhould be in them, *Sinking* between the Rocks, and running *Under Ground:* in ſo much as that in ſome Places where they are Overflow'd in *Winter*, they are forced in *Summer* to ſend their Cattle many *Miles* for *Water*. There is one Place on a Hill near *Tuam* between two of theſe *Turloughs*, where there is a *Hole* the Superſtitious People call the *Devil's Mill*; and make *Fables* concerning it: If you ſtand by this Place, you will hear a Great *Noiſe*, like that of Water under a Bridge. When there is a *Flood* in *Winter*, one of the *Turloughs* Overflows, and *Vents* it ſelf into the *Hole:* And the *Noiſe* doth, in all likelyhood, proceed from a *Subterraneous Stream*; which in *Summer* has Room enough to *Vent* all its Water, but in *Winter*, when *Rains* fall, the Paſſages between the Rocks cannot *Vent* the Water, and therefore it *Regurgitates*, and Covers the *Flats*.

Theſe *Turloughs* are Hard to *Drain*: Often they are Encircled with Hills, and then 'tis not to be expected; often they have a *Vent* by which they ſend out a conſiderable Stream, and then it is only making that Paſſage as Low as the Bottom of the *Flat*, and that will Prevent the *Overflowing*; it ſometimes happens that the *Flats* are as Low as the Neighbouring *Rivulets*, and in all Probability are Filled by them, and then it is not only Neceſſary to make the Paſſage from the *Flat* to the *Rivulet*, but likewiſe to *Sink* the *Rivulet*, which is very troubleſome, commonly the Paſſage to be Cut being *Rocky:* And therefore a good *Computation* (upon a *Survey*) ought to be made, whether it be worth the while to Attempt it. However the *Holes* ought to be Opened that the Water in its Ordinary Courſe may get ſooner away: And they are to be Eaten very *Bare* towards the End of *Summer*, that as Little Graſs as is Poſſible may be Spoilt by the Water.

The Motion of a Bog *in* Ireland; *by* ..... n. 233. p. 714.

LXXIX. 1. *Jun.* 7. 1697. near *Charleville*, in the County of *Limerick* in *Ireland*, a Great *Rumbling* or Faint Noiſe was heard in the Earth, much like unto the Sound of *Thunder* near ſpent; for a little Space the *Air* was ſomewhat *Troubled* with little Whisking Winds, ſeeming to meet Contrary ways; and ſoon after that, in the *Bog* of *Kapanihane*, upon the Eſtate of *Brook Bridges* Eſquire, ſtretching *North* and *South*, the Earth began to *Move*, *viz.* *Meadow* and *Paſture Land* that lay on the ſide of the *Bog*, and Separated by an Extraordinary Large Ditch, and Other Land on the Further ſide adjoyning to it; and a Riſing, or Little Hill in the middle of the *Bog* hereupon *Sunk Flat*.

This *Motion* began about 7. of the Clock in the Evening, fluctuating in its *Motion* like *Waves*, the *Paſture Land* Riſing very High, ſo that it Over run the Ground beneath it, and *Moved* upon its Surface, Rowling on with great

Puſhing Violence, till it had covered the *Meadow*, and is held to remain upon it 16 *Feet* Deep.

In the *Motion* of this *Earth*, it drew after it the Body of the *Bog*, part of it lying on the place where the *Paſture Land*, that *Moved* out of the place it had before, ſtood; leaving great *Breaches* behind it, and ſpewings of Water, that caſt up *Noiſome Vapours*.

By Mr. J. Honohane. *ib.*

2. The Line *A B.* is the *Meridian*; *C.* a *Meadow*, containing 3. *Engliſh Acres*, and 32. *Perches*; *D.* firm *Paſture-Land* (but of a Courſe *Boggy* Subſtance) containing 4. *Acres* 3. *Roods*. The Line 1 2 was a Hedge of a large

Fig. 176.

Aſh and *Willow-Trees*, between the *Meadow* and the *Firm-Land*; 3 4 was the *Edge* of the *Bog* next to the *Paſture*. The *Prickt* Lines from 3 to 5 and from 4 to 6 ſhew the Limits or *Bounds* of the *Bog*. The *Meadow C.* was *Lower*, by a Deſcent of 5 *Foot*, than the *Paſture D.* and the *Paſture D.* was Lower by 6 *Foot* than the Surface of the *Bog*. And there was yet a conſiderable *Riſing* and Hill, as at *E*, the Height whereof was more than 10. *Foot* above the Surface of the *Bog*; ſo that there was a *Deſcent* from *E.* to the *Meadow*.

The *Cauſe* of the *Motion* I preſume was this; a more than Ordinary *Wet Spring* occaſioned a Prodigious ſwelling of the Height of the *Bog* at *E.* and at length Moiſtened the Whole; bnt chiefly the under part thereof; the Water ſoaking to the Bottom. By this means the *Turfy Hill E.* being as it were undermined, naturally *Sunk* down and conſequently Preſſed the *Bog* on all Hands, chiefly towards the *Deſcent*, till the *Paſture D.* was Forced on the *Meadow C.* Overturning the intermediate *Hedge*; ſo that the Line 3 4 is now become 1 2. and the *Meadow* and the whole *Bog* are Level; only there are *Chaſmes* and great *Cracks* throughout the Whole Surface of the *Bog*, repreſented by the Stroaks about E. The *Bog* contains 40 *Acres*.

The Spaniſh Sembrador *and its Uſes; by the E. of* Sandwich. n. 60. p. 1056.

LXXX. In the Deſcription of this *Sembrador*, (Publiſht by *Don Joſeph de Lucatello* Knight, *Inventor* of the Engine, and Dedicated to Signor Don *Geronimo de Camargo*, Counſellor of the *Conſejo Real de Caſtilla* and of the *Hazienda Real*,) it is Repreſented;

Firſt, that both the Ancient and Modern Husband-Men have Agreed, that the *Perfection* of *Agriculture* Conſiſted in *Setting* the *Plants* in *Proportionable Spaces*, and giving *ſufficient Depth* to the *Roots*, that they may Spread enough, to receive that Nouriſhment from the Ground which is neceſſary to Produce and Ripen the *Fruit*.

2. That Care hath not been had, in the *Practice* of this important part of *Husbandry*: ſince even at this Day, all ſorts of *Seeds*, of *Corn* and *Grain*, are *Sown* by *Handfulls*; throwing them out by *Aim*, Heedleſly and by Chance (counting it too Tedious and Chargeable to *Set* them *one by one* in Large Fields). Whence we ſee *Corn* Sowed in ſome places too Thick, in Others too Thin, and the Greater part of it not Covered, nor Deep enough; whereby it is not only Expoſed to be Eaten by *Birds*, but alſo in *Cold Countries* to be Spoiled by *Froſt*, and in *Hot Regions* by the *Sun*. Upon theſe Conſiderations, *D. Joſeph de Lucatello* hath after much Experience Perfected an

Inſtrument

Inſtrument, which being faſtned to the *Plough*, at once *Ploughs*, *Soweth*, and *Harrows*; whereby is ſaved the Labour of the *Seeds man*; and the *Grain* falling in *Order*, and in the *Bottom* of the *Furrow*, all of it remains in One and the Same Diſtance under Ground, ſo that of 5 parts of *Seed*, 4 parts are Saved; and then in the *Crop* is Gained Incredible Abundance.

3, That the *Inventor* preſented it at the Feet of his *Catholick Majeſty*, who cauſed Tryal to be made thereof in the *Buen Retiro*, where it did Anſwer Expectation, notwithſtanding the *Drought* of the *Year*, then much Damnifying all *Corn*: an ordinary Husband Man from a meaſured ſpace of Ground there, Sowed in the Common manner, Reaping 5125. where he by his Contrivance from an Equal ſpace of Ground there alſo, Reaped 8175 beſides the *Seed* ſaved in the *Sowing*.

4 That thereupon his ſaid *Catholick Majeſty* did Grant to the *Inventor*, the *Privilege*, That He *Only* and his Aſſignes may *Make* and *Diſtribute* theſe *Inſtruments*, in all the Kingdoms and Provinces of that Monarchy *in Europe*, at the *Price* of 24 *Rials Plate* Each, and *out of Europe* 32 *Rials Plate*, of which the 5*th* part ſhould be paid to the *King*: Prohibiting to all others the *Making* and *Uſing* this *Inſtrument* under ſeveral *Penalties*.

5. That before the *Inventor* came to the Court of *Spain*, He made a Great Tryal of it before his *Imperial Majeſty*, in the Fields of *Laxemburg* in *Auſtria*, where the Land uſually yields *Four* or *Five fold*: But the Crop from the Ground Sowed with This *Inſtrument* was *Sixty Fold*; as appears by a Certificate given in *Vienna Aug.* 1. 1663. *ſt. n.* by an Officer of the *Emperor* appointed to ſee the ſaid Ground Sowed and Reap'd.

6. That this *Privilege* being Diſpatch't, he Publiſh't his *Contrivance* and *Inſtructions* as follows.

1. Fig. 177. Is a *Box* of *Wood*; *a. b. c. d.* the Cover of that part where the *Corn* is Put in; (which is Open in *Fig.* 178. at W.) And *e. f. h. g. k. l.* the two Sides which Cover that part of the *Box*, where the *Cylinder*, which is Stuck round with 3 *Rows* of little *Spoons*, is Moved about to Throw out the *Corn*; (which Sides are Taken off in Fig. 178, to make the *Cylinder R. S.* with the *Spoons x. x. x. appear*). The inner Shape of theſe Sides is expreſſed in Fig, 179 where may be ſeen four *Triangular* pieces *p. p. p. p.* leaving *Triangular* Interſtices *q. q. q.* which ſerve to Conveigh the *Corn* Carried up in the *Spoons*, and Diſcharged at the Top of the *Cylinder*, ſo as they may juſt Run out, at the *Holes* Underneath the *Box*; (the Parts of Which Anſwer to the Parts of Fig. 177. according to the Letters.) *T* is one of the *Wheels*; *V.* the Other End of the *Cylinder*, upon which, the Other *Wheel* is to be Placed. *Fig.* 177. 178. *Fig.* 179.

2. This *Sembrador* muſt be Tied faſt to the *Plough*, in the Manner as is ſeen in Fig. 180. ſo that the*Corn* may fall in the *Furrow*, and at the Turning of the *Plough*, the *Ears* of the *Plough* may *Cover* the Corn of the Laſt Furrow with *Earth*. *Fig.* 180.

3. Becauſe the *Seed* ſow'd by this *Inſtrument* is placed in a Convenient Depth, *viz.* in the Bottom of the *Furrow*, whereas the *Seed* ſcattered the Common way, remains nearer the Superficies of the Earth, or quite Uncovered, therefore it muſt needs *ſhoot* forth ſomewhat *Later*: So that it is Requiſite, the Husband-man, uſing this *Inſtrument*, ſhould Sow 8 or 10 *Days* ſooner than the accuſtomed *Seed time*; *viz.* Beginning to Sow in the Middle of *Septemb.* and making an End at the Middle of *Novemb.*

4. In *Stiff Ground* the *Furrows* ought to be 5 or 6 *Inches* Deep; in *Middle* ſort of *Ground*, 6 or 7; and in *Light* and *Sandy Ground* 7 or 8 *Inches*; and according to this Proportion, the Husband-man muſt Govern himſelf, Deepning or *Shallowing* the *Plough*, as the Condition of the Land ſhall Require.

5. Special *Care* muſt be had, that the *Wheels* on the Sides of the *Inſtrument* do always *turn round*, and never *Drag* along, *without Turning*; as alſo, that the *Ears* of the *Plough* be made ſomewhat Bigger than the Ordinary Ones.

6. 'Tis alſo Convenient, that the *Seed* be well *Sifted* and *Cleaned*; that ſo the little *Spoons* may every time take up a *Grain* and the *Seed* be the better *Diſtributed*.

7. In *Barley* 'tis to be well obſerved, that it be made *Clean* in that manner, that the *Straw* and *Beards* be broken off, as near the *Grain* as may be: That ſo they hinder not the Iſſuing of the *Grain*, out of the *Inſtrument*.

8. After *Seeds-time* done, *Furrows* muſt be made to *Drain* the Land of Water, according to the Uſe of Each Country, without doing any thing more Extraordinary, until the *Harveſt*.

The following *Inſtructions* were alſo Publiſht.

1. Before they *Sow* the Ground, they muſt give it ſo many *Tilths* as is accuſtomed in that Country where the Land lyeth.

2. When they go about to *Sow*, the *Ploughman* muſt begin to open a *Furrow* with the *Plough* for One or Two Paces; and when the *Plough* is in the Ground in a Convenient Depth, then they muſt Tye the *Sembrador* to the *Plough-Beam*, ſo that the Nails in the Wheels may ſtand upon the Ground to make the Wheels turn round.

3. The *Ears* of the *Plough* are to be made *Larger* than hitherto: Whence Two Advantages will ariſe. 1. It will better Cover the *Furrows* when *Sown*; and make *Wider Furrows* to receive the *Seed* when they do *Sow*. 2. Thoſe *Larger Ears* will prevent the Blows, the great *Clods* and *Stones* will give the *Sembrador* (if the *Clods* be not Broken, and the *Stones* pickt out.) But when there are ſuch *Great Stones* in the Land, as the *Plough* cannot Penetrate, then the *Plough man* by Lifting up his *Plough* muſt paſs over it, until he meets with *Mould* again; and ſo muſt the *Sembrador* alſo be Lifted up, the Weight thereof being but very little, and no Conſiderable Trouble to the Ploughman.

4 When the *Clods* and *Stones* cannot be Maſtered with only one pair of

Ears

Ears, you muſt add Another Pair of them to the *Plough*, 4 or 5 *Inches* Higher than the Firſt (chuſing a fit place in the *Beam* to place them in) although behind the Others a Little; for ſo, the *Sembrador* will be perfectly Saved and Defended. And the *Second Ears* are to be of the ſame Bigneſs with the *Firſt*. And this is found, by Experience, to be the Beſt Remedy againſt the *Stones* and *Clods*.

5. The time of *Sowing*, according to the moſt experienced Farmers, is when the *Mould* of the Land is *Dry*, or but a little enclining to *Moiſture*: In either of which Conditions of the Land, this *New Sembrador* works without *Clogging* the *Wheels*, or ſtopping up with *Dirt*, thoſe *Holes* through which the *Grain* is to Iſſue forth.

6. When this *Sembrador* Works as it ought to do, it will *Sow* three *Celamines*, or about a *Peck* of *Wheat*, and 5 *Celamines* (or $1\frac{1}{2}$ of a *Buſhel*) of *Barley*, on as much Land as would take up about $1\frac{1}{2}$ *Buſhel* after the Common Way of *Sowing*. And if it much Exceed or Fail of this Proportion, it noteth ſome *Fault* in the *Inſtrument*, or *Careleſsneſs* in the *Ploughman*.

7. The *Spoon* muſt be made for *All Seeds*, Proportionably to their *Bigneſs*.

8. You muſt *Plough* the *Furrows* very Cloſe One to Another, that ſo the *Plough*, when it Turns back, may the better *Cover* the Laſt *Furrow*, which is left *Open*, and *Sowed* as it came along.

9. After having *ſown* the Land, in the ſaid manner, the Land ſhould be made as *Plain* as can be, and no ſuch *Furrows* made to Carry away the Water, as Hitherto hath been uſed: But it will be ſufficient, that at every 4 *Yards* Diſtance (one from the Other) *Furrows* be made. For Experience hath taught us, that the Land laid up *without Furrows*, bears more Corn, than that which hath *more Furrows*, becauſe the *Wheat* and *Barley*, and *Other Plants*, receive greateſt Damage by *Drought*. And therefore this ought more eſpecially to be obſerved in *Spain*, one of the *Dryeſt* Countries of *Europe*.

10. In many Parts of *Spain*, in 1664, it was found, that Land *Sown* in *September* hath yielded a Better *Crop*, than that which was Sow'd in *October*; and that *Sown* in *October* better than that *Sown* in *November*. Which Proveth, that 'tis more Advantageous to *Sow Early*, than *late*.

11. They have obſerved alſo, That it is very Profitable to *ſow* in the *New Moon*, becauſe it will *Shoot* forth, and *Thrive*, and *Ripen ſooner*. In *Spain*, *Italy*, and the *Iſlands* of the *Mediterranean*, they may begin the *Firſt New Moon* in *September*, and ſo go on, and End with the *New Moon* in *November*. But in *Germany*, and the *Low Countries*, they begin in the End of *Auguſt*, and End with the *New Moon* of *October*.

LXXXI. It is vulgarly known, that the ſurface of ſome Ground is ſo hollow, light, and ſwoln by a *Hot* and *Working Ferment*, that it muſt needs ſend up a *Warming ſteam*; as appears by the Quick Riddance of all the *Snow* that

Agreſtick *Obſervations and Improvements*; *by Dr.* J. Beale: n. 116. p. 359.

that falls on it, and (in many places within my Knowledge) Diſſolving the *Snow* before it falls on the ground; that ſome *Stones* by an Innate *Warmth*, and ſome *Waters*, do *Impregnate* the Earth, and that other *Stones*, by their contrary Qualities, or by their Poſitions, have a quite contrary Operation; that ſtreams of *Water* running over *Lime-ſtones*, or through Veins of *Marle*, or of that ſort of *Chalk* which is kind for *Manure* (for there is a ſort of *Chalk* which is *Barren*) doth *Fertilize*; that ſome other *Waters* are *Hungry*, *Uliginous* and *Corroſive*; and that thoſe *Rivers* which are filled with a *Black-water*, by Rain running over *Heaths*, do much Miſchief where they overflow, begetting *Heath* all over the Paſtures.

In the ſharpeſt *Froſt* that I have known theſe many years, the Ground having been alſo ſome days Covered with *Snow*, I ſaw a ſmall *Stream* (no bigger than might run from the Mouth of an ordinary *Quart Glaſs-Bottle*) ſliding Merrily, and *Smoaking* all the way over the *Lawns*. I could not diſcern, that any *Snow* had fallen within 5 or 6 *foot* on each ſide; (if it did, none Remained there;) and ſo far the *Graſs* at that time, about *Chriſtmas*, was as *Green* as any *Leek*, and the *Froſt* (ſo far) apparently *Diſſolved*. Of this I then wrote to our worthy Friend Mr. *Evelyn*, not for any wonder, (for perhaps there are, or may be Thouſands of ſuch *ſmoaking ſtreams* in *England*,) but only Repreſenting how ſuch a *Stream* may *Warm* a *Manſion*, and *Cheriſh Tender Evergreens* well ſheltered from Winds, and *flowry Gardens*, all the *Hard Winter*, and do us better ſervice in an extream *Hot Summer*. I have been Perplext in Obſerving my ſelf, an hundred times, the Difference of *Heat* and *Cold* between two Villages within a Mile of each other, where we could obſerve no diſparity of Hills or Rivers; only the *Springs* in the one were all ſhallower, in the other ſome were Deeper. In a large Tract of Land the Surface was of ſo *Hot* a *Ferment*, that at every ſtep I trod up to the *Ankles*. *I* cauſed it to be examined by the Spade, and found it, as far as *I* tried here and there, at a foot depth, as thick ſet with *Pibble-ſtones*, as if a Cauſey had been Pitch'd there; yet was it a Quick and *Pregnant* Land for *Flowers*, *Fruit-Trees*, and *Vines*, theſe *Pibbles* bing diſlodged, and ſome of them Carried away. *I* have ſeen Fields where the Surface did ſeem Covered with *Pibbles*, not *Flinty*, nor *Limeſtone*, yet they bore full Burthens of the beſt and cleaneſt *Rye* and *Oats*: The Husbandmen took away the *Pibbles* from off the Surface, and then the Land Bore as ſtrong *Wheat*, *Peaſe*, and *Barley*, as before it Bore *Oats* and *Rye*. In other parts where I have been, the Husbandmen took away the *Stones* which ſeemed to Cover the Fields, and ſuſtain'd great Loſs for their coſtly Labour; their *Corn* was much Weaker for ſome Years after. *I* can Attribute theſe Differing Events to nothing, but the Difference of *Stones*: Some Intrinſically *Warm*, and *Impregnating* above Ground; ſome *Cold* and not *Impregnating*, whilſt in that Poſition or ſituation. Yet ſome Experience forbids me to Deny, that even ſuch *Stones*, when Covered with Earth, at a certain Depth, may Increaſe the *Fertility* of the Land. And the *Hot* and *Bibulous* Land, which Drinks up the *Rain* and *Snow* as ſoon as it falls, ſeems to have ſome *Cooling* Refreſhment from Under ground-*Pibbles*, which are of a *Cold*, *ſtiff*, and *ſullen* Nature.

What

What *I* have to ſay of *Warming* and *Fertilizing Rocks*, *I* ſhall deliver with an aſpect towards *Scotland*, for *Horticulture*. *I* had ſeveral times Conference with Sr. *Robert Morray* B. M. (who was an Honour to his Country, and a Bleſſing to the place where he Abode) concerning *Eſculent* and *Olitory Gardens*, and (under one) *Nurſeries* of *Fruit-Trees*, and other Uſeful Vegetables in *Scotland*. *I* Repreſented, that, almoſt within my memory, they are become the Chief Relief of *England*; that 'tis lately found, that *Auſtere Fruit* yield the *Strong* and *Sprightful* Liquor, which Reſembles the *Wine* of the *Grape*; that the Return of *Gain* from *Gardens* is Great and Speedy; *Nurſeries* neither a Chargeable nor a Burthenſome Addition, but a Congruous Engagement of the Multitude to Perſevere in the Nobleſt kind of *Agriculture*. Sr. *R. M.* granted all that *I* ſa'd; and *I* am ſure, he Acted and Executed all that he could for the Good of his Own Country, and for *England*, *&c.* But, ſaith he, there are ſo many *Rocks*, and ſuch *Bleak winds* in *Scotland*, that they can hardly draw in the ſame Yoke with *England* for *Gardens* and *Orchards*. *I* Replyed that in *Devon* and *Cornwall*, they *Fenced* their *Gardens* and *Orchards* with *Flanders Furrs* and Tall *Holly* from the *Sea-winds*; and they have Lofty *Firrs* and goodly *Pines* in *Scotland*: and *New England*, (where the *VVinds* are as *Keen*, and the *Snow* and *Froſts* as Deep, and as Long laſting, as in many parts of *Scotland*) is yet full of Fruitful *Orchards*. And if *Scotland* be farther in the *North*, yet *Norway* is rich in *Boſcage*; and the Seeds of the *Hemlock-Tree*, *Spruce* and *Cedars*, from *New England*, *New-found-Land*, and *Virginia*, may perhaps rejoyce in the Exchange of *Northern America*, for the *North* of This Iſland.

This *I* told Sr. *R. M. I* Durſt undertake, that when *Edinburgh* and their Chief *Towns* and *Univerſities* ſhall plant *Kitchen Gardens*, as we do now in *England*, they ſhall Receive their Grateful Reward the Firſt Year, and bear the Charges of their *Nurſeries* abundantly; and ſo hold on; and within 7 *Years*, ſecure their Poſterity of the Benefit, and Delight themſelves with the *Fruit* of their Pleaſing Labour.

Now for *Fertilizing Rocks*, *I* made bold to Repeat it often, That within a days Journey of the *Heart* of *England*, *I* could ſhew 3 *Gardens*, the Beſt that *I* have ſeen for *Flowry* Beauties, *Engliſh Evergreens*, and *Sallads* all the *Winter* long; all theſe on a *Hard Rock*, in moſt places but One *Foot* deep under Earth; in ſome Two, in few places Three Foot Deep; very Lofty Hills cloſe on the *South ſide*, the *Declivity* of the *Gardens* due *North*; and the *Rock* perfectly *Bare* next to the Walls on the *North ſide*. And *I* ſaw Rich *Hop Yards* in the ſame Caſe, but in Deeper Ground, next to the *Garden* on the *South ſide* of the Garden: And theſe *Northern Hop Yards* Eſcaped many Blaſts, which ſeiz'd on the *Hop Yards* on the *South ſide* of the Hill. On the Steep Aſcent, on the *North-ſide* of one of theſe *Rocky* Hills, where no *Plough* could come, *I* ſaw a Gentleman *Ploughing* up the ſhallow Turf with a *Hand Plough* for *Flax*, and *I* ſaw good *Flax* Grow there, to the largeneſs of a Village-Field. His *Hand Plough* had a ſtem of *Aſh* or *Sally* about 7 *foot* long, and a *Plate* on one ſide near the End, to *Turn* the Turf; a *Coulter* to be let out ſhorter

or

or Longer, to Cut the Turf 4. or 5. or more *Inches* Deep, as the Land affords it; and a Small Iron *Wheel*. This *Hand Plough*, the Maſter and his Man by turns, Drove before them with a Walking Speed; having Leathern Aprons before them to ſave their Cloaths. For the *Cauſes* of this *Hardy Fertility*, *Viderint Philoſophi*. *I* am ſure of the Truth of what I write; And I am willing to Apprehend, that if in *Scotland* they did, in Fit Places, Sow the beſt *Flax Seed* of *Flanders* as many here do, they would make good *Holland-Linnen*, *Laune*, and *Cambrick*, as now they do *Scotch-Cloth*.

It is no Hard Task to ſhovel down the Shallow and Moſſy Turf, from the Steepeſt Declivities of *Rocks*, into places where it may have ſome Receptacle or Stay: and there to *Impregnate* it with the *Spade* and *Compoſt*, for *Gardens* or *Vineyards*. And there the *Tenth Part* of an *Acre* in *Gardening* may yield More Profit, than *Ten Acres* of Ordinary Tillage in a *Corn-Field*.

I am ſo much a Stranger to *Scotland*, that I cannot ſay, whether *Saffron*, *Licorice*, *Hops*, *Madder*, *Oade*, or what other Rich Commodities do Proſper there: but this I know, that our *Engliſh Saffron* and *Licorice*, do far excel all the *Forreign*, which our Druggiſts do ſell us from the *South*. And ſince *Vines* and *Mulberries* have Travailed from the Remoteſt *Eaſt*, through all the *Hotteſt* Countries, and have abundantly Enriched our next Borderers, and have received Acceptable Hoſpitality, as far they have been Tried, in this our Iſland: We have encouragement enough to adventure the Cheap and Eaſie Trial.

ib. p. 364. n. 133. p. 816.

Some of my Correſpondents Tried the *Mulberrie* and *Silkworm* as far in the North as *Huntingtonſhire* and *Cheſhire*; and *Sr. James Craig* tried them in the *Moiſteſt* place of *Ireland*, in the County of *Cavan* in *Ulſter*: and all boaſted their ſucceſs, *An.* 1651, 1652, 53, 54, 55. Wherever *Mulberries* grow, I am apt to expect, that the *Worms* will Live, and Spin, and Furniſh the *Silken-Trade*.

In *Devonſhire* they Mingle *Black Mulberries* fully Ripe, with a Full-Bodied *Cyder* in the time of Grinding or Preſſing the *Apple*, with Diſcretion for *Tincture* and Reliſh: And they Eſteem it a very Wholſome and Stout *Wine*.

Vid. Sup. §. XXXIX. 2.

'Tis ſtrange, that in 9 or 10 *Years* ſince this was Publiſhed, the practiſe hath not been ſpread into other Countries, where they abound with ſtrong and *Winy Cyder*; many being willing that their *Cyder* ſhould in *Tincture* reſemble *Claret*, *Tent*, or *Alicant VVine*. But it may ſeem, that we do yet Retain ſomewhat of our Fathers averſneſs from Planting *Mulberries*, which they ſhewed near the Beginning of King *James* his Reign, to our great Loſs and ſhame.

The Mulberrie requireth a Rich, ſucculent and Rank Ground, which is not wanting in the approaches of any of our Cities and Towns. And Mr. *Evelyn* hath written as well as can be written, both to *Inſtruct* and to Encourage the *Planting* of them.

The *VVhite Mulberries* (as we call them) are for the *Fineſt Silk*; but to *Mingle* with *Cyder*, and for our *Junkets*, (as *Palladius* hath Hinted to us) we ſhould ſend for the moſt Delicious *Black Mulberries* which may be had in *Naples*,

Naples, *Sicily*, *Virginia*, or any of the *East* or *West-Indies*: Not truſting to the *Seed*, but by all means to have *Young Plants*, of the Beſt ſorts, ſent in Boxes, containing ſome of the Connatural Soil. Thus if the Gardens about *London* were well Furniſht they might eaſily be diſperſed into other parts, without more adoe: For, few *Plants* may be more Eaſily *Propagated*, when they are *Young*. A Few Rooted *Mulberries*, being preſſed down, and Covered with Earth in fit places, ſo that the *Eyes* may be very Lightly Cover'd and the *Sprouts* or *Branches* (if there be any) may be Cut very near to the Ground; or a *Good Branch*, after due depth of the Bigger End in the Rich mold, thus ordered as before; will ſoon become a *Perpetual Nurſery*. And if the Worſt *Mulberries* were well Diſperſed, they may be ſoon Amended by putting the *Largeſt Black Mulberrie* upon that of the *Small* kind; it being certain, that it takes better upon that, than upon the *White Mulberrie*.

Vinous Shrubs are now coming into *Faſhion*; of theſe do ſome make *Sugar Wines* by Art, to be Compared (for Wholeſomneſs and Pleaſantneſs to many Palates) with Rich *Wines* of the *Grape*. For the *Sugar-Cane* doth hardly yield to any *Vine* in the World: and we Hope that *Meath*, *Methleglin*, and other *Hony-Drinks* will in a ſhort time give place to theſe *Sugar-Wines*, when perfectly well made.

Beſides 'tis good Imployment for the Poor Women and Children to Gather the *Fruit*: and a Special *Improvement* of our *Waſte-Lands* and *Heaths*, only by Turning the *Turf* and *Burnt-Heath* (if there be any) into the Trenches and Pits made by the Plough or Spade, for *Banks* or *Beds*.

Many Diſcourage themſelves from *Planting Cider-Orchards*; ſaying that if they had the *Fruit*, they ſhould yet want many matters too Coſtly for them. For their Sakes, *I* ſhall here inſtance, that in all the Neighbourhood round about *Yeoville* in *Somerſetſhire*, they that make 20 *Hogſheads* of *Cyder* yearly, and much more, do *Pound* all their *Fruit* in *Troughs*, made for the purpoſe Deep and Strong, with *Broad-Feeted-Pounders*, one, two, or three (as their need requireth) Pounding together in the Same *Trough*. And to me they hold the Paradox ſtoutly, That, without more Coſt or Trouble, this is the Beſt and Cheapeſt way. Workmen are cheaper in the Country at ſome ſeaſon, than in ſome Cities. And 'tis a Charity to Employ Men that want Employment, rather than Beaſts; and ſometimes 'tis Unſafe to truſt, either to the *Wind* or to the *Water*. n. 134. p. 846.

Cyder (you know) Coſts no Fewel to Brew it, and the Labour is but once in the Year.

'Tis drawn by Divine Chymiſtry; ſo many *Trees*, ſo many huge *Alimbecks*, which attend to that Divine Work conſtantly all the Year; They need no *Furnaces*, to ſend forth a *Corroding* Smoak to Choak all the City, to Strangle them into *Conſumptions*, and to Corrupt all Beauties and Amenities. Neither *Iron*, *Steel*, nor *Marble*, can reſiſt the Fumes of Brewing Houſes: whereas *Cyder* is of a Thouſand kinds, Proper to Cure many Diſeaſes; and a kind *Vehicle* for any Healing Vegetable or other Medical Matters.

The *Cyder* of the beſt *Pepins* duly Ripen'd and kindly Fermented, is a Pe-

uliar Remedy for the *Conſumption*: And generally all Strong and Pleaſant *Cyder* Exciteth and Cleanſeth the *Stomach*; it ſtrengthneth *Digeſtion* and infallibly frees the *Kidneys* and *Bladder* from breeding the *Gravel* and *ſtone*. This is (above all) the Peculiar Excellency of the right *Red ſtrake* of *Irchin Field*, when it eſcapes all Sophiſtications. But that which makes *Cider* Fit to Accompany the *Trades Men's Granary* is, that if it be made of Right *Cider Fruits*, ſo that it will be Full Bodied, and Strong, it will hold Good without Decay, and will Yearly be much *Improved* for ſome Years, to the next *Plentiful Year*, as uſually it falls out; and beſt of all in Large Veſſels, the Larger the better. *Trades men* ſhould not be for *Bottled Cider*, which is commonly more Windy than Healthful. It hath been tried from my Childhood in Veſſels of 14. 15. or 16. *Hogſheads*, of the Free Houſhold Meaſure, containing between 60. or 70. *Statute Gallons*; I have been Often told, thar Sr. *John VVinter* had a Veſſel which contaned 30. or at leaſt 28 *Hogsheads*.

When the Citizens ſhall Ordinarily Drink *Cider* well *Diluted*, as the *French* drink *VVine*, and as the ſober People in all our *Cider-Countries* Drink their *VVaſhings* of *Cider* (as they call it) or *Cider* well *Diluted* in the *Grinding-Time*, and as they Drink in *London* their *ſix ſhilling Beer*, I am perſwaded it will much Conduce to their Health; and I have often heard *Labouring* People affirm that they are more ſtrengthned for Hard Work by *Cider* largely *Diluted*, than by very Good *Beer*.

Yet *I* have much more to ſay for *Houſhould-Gardens*, as a fit Match for *Granaries*. *Coleworts* and *Cabbages*, with a little care, hold out 7. or 8. Months in the Year. *VVe* have them all the Year round; good ſauce for *Bacon* as Red as any Roſe, as they have it in *Herefordſhire*, where the *Swine* will get a ſhare of the *Fruit*, which fall from their Hedges; and the *Bacon* of *New Foreſt* is generally Commended. Theſe are in Good Houſes always at hand, and may be eaſily Dreſſed without Waſte of much Time. But *Roots* of all ſorts, *Rapes*, *Turneps*, *Carrots*, *Parſneps*, *Skirrets*, *Potado's*, do challenge the Precedence Before *Granaries*: They are a kind of *Under Ground Granaries*, and do often times hold out, when *Corn* faileth; eſpecially the *Potado's*, of *Barbados*, or of *Virginia*.

Vid. Sup. §. VIII. The *Potado's* of *Barbados* (in our freſh Memory) relieved *Ireland* from 2. *Years Famine*, when their *Corn* failed there; as *Cheſnuts* relieved *France* in the extremity of their *Civil VVar*, when their Ploughs were forſaken. Theſe *Potado's* coſt little or no *Culture*, for 10. *Years* together: being only covered with *Fern*, or other *Light Muck*, and that Turned in with the Earth, and 2. or 3. *Roots*, as often as there is Occaſion to take any of them up for Uſe; and they ſhould be taken up, here and there, (by ſmall parcels) where they grow Thickeſt. A Few *Acres* of theſe will run far to Furniſh a *City*, and the Country round about. They have been ſold in the Markets of *Briſtol* and *VVells*, at the price of 4 *ſhillings per Buſhell*: Dear enough in reſpect of their Eaſie *Propagation* and *Culture*, and Cheap enough in reſpect of their Uſe. Children of Poor people thereabout Eat them *Raw* (inſtead of *Bread* and other *Food*) without Hurt; ſome do *Roſt* them in Embers, as they do *VVardens*; ſome do *Boyl* them, peel them, and Eat them with Butter and Pepper, either ſerved

ved Whole, or Chopt, as they do *Parſneps*; ſome do Strengthen their *Beer* or *Ale*, or make Good Drink with them; ſo they are to them, inſtead of *Corn* and *Malt*, and an Acceptable Treat. Every way they are a Strong and Wholeſome Nouriſhment for Labourers. Some do *Parboyl* them ſlightly, Peel them, and Mince or Cut them in ſmall bits, Mingle them with Slices of Fat Fleſh, Seaſoning all to their Palate, and *Bake* them in Pyes or Paſtyes: and they Eſteem them a Reſtorative Delicacy, not much Inferior to *Artichoaks*. *I* obſerve them to Grow and Proſper abundantly in much Differing kinds of Soil, from the *North* of *Shropſhire* to the *Sea-Coaſt* of *Dorſetſhire*. But they like not a ſtiff and ſtrong Land: *I* tried them 2 *Years* in a ſtrong Wheat Land, and could get no good of them There; all the Roots, which were there generated, were little bigger than the *Bulbs* of *Saffron*. In Light and Hollow Land of the *Hotteſt Ferment* (which is commonly of Little Worth for *Corn* or *Paſture*) there *Potado's* Thrive beſt and Taſte beſt. But now *I* am at a Difficulty whether the Great *Difference* which we find in the *Reliſh*, be from the Differing *Kinds* of the *Potado's* of *Barbados* and *Virginia*, (for both have the ſame Reſemblance *above ground*:) or whether the Difference, which we find, be only from the Diverſity of the *Soyl*.

That the *Soyl* makes a Great Difference, and that all may be Careful to Chooſe a fit *Soyl* for their *Garden-Diet*, *I* ſhall here Offer ſome Notable inſtances to prove it. All the people here, (the very Vulgar,) do find the *Carrots* and *Turneps* or *Rapes*, from the *Common Fields* of *Meriot*, 8 Miles from hence Weſtward; far to Excel other very Good *Turneps* and *Carrots* in Fatneſs and pleaſing Reliſh And *Cabbage-Plants* from the Wide Fields of *Lydiard*, Weſtward of *Taunton*, (where they have a *Rich Reddiſh Soyl*) do ſo far Excel all other the Beſt *Cabbage Plants*, that theſe *Lydiard Plants* are Bought in all places at 80 Miles Diſtance, and *Garden Plants* are ſometimes much Altered in Taſte and properties, by the Accidents of the Year. In a Droughty *Summer*, (the *Plague* then being *Hot* in *London*,) we had *Carrots* in *Northamptonſhire* from a Kind Soyl, where they were wont to be very good; but then ſo Rank, Dry, and Earthy, that we could not endure to ſee them on the Table.

I hear that the *Turneps* of *Hackney* are better than other *Turneps* about *London*. We have here very good *Turneps*, White and Yellow, which are Fatter and Eſteemed more Reſtorative. But all *England* wants the *Bohemian Turneps*, *Blood Red* on the Outſide, which are Extolled by *Muffet* (as he found them in *Prague*) to be ſo *Reſtorative* and *Delicate*, that the Emperour himſelf Nurſeth them in His Garden.

The *Spaniſh Potado* requires Diligent *Culture*, much *Sun* and a Light and pregnant *Garden Soyl*. In the *Modern Latin* they are called *Glandes Malacenſes*, being brought into *Spain* from *Volez Malaga*, a Province in *America*. They report that more than a Dozen of their Huge *Spaniſh* Ships were brought at One Time to *Sevil* in *Spain*, fully Fraighted with theſe *Potado's*, and were ſoon diſperſt all over *Spain*. We ſay the *Spaniard* is Slow at every thing: But they may ſay, the *Engliſhman* in many parts of *England*,

is more Slow at the beſt improvements of Our own Country; Witneſs our Want of *Vineyards*, of *Groves* of *Mulberries*, of the beſt *Cheſnuts*, *Wallnuts*, *Figs*, *Almonds*, which are Wanting in moſt Parts, and do not *Refuſe* to Grow in *Our Climate*.

Improvements of Agriculture; *by Dr.* M. Liſter. n. 225. p. 412.

LXXXII. For the *Improvement* of *Sandy*, *Light*, *Ground*, or any *Clay* well *Sanded*, I Recommend upon Experience *Vicia Multiflora Nemorenſis Perennis*, *ſive Dumetorum. I. B.* It hath theſe Qualifications, beſide thoſe mentioned in the Title of *J. Bauhine*, (*viz.* of its being *Perennial*, Thriving even in *Woods* and among *Buſhes*, and being of the *Pulſe* or *Pea* kind) that it Shoots 1000 *Roots* far and wide, and ſpreads it ſelf Under Ground like *Quick-Graſs*: Above Ground it is ſo Rampant, that it will Climb a *Fathom* and *half* upon Meaſure, and will preſerve it ſelf in Spite of *Weeds* or *Drought*. Again, it may be *Set* as well as *Sown* in *Furrows*: And for this Purpoſe the *Roots* may be Dug up in *Sept.* as well as the *Ripe Seed* then Gathered; by this means the Growth of it would be mightily Advanced, for the Older the *Roots* are, the Stronger, and Fuller of *Buds* and *Shoots* they are. I *Sow'd* the Latter End of *March* the *Seeds* I had Gathered in *Sept.* and had that Year a very Great Encreaſe; the *Bed* being thick Covered over with *Graſs* above 2 *Foot* high; but it did not *Flower* that Year. I Reckon'd that *One Pea* had put forth *that Year* above 30 *Shoots* in *Auguſt*: In the *Second Year* it *Flowered* by the Middle of *June*, and Bore a Wonderful *Crop*, the *Roots* being innumerable. I have obſerved this *Pea* very Common in all the *Mountains* as well as *Plains* of *England*, where *Buſhes* or *Hedges* are. Both the *Pea* and *Graſs* are very *Sweet*, and very Agreeable to *Cattle*, as I have Tryed.

Agriculture may be alſo Conſiderably Advanced, by the great Choice of *Plants*, even of thoſe of our Own Growth, of the *Pulſe Kind*; of which I Recommended this Liſt.

Lathyrus major Latifolius. Ger.
Lathyrus Luteus Sylveſtris Dumetorum. I. B.
Aſtragalus Sylvaticus Ger.
Vicia Sylveſtris Semine Rotundo Nigro C B.
Orobus Sylvaticus Noſtras. C B. P. in Append.
Vicia Sylvatica Multiflora maxima. P. B.

I alſo Recommend as *Subſtitutes* of *Hemp* and *Flax*, of our *Engliſh* Growth *viz.* *Perennial Plants*;

Linum Sylveſtre Anguſtifolium. I. B.
Linum Sylveſtre Floribus Cæruleis. Ger.

Corona Fratrum; of the *Thiſtle Kind*. This Plant is generally a *Yard* Tall; its *Fibres* are exceeding *Tough* and *Strong*, beyond any I ever tryed; it puts forth many of theſe Tall and very Thick Stalks Yearly; it naturally Grows to this Bulk in moſt *Barren Soils*, as the *Dry Woolds*, and High Paſtures, in *Yorkſhire* and *Lincolnſhire*.

It may be Objected, that as *Annual Plants* require more Labour and a *Fatter Soil*; ſo they Recompenſe it in Largeneſs of Growth and Fruit: And alſo, that Plants of *Laſting Roots*, are more Harſh and Bitter, and not Palatable

for

for *Man* or *Beaſt*. I anſwer, that the *Compendium* of *Labour*, in *Husbandry*, is all in all; and that therefore the *Durable Plants* will turn to Better Account: I refer to the Wonderful Examples of Such as have already been made Uſe of, as *St. Foin*, *&c.* And it is Probable that by ſome *Tillage*, even *Harſh Plants* may be improved and brought to be Kinder Food. The ſame *Aſparagus* which we Eat, Grows *Wild* in the *Marſhes* of *Lincolnſhire*, very Fair, and not to be Diſtinguiſhed by the Eye from that in our *Gardens*: but is intollerable *Bitter*, which *Garden Culture* alone has Civilized, and made Pleaſant to the *Taſte*. For this Purpoſe *Liming* of *Paſture Ground* makes it Palatable to *Cattle*: For Caſt *Lime* over the One Half of a *Paſture*, the Cattle will not Bite any where elſe Willingly, and will Eat here to the Bare Ground, much Neglecting the Other Half. I did uſe when I Lived in the *North*, to *Lime* my *Aſparagus* and *Lettice Beds*, and this did ſo far *Meliorate* them, that they far Exceeded in Tenderneſs, and Pleaſant Taſte; Covering the *Aſparagus* in *Winter* with *Clean Wheat Straw*, inſtead of *Naſty Litter*, and *Sowing* the Bed thick with the Powder of *Burnt Oyſter-Shells*.

Perhaps *White Briony*, of all our *Engliſh Plants*, would beſt Succeed both for *Hay* and *Corn*; as giving the *Moſt Graſs*, if we would that way Uſe it; and alſo Yielding a *Root* of a Prodigious Bigneſs, which Seaſonably taken up, is little elſe but a Maſs of *Fine Flower*. 'Tis true, it is a *Churliſh Purge*, and not fit *Food* for *Man*, or any Other *Animal* we keep: But ſuch and much Worſe is the *Callava Root* of which the *Indian Bread* is made, and which by *Exſuccation* and *Baking* alone, proves *Innocent* and *Wholeſome*. If the *Vaſt Shoots* it makes be Deſigned for *Hay*, they are to be *Cut* when Tender and in the *Flower*.

LXXXIII. *Sow* all Sorts of *Grains*, and *Plant Kernels* in Beds of Earth, at the very Time when the *Sun* Enters into the *Vernal Æquinox*; and take them Up, when they are Strong enough to be *Tranſplanted*, at the Time of the *Full Moon*: Which time is always to be obſerved, if you will take them Up, and *Replant* them again.

To make Plants *Grow to an* Extraordinary Bigneſs, *by M.....*: n. 116. p. 356.

But now to know the *Moment*, or very Near the *Moment*, of the ſaid *Æquinox*, take ſome *Aſhes* of *Vine-wood*; put them in an *Earthen Pot Leaded*, or in a Pot of the *White-Earth* of *Tayence*, very Clean; Pour upon it *Common Water*, or Fountain, or Rain Water, that is very Clear, from the $\frac{9}{19}$ of *March* to the $\frac{11}{21}$ of the ſame; and at the Time when the *Sun* Enters into the *Æquinoctial Point*, you will ſee the *Aſhes* make the *Water Turbid*, and then is the Time of *Sowing* your *Grains* and *Planting* your *Kernels*.

LXXXIV. I am of Opinion, that one Conſiderable Way to improve *Gardening*, and the *Culture* of *Plants*, would be to give a *Deſcription* of the *Plants* themſelves, then the *Soils*, *Climates*, and *Countries*, where the *Vegetables* to be Cultivated *Naturally* Grow; and what *Seaſons*, *Rains*, and *Meteors* they have: Which being *Imitated*, as much as Poſſible, perhaps Some Plants

Gardening *Improved*; *by Dr.* H. Sloan. n. 251. p. 119.

Plants might Thrive Better, than now they do in the Fatteſt Ground. And to this purpoſe I have been aſſured by an Honourable and very Ingenious Perſon, that he has known ſome *Plants*, particularly *Centaurium Minus*, which not Growing the Ordinary Way, was Tryed by Dropping the *Seed* on the Surface of the Ground amongſt the *Graſs*; by which Artificial *Imitation* of *Nature*, it came to Perfection, which No Other way could be brought about.

The Succeſs of a New Stove; by Sir Dudly Cullum. n. 212. p. 191.

LXXXV. I have made a *Stove* for my *Green-Houſe*, according to Mr. *Evelin*'s Late Invention, Publiſht in the *Calendarium Hortenſe*. I laid my *Pipes* (of *Crucible Earth*) not too near the *Fire-Grate*, which is about 16 *Inches*; and I made a *Trench* the whole Length of my *Houſe*, under the *Paving*, about 18 *Inches* in Breadth and Depth (Cover'd with an Arch of Bricks) and at the Other End of the *Trench*, having an Iron Plate about 18 *Inches Square*, to Take Off, and put on, with a Round Hole at Each Corner of about 3 *Inches Diameter*, with a Lid to ſlide open and ſhut, ſo that by Opening any of theſe Holes, or all of them, more or leſs, or taking off the whole Plate, I can Releaſe ſuch a Quantity of *Air* out of the Houſe, to Blow the *Fire* ſo as to Increaſe or Diminiſh the Blaſts; and as Mr. *Evelin* was pleaſed to Inform me by a Letter, concerning *Diſtributing* the *Air* at its Admiſſion, more Equally through the *Houſe*, I inſerted my *Pipes* into a *Channel*, all along the *Wall*, at the End of the *Houſe*, with thoſe ſeveral *Overtures* he mentioned; all which, prove moſt admirably well.

To make Fruit *and* Flowers *Grow in* Winter; *by Sir* Rob. *Southwell.* n. 237. p. 44.

LXXXVI. Take up *Trees* by the *Roots* in the *Spring*, juſt as they put forth their *Buds*, preſerving ſome of their *Own Earth* about the *Roots*; ſet them ſtanding Upright in a *Cellar*, until *Michaelmaſs*; then put them into *Veſſels*, with an Addition of more *Earth*, and bring them into a *Stove*, taking care to *moiſten* the *Earth* every Morning with *Rain-water*, in a Quart of which, you muſt Diſſolve the bigneſs of a *Walnut* of *Salt Armoniack*, and about Lent *Fruit* will appear.

As to *Flowers*, Take Good *Earthen Potts*, and therein *ſow* your *Seed* at *Michaelmaſs*, *Watering* it in the ſame manner with the like *Water*, and by *Chriſtmaſs* you will have *Flowers*, as *Tulips*, *Lillies*, &c.

This and the Other may be done in a Good *Warm Kitchin*; and ſuch Days as the *Sun* Shines, you may ſet them forth for ſome Hours.

To keep Fruit, or Flowers *the whole Year; by Sir* Rob. Southwell. n. 237. p. 44.

LXXXVII. Take *Salt Petre one Pound*, *Bole Armoniack two Pounds*, Ordinary Clean *Sand* 3 *Pounds*; Mix all together; and Obſerve This *Proportion* in other Quantities.

Then in *Dry Weather*, take *Fruit* of any ſort that is not fully *Ripe*, Each, with its *Stalk*; put them in, One by One, into an *Open Glaſs*, till it be full; and then Cover it with *Oil'd Cloth*, cloſe Tyed down; Then in a *Dry Cellar* put each of theſe *Glaſſes* 4 Fingers under Ground, and ſo as that quite round each *Glaſs*, and Above and Below, there may remain 2 Fingers Thick of the ſaid *Mixture*.

Flowers alſo may be Uſed in the ſame manner.

LXXXVIII. I

LXXXVIII. I would adviſe ſuch as ſuffer Detriment in their *Green Houſes*, not to Deſpair, when they ſee the *Leaves* of their *Myrtles*, *Oranges*, *Oleanders*, *Jaſmines*, and other *precious Fruits*, *Ruſſet*, or altogether *Shrivelled* and Faling; but to *Cut* them to the *Quick*, Plaiſter the *Wounds*, and Plunge their *Caſes* and *Pots* (Trimmed with *Freſh* Mold, *&c.*) in a *Warm Bed*, Carefully Refreſhed, Shaded, Aired and Treated as *Sick Patients*, and as the Prudent Gardner beſt knows how. But above all, that he be ſure, not to Expoſe them, 'till the *Eaſtern Winds* (which I call our *Engliſh Eteſians*, and which make our *Springs* ſo uncomfortable, when we think *VVinter* and all Danger paſt) be Qualified; for they are Deadly to all our *Plants* Abroad, and frequently do us More Prejudice than the Moſt Churliſh *VVinters*; as Commonly finiſhing the Deſtruction of what the *Froſts* have ſpared. Nor are we to be flattered with a *VVarm Day* or Two, which are apt to Tempt Gardeners to *Set out* their *Plants*, before the End of *April*, or that we find the *Wiſe Mulberry* put forth which is Certainly the moſt *Faithful Monitor*; nor ſhould we indeed, *Cut*, or *Tranſplant* any of the *Perennials*, till of themſelves they begin to *Sprout*.

Remedies for Decayed Ever-Greens; *by Mr.* J. Evelyn. n. 158. p. 561.

LXXXIX. In the *Spring*, being Flattered with ſome *Warm glances* and *Refreſhing Days*, many are apt to *Expoſe* their *Choice Greens*, which upon a ſudden Change to its Former *Cold*, with Sharp *Eaſtern Winds*, proves more Pernicious to Such *Strangers*, than all the former *Winter*, and ſeems to finiſh the Deſtruction of what the Former *Cold* had Spared; a Matter too frequently ſeen among us, we Enjoying no certain Steady *Summer* till after the *Solſtice*. But theſe tender *Exoticks* loſing their *Leaves*, having received Detriment, with their Tops ſhrivelled and the like, are oftentimes not Capable of Enduring the interpoſing *Scorching Heat* of the *Sun*, which oftentimes happens by *Fits* in the *Spring*; when the Prudence and Care of the *Gardener* is eſpecially Tried, Gradually to Help and Recover his *Sick Patients*, ſometimes by Due *Trimming*, *Earthing* with *Freſh* Suſtenance, *Looſening* the *ſtrait Bound Earth*, and ſometimes with the Help of a *Warm Bed*, and Gentle *Watering* and *Shadowing* and the Like, patiently and Carefully Waiting the Return of the Bounty of the *Heavens* to help his Endeavours.

Cautions about Expoſing Ever-Greens; *by Mr.* Jac. Bobart. n. 165. p. 771.

In the *Flower-Garden*, eſpecial, Obſervance ought to be Taken of the *Choiſer Roots* of the *Aſian Ranunculi*, *Aulmoneys*, Tender *Narciſſi* and diverſe Others of the like Tenderneſs, and Strangers to ſuch Entertainments as our *Northern Countries* afford; that if *Hard Froſt* ſhould happen, they ſhould be ſecurely Covered and Kept from the *Froſt*, if poſſible, till the too *Frigid Moiſture* of the *Earth* be *Digeſted*, which would prove Pernicious even to the *Death* and *Rottenneſs* of many ſuch *Roots* and *Plants*.

Vid. Sup. Cap. I. § LIII.

XC. *Papers*

XC. Papers *of leſs General Uſe*, Omitted

n. 40. p. 793. 1. *Directions* for *Tranſporting Vegetables.*

n. 220. p. 239. 2. *Phytologia Tingitana*; or, an *Alphabetical Catalogue* of *Plants*, Growing within the *Fortifications* of *Tangier*, 1673. by Mr. *Spotſwood.*

n. 232. p. 677. 3. A *Catalogue* of ſome *Guinea Plants*, with their *Native Names* and *Virtues*; ſent by Mr. *J. Smith* from *Cabo Corſo*: with *Remarks* on them; by Mr. *James Pettiver.*

n. 244. p. 313. 4 An *Account* of 46 *Eaſt Indian Plants*, Collected at *Unanercoonda*, about 12 Miles from *Fort* St. *George*; by Mr. *Sam. Brown*; with their *Names*, *Deſcriptions*, and *Virtues*; by Mr. *James Pettiver.*

n. 236. p. 1. n. 264. p. 579. n. 267. p. 699. 5. An *Account* of Part of a Collection of *Curious Plants* and *Drugs*, gathered by Mr. *Sam. Brown*, a Phyſitian at *Fort St. George* in the *Eaſt-Indies*, and lately given to the *Royal Society*, by the *Eaſt-India Company*: With Remarks, by Mr. *Pettiver.*

n. 193. p. 504. 6. *Quæries* concerning *Indico*; by——

n. 40. p. 797. 7. *Quæries* concerning *Vegetation*, eſpecially the *Motion* of the *Juices* of *Vegetables*; by——

n. 43. p. 858, 862. n. 46. p. 919. 8. *Quæries* concerning the *Circles* of *Wood* in the Bodies of *Trees*, and the *Motion* of *Sap*: by Dr. *Ez. Tonge.*

n. 44. p. 881. n. 46. p. 914. 9. *Quæries* concerning *Vegetation*, and the *Motion* of *Sap* in *Fruit-Trees*; by Dr. *Ez. Tonge.*

n. 57. p. 1165. 10. *Quæries* concerning *Vegetation*, and the *Motion* of *Sap*; by Dr. *Ez. Tonge.*

n. 68. p. 2073. 11. *Inquiries*, about *Retarding* the *Aſcent* of *Sap*, and the *Motion* of *Sap*: by Dr. *Ez. Tonge.*

n. 68. p. 2074. 12. Some further *Enquiries* concerning the *Running* of *Sap* in *Trees*; *Colouring* the *Fruit* and *Leaves*; *Multiplying Crab ſtocks*; and *Propagating Trees*, by *Layers*, *&c.* by Dr. *Ez. Tonge.*

n. 70. p. 2121. 13. *Inquiries* relating to the *Circulation* of the *Sap* in *Trees*; by Dr. *Martin Liſter.*

n. 74. p. 2218. 14 An *Enquiry* ſuggeſted from *Italy*, whether it be likely to find ſomething in *Plants*, *Analogous* to the *Heart* in *Animals*

n. 40. p. 801 15. An *Invitation* to make further Trial of the *Juices* of *Trees* by *Tapping* them; by Mr. *H. Oldenburgh.*

n. 252. p. 186 16. Two *Problems* concerning the *Texture* of *Plants*; and the *Diſcovery* of *Poyſon* by *Opium*; Propoſed by——

n. 5. p. 91. 17. *Enquiries* concerning *Agriculture*; by the *Committee* of the *Royal Society* for Conſidering of *Agriculture.*

n. 40. p. 799. 18. *Enquiries* concerning the *Uſe* and *Culture* of the *Kitchen Garden*, and *Winter Greens*: by——

XCI. Accounts *of Books, and* Additions, Omitted.

1. *Baſis Botanica:* Seu brevis ad *Rem Herbariam* Manuductio, omnes *Plantarum* Partes, una cum earundem *Virtutibus* ſecundum Noviſſima *Botanicorum* Fundamenta, Generali quadam Methodo commonſtrans; a D. *Chriſtiano Ludovico Welſchio. Lipſ.* 1697. *in* 12o. n. 243. p. 304.

2. *Abr. Coulei Angli,* ſex Libri *Plantarum,* Poemate *Latino* conſcripti. *Lond.* in 8o. n. 36. p. 716.

3. *Præludia Botanica Roberti Moriſon, Scoti Abredonenſis, Lond.* 1669 in 8o. n. 46. p. 934.

4. Dr. *Moriſon*'s New *Univerſal Herbal.* n. 114. p. 327.

5. Cl. *Salmaſii* Præfatio in Librum de *Homonymis Hyles Jatricæ.* Ejuſdem de *Plinio* Judicium. *Divione. An.* 1668. *in* 4to. n. 46. p. 935.

6. Quadripartitum *Botanicum Simonis Pauli,* Med. Reg. in *Dania. Argentorati, in* 4*to.* n. 76. p. 2291.

7. Waare Oeffening der *Planten,* door *Abraham Munting.* M. D. *Amſterd.* 1672. *in* 4*to.* n. 111. p. 247.

8. *Memoires* pour ſervir a l'*Hiſtoire* des *Plantes*; dreſſez par M. *Dodart.* M. D. *Paris.* 1679. *Ph. Col.* n. 1. p. 39.

9. *Hiſtoria Plantarum,* ſpecies hactenus editas, aliaſque inſuper multas noviter inventas & deſcriptas complectens. Auth. *Joh. Rai.* è *Soc. Regia. Lond.* 1686. *in Fol.* n. 186. p. 283.

10. *Phytographia*; by *Leonard Plukenet.* M. D. *Lond.* 1691. *in Fol.* n. 193. p. 528. n. 196. p. 618.

11. *Almageſtum Botanicum*; S. *Phytographiæ Plukenetianæ, Onomaſticon,* &c. *Lond.* 1696. in *Fol.* n. 225. p. 434.

12. *Catalogus Plantarum Angliæ,& Inſularum adjacentium tum* Indigenas, tum in Agris paſſim Cultas complectens. Opera *Jo. Raii.* M. A. 1670. in 12o. *&* 1677. in 8o. n. 63. p. 2058 n. 133. p. 834.

13. The *American Phyſitian*; or a Treatiſe of *Roots, Plants, Trees, Shrubs, Fruit, Herbs, &c.* growing in the *Engliſh Plantations* in *America:* Whereunto is annexed, a Diſcourſe of the *Coco Nut-Tree,* and the Uſe of its *Fruit.* By *W. Hughs. Lond.* 1672. in 12o. n. 83. p. 4078.

14. *Catalogus Plantarum* quæ in Inſula *Jamaica* ſponte proveniunt, vel vulgo coluntur; cum earandem *Synonymis,* & *Locis Natalibus*; adjectis aliis quibuſdam quæ in Inſulis *Maderæ, Barbados, Nieves,* & *Sancti Chriſtopheri,* naſcuntur. Seu *Prodromi Hiſtoriæ Naturalis Jamaicæ* Pars prima. Aut. *Hans Sloane.* M. D. 1696. in 8o. n. 221. p. 293.

n. 104. p. 87. 15. *Icones & Descriptiones Rariorum Plantarum Siciliæ, Melitæ, Galliæ, & Italiæ*; Auth. *Paulo Boccono* 1674.

n. 247. p. 462. 16. *Museo* de *Piante Rare* della *Sicilia, Malta, Corsica, Italia, Piemonte, & Germania, &c.* di Don *Paolo Boccone*, &c. *To which are here Added some Remarks by* Mr. *J. Ray.*

n. 145. p. 100. n. 198. p. 682. n. 200. p. 762. n. 214. p. 276. 17. *Hortus Indicus Malabaricus*, continens Regni *Malabarici* apud *Indos* Celeberrimi, omnis generis *Plantas Rariores*; *Amstel. An.* 1678. 1679. 1682. *&c. To which here are Added some Remarks by* Tancred Robinson, M.D.

n. 236. p. 29. 18. *Hortus Medicus Amstelodamensis*, sive *Plantarum* tam *Orientalis* quam *Occidentalis Indiæ*, aliarumq; *Peregrinarum* Descriptio & Icones; Autore *Johanne Commelino*; *Latinitate* donatus, *Notis & Observationibus* illustratus a *Frederico Ruyschio*, M. D. Botan. Profes. &c. et *Francisco Kiggelario. Amst.* 1697. *Here are many Additional* Remarks *by Mr.* James Pettiver.

n. 249. p. 63. 19. *Paradisus Batavus*; continens plus centum *Plantas, &c. With Additional Remarks by Mr.* Jo. Ray.

n. 199. p. 729. 20. *Catalogus Plantarum Horti Academici Argentinensis:* in Usum *Rei Herbariæ* Studiosorum; adcurante *Marco Mappo*, M. D. *Argentorati.* 1691. in 12*o.*

n. 245. p. 385. 21. *Histoire* des *Plantes* qui Naissent aux environs de *Paris:* avec leur *Usage* dans la *Medicine*; per M. *Pitton Tournefort*, M. D. a *Paris* 1698. *in* 8°.

n. 265. p. 651. 22. *Flora Noribergensis*; *&c.* Being a *Catalogue* of such *Plants* as not only Grow *Spontaneously* about *Nuremburg*, but also of such *Exoticks* as the *Physic Garden* of that City hath lately Raised: with the *Figures* and *Descriptions* of many of the most *rare*; by *Jo. George Volkamer*, M. D. 1700 in 4°.

n. 81. p. 4027. 23. *Plantarum Umbelliferarum Distributio Nova* per Tabulas Cognationis & Affinitatis, ex Libro Naturæ Observata & Detecta; a *Rob. Morison, Med. & Prof. Bot. Regio*, &c. *Oxonii*, 1672.

n. 74. p. 2235. 24. De *Absynthio* Analecta; per *John Michael Febr.* M. D. *Lipsiæ*, 1668. in 8°.

n. 74. p. 2236. 25. *Crocologia*, Auth. *Joh. Ferdinando Hertodt.* M. D. *Jenæ* 1671. in 8°.

n. 125. p. 621. 26. *Cochlearia Curiosa*; or the Curiosities of *Scurvygrass:* written in *Latin* by Dr *Andr. Molimbrochius* of *Leipsig*; and *English'd* by Dr. *Tho. Sherly Lond.* 1678. in 8°.

n. 167. p. 870. 27. *Joh. Nicholai Pechlini.* M. D. *Theophilus Bibaculus*; sive de *Potu Theæ* Dialogus *Franc.* 1684 in 4*to*.

n. 211. p. 150. 28. Epistola de *Generatione Plantarum* ex *Seminibus*; a *Josepho de Aromatariis. Frankf.* 1625.

n. 78. p. 3037. 29. The *Anatomy* of *Vegetables* begun: with a General Account of *Vegetation* founded thereon; by *Neh. Grew.* M. D. F. R. S. *London* 1671. in 12*mo*

n. 97. p. 6131. 30. An Idea of a *Phytological History* propounded: together with a *Continuation* of the *Anatomy of Vegetables*, particularly prosecuted upon *Roots*, and an Account of the *Vegetation* of *Roots*, grounded chiefly thereupon; by *Neh. Grew.* M. D. & F. R. S. *Lond.* 1673. in 8*vo.*

n. 120. p. 486. 31. The *Comparative Anatomy* of the *Trunks* of *Plants*: together with

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an Account of their *Vegetation* grounded thereupon; by *Neh. Grew.* M. D. in 8*vo.*

32 The *Anatomy* of *Plants*; with an *Idea* of a *Philoſophical Hiſtory* of *Plants*: and ſeveral Other Lectures, read before the *R. Society*; by *Neh. Grew.* M, D. 1682. n. 150. p. 303.

33. *Marcelli Malpighii Anatome Plantarum*; cui ſubjungitur Appendix, iteratas & auctas ejuſdem de *Ovo Incubato* Obſervationes continens. *Lond.* 1675. & 1679. in *Fol.* n. 117. p. 401. *Ph. Col.* n. 1. p. 38.

34. The *Poſthumous Works* of S. *Malpighi.* In this Account of them, S. *Jean Marie Lanciſi* gives an *Encomium* and *Character* of the *Author.* n. 226. p. 320.

35. *Marcelli Malpighii* Philoſophi & Medici *Bononienſis*, è *Regia Soc. Lond. Opera Poſthuma*: Fig. Æneis illuſtrata; quibus præfixa eſt *Ejuſdem Vita*, a Seipſo ſcripta. *Lond.* 1697. in *Fol.* n. 228. p. 545.

36. A Philoſophical Diſcourſe of *Earth*, relating to the *Emprovement* of it for *Vegetation* and the *Propagation* of *Plants*; By *J. Evelyn*, Eſq; *Lond.* 1676. in 8*vo.* n 119. p. 454.

37. The Epitome of the whole Art of *Husbandry*: with additions of New Experiments thereto belonging; Written by *J. B. Lond.* 1675. in 8*vo.* n. 114. p. 320.

38. *Syſtema Horticulturæ*: containing in *Engliſh*, the *Art of Gardening*, in 3 Books; by *J. W.* Gent. in 8*vo.* n. 136. p. 922.

39. *Sylva* & *Pomona*; by *J. Evelyn.* Eſq; *Lond.* 1669. in *Fol.* n. 22. p. 398.

40. Dr. *Richard Sharrock's Hiſtory* of the *Propagation* and *Improvement* of *Vegetables*, by the Concurrence of Art and Nature. *Oxon.* 1672. in 8*vo.* n. 53. p. 1071. n. 84. p. 5002.

41. A ſhort and ſure Guide in the Practice of *Raiſing* and *Ordering* of *Fruit-Trees*; by *Fran. Drope.* B. D. *Oxon.* 1672. n. 86. p. 5049.

42. The *Garden of Eden*: or an Account of the *Culture* of *Flowers*, and *Fruits* now Growing in *England*; with particular Rules, how to advance their Nature and Growth as well in *Seeds* and *Herbs*, as in Ordering of *Trees*; by Sr. *Hugh Platt.* in 8*vo.* n. 113. p. 302.

43. The *Planters Manual*: being Inſtructions for the *Raiſing*, *Planting*, and *Cultivating* all ſorts of *Fruit-Trees*; whether *Stone-Fruits*, or *Pepin-Fruits*; with their Natures and Seaſons. Very Uſeful for ſuch as are Curious in *Planting* and *Grafting*; By *Charles Cotton* Eſq; *Lond.* 1675. in 8*vo.* n. 116. p. 373.

44. *Nurſeries*, *Orchards*, *Profitable Gardens*, and *Vineyards* encouraged; the Preſent Obſtruction removed; and probable Expedients for the better Progreſs; propoſed, for the General Benefit of his Majeſties Dominions, and more particularly *Cambridgſhire*, the *Champain Countries*, and *Northern Parts* of *England:* In ſeveral Letters out of the Country; by Dr. *J. Beal*, and Mr. *Anth. Lawrence.* n. 129. p. 748.

45. The art of *Pruning Fruit Trees:* and a Tract of the Uſe of the *Fruits* of *Trees* for *Preſerving* us in *Health*, or for *Curing* us when we are *Sick.* Tranſlated from the *French. Lond.* 1684. 4*to.* n. 163. p. 733.

n. 15. p. 262. 46. The *Engliſh Vineyard* Vindicated; by Mr. *J. Roſe.*

n. 126. p. 646. 47. The *French Gardiner*, Reprinted: To which is annexed the *Engliſh Vineyard Vindicated*; and the Way of *Making* and *Ordering Wines* in *France*. in 8°.

n. 93. p. 6019. 48 *Vini Rhenani*, imprimis *Baccaracenſis*, Anatomia Chymica; a *Joh. Davide Portzio* Phil. & Med. D. *Heidelbergæ*. 1672. in 12°.

n. 69. p. 2116. 49. Joh. Henr. Meibomii de Cereviſiis, Potibuſque & Ebriaminibus extra Vinum aliis Commentarius; annexo Libello Turnebi de Vino. Helmeſtadii 1668 in 4°.

n. 123. p. 574. n. 115. p. 352. 50. *Vinetum Britannicum*: Or a Treatiſe of *Cider*, and ſuch Other *Wines* and *Drinks*, as are extracted from all manner of *Fruits*, growing in *this Kingdom*: With the Method of *Propagating* all *Vinous Fruit Trees*; and a Deſcription of a New Invented *Ingenio* or *Mill*, for the more Expeditious and Better Making of *Cider*. Alſo the Method of Making *Metheglin*, and *Birch-Wine*. With Copper Plates; by *J. W.* (Author of the *Syſtema Agriculturæ*) in 8°. *Advertiſements on this Book are here added by Dr.* Beale.

n. 124. p. 583.

n. 126. p. 644. 51. The Manner of *Raiſing*, *Ordering* and *Improveing Foreſt Trees*: Alſo how to *Plant*, *Make*, and *Keep*, *Woods*, *Walks*, *Avenues*, *Lawns*, *Hedges*, *&c.* With ſeveral Figures Proper for *Avenues*, and *Walks*, to End in; and Convenient Figures for *Lawns*: Alſo Rules and Tables ſhewing how the Ingenious *Planter* may *Meaſure Superficial Figures*; with Rules how to *Divide Woods* and *Land*; and how to *Meaſure Timber* and Other *Solid Bodies*, either by *Arithmetick*, or *Geometry*. &c. by Mr. *Cook*. in 4°.

CHAP. VI.

Zoology.

Obſervations in the Ordering of Silk-Worms; *by Mr.* Edw. Digges. n. 2. p. 26.

1. 1. I Have Kept *Leaves* 24 *Hours* after they were Gathered, and Flung *Water* upon them to Keep them from *Withering*: Yet when (without *Wiping* the *Leaves*) I *Fed* the *Silk Worms*, *I* obſerved they did as Well, as thoſe *Freſh Gathered*.

2. *I* never Obſerved that the *Smell* of *Tobacco*, or other *Smells* that are Rank, did any ways Annoy the *Worm*.

3. Our Country of *Virginia* is very much Subject to *Thunders*: And it hath *Thundered* exceedingly when *I* have had *Worms* of all Sorts; ſome *Newly Hatched*; ſome half way in their *Feeding*; others *Spinning* their *Silk*; yet *I* found None of them Concern'd in the *Thunder*, but kept to their Buſineſs as if there had been no ſuch Thing.

4. I have made many *Bottoms* of the *Brooms* (wherein Hundreds of *Worms Spun*) of *Holly*: and the *Prickles* were ſo far from Hurting them, that even from thoſe *Prickles* they Firſt began to make their *Bottoms*.

II. *Silk*

The Nature and Qualities of Silk; *by Mr.* Will. Aglionby. n. 252. p. 183.

If *Silk*, which is the *Spittle* of a *Worm*, hath its Good or Bad Quality from the *Nouriſhment* the *Worm* Receives either from a *Good* or *Bad Leaf*. When the *Spring* proves Delightful and Sweet, the *Worm Feeding* on a good and Tender *Leaf*, Free from the Prejudices of an Unkind Seaſon, (which ſometimes Spoil the *Leaf* by giving it a Rough, Groſs, and Heavy Nature) then one may Expect a *Profitable Harveſt*: and in ſuch Years 'tis beſt to make a Good Proviſion, for *Silk* will then find Good Sale when moſt Abundance, and the Buyer meets with that of a good Subſtance, which the Advantagious Seaſon very much Contributes to; but not Knowing how long it may Laſt, about *Mid ſummer* (or St. *John's Tide*) they begin, in *Piedmont* to *Draw* the *Silk* from its *Cocon*, to ſee What it *Yields*, and Judge of its Increaſe or Scarcity, as well as the Eſtimate of its Goodneſs and *Perfections*; thoſe moſt Deſireable are, that it proves Clean, Light, and Strong.

In caſe the Seaſon ſhould not prove Plentiful, then they Buy as Faſt as they can *Old-Silk*, and Keep as much as they Can of the Other, for the *Beſt Fabricks*; that ſo they may not be Obliged to Hazard all their Good, at the price of the Worſt; which is commonly Practiſed: But if the Seaſon promiſes a great and Satisfactory *Harveſt*, they take the *New*, and put it apart for the *Beſt Fabrick*; not Deſpiſing the *Old*, but only Laying it aſide till *Proof* be made whether the *New* be Better or Not.

To know the Beſt Silk.

The *Goodneſs* of *Silk* is Diſtinguiſhed by its *Lightneſs*, as the moſt Eſſential Quality: which every Body knows Carries a Conſiderable Profit along with it, when Bought by *Weight*, and ſold by the *Yard* or *Aune*. It is to be Noted, that the *Organcine* is *Superfine*, it being the Beſt Sort, and N°. That the Two *Threads* are Equal in *Fineneſs*, that is to ſay, both alike in Smoothneſs, Thickneſs and Length, for the Thread of the *Firſt Twiſt*: For the *Second*, it matters not whether the Single Thread be Strong before the *Two* are Joyned, unleſs to ſee whether the *Firſt Twiſt* Prove Well. It is neceſſary the *Silk* be *Clean*; the *Straw Colour* is Commonly the *Lighteſt*, and the *White* the Heavieſt of all. It is likewiſe Convenient, that the *Skeans* be *Even*, and All of an *Equality*, which ſhows they were Wrought together: otherwiſe with great Reaſon one may Suſpect that it is *Refuſe-Silk*, and cannot be *Equally Drawn* Out and Spun; for One *Thread* will be ſhorter than the Other, which is Labour and Loſs. It will be alſo Requiſite to Search the *Bale* more than Once, and take from out of the *Parcels* a *Skean* to make an *Eſſay*: for unleſs one Buys that which one knows by *Tryal*, there is a Hazard of being *Cheated*; and ſo for one ſort have Another.

To Eſtimate it by Eſſay.

To *Eſtimate* the *Silk* by *Eſſay*, Fix the *Eſſay* upon One *Eighth* of a *Portée* Hand of *Silk*, of 110. *Aunes* of *Lyons* in Length, and ſee what it Makes of *Aunes* by the *Eighth* Part; the *Skean*, which is of 80. *Threads*, muſt be *Multiplied* by 110. which is the Length of the 110. *Aunes*, from which Number muſt be Deducted one *Eighth*; as for Example, 110. by 80. makes 8800. the *Eighth Part* of which is 1100. which is the *Eigth Part* of a *Portée*. Now to Calculate what theſe 1100 *Aunes* [illegible] *eigh*, which is the *Eigth* Part of a *Portée*, or of 110. *Aunes* of *Lyons*, it will be Proper to take a *Skean* out of the

the *Parcels*, which you take from Out of the *Bale*, which you judge may Contain at leaſt 1100. *Aunes*, to make the one *Eighth Part* of a *Portée*; which *Portée* muſt be Divided on 2. *Bobbins*, half on Each; then Fix the 2. *Bobbins* on the *Cantre (Beam,)* and from thence paſs it through the *(Combe) Hourdiſſoir*; this done, you Cut off your *Silk*, and *Weigh* it, and *Multiply* the *Weight* by *Eight*, it will Weigh juſt as Much as a *Portée* of 110. *Aunes* of *Lyons:* Which is the General Rule of Calculating, when they *Draw* the *Silk* Out. By this Means one may Learn to Adjuſt the *Weight*. There are *Silks* of *Piedmont* which are very *Light* and *Clean*, and to be Preferred before any in *Sale*. The *Portee* of *Silk* of the *Lighteſt* Weighs near 24 *Penny Weight*, to 25 and 26. Others 27 and 28 which *Weight* may be *Diſpenſed* with, on Condition the Other Qualities be as Good, *to wit*, well Wrought, Even, Fine, and Clean; but *above* theſe *Weights* they cannot be, unleſs they Abate of their Profit, Proportionable to what they Want in *Lightneſs*.

The Connought Worm; *by Mr:* Will. Molyneux. n. 168. p. 876.

III. The *Connought-Worm*, which I find in *Godartius* of *Inſects* Deſcribed by the Name of the *Elephant-Caterpillar*, is reported to be the only *Poyſonous Animal* in the Kingdom of *Ireland*. One of them was ſent *Alive* to me from the Country, about 40 *Miles* from *Dublin:* The Gentleman that ſent it, had Kept it above 6 *Weeks* in a Large Box on a Graſſy Sod, now and then Giving it a *Freſh Sod*, and *Ragwort* to Eat, beſprinkling them with *Dew*. Some of theſe *Worms* are as Thick as a *Man's-Thumb*, and above 3 *Inches* Long: and ſome *Live* ſo long, as to have *Fine Hair*, thinly Diſperſed over their *Bodies*.

The Ingenious Gentleman who ſent it me is of Opinion, that the *Animal* is indeed *Pernicious*, if Eaten by a *Beaſt*. For *firſt*, the *Diſeaſe*, imputed to this Creature, ſeldom or Never affects the *Cattle* but in *Autumn*, and then, only this *Inſect* is to be Found; *Secondly* it ſeldom or Never Attends Any *Cattle* but what Feed in *Low Marſhy Grounds*, and there only this *Animal* Frequents; *Thirdly*, *Cows* who are Greedy Feeders by Great Morſels (by reaſon of their *Chewing* it afterwards in their *Cud*) but eſpecially *Swine* that feed in *Low-Grounds*, are the Only Creatures troubled by this *Worm*; *Fourthly*, the *Worm* is very Rare, and ſcarce to be Found in 7 *Years*, and ſo Likewiſe is the *Diſtemper* that Proceeds from it; being Rare to have a Beaſt Affected by it. As to the *Symptoms* that attend its *Venom*, they are *Swelling* in the *Head*, and (as a Peculiar *Characteriſtick*) the *Swelling* and *Procidentia Ani*, in ſo much that the *Rectum* will Hang out above *half* a *Foot*. The Effectual *Cure* applyed to this Malady in *Black cattle*, is a *Drench* of the Herb *Bears-Foot*, *Rue*, *Garlick*, *Butter* and *Beer*; but for *Swine*, *Raddle* pounded ſmall mingled with *Butter-milk*. Theſe only are uſed by the *Engliſh Husbandmen*. But the *Iriſh*, as they certainly impute the *Malady* to this *Inſect*, ſo they Draw the *Remedy* therefrom: For they aſſert, that if a *Hole* be Bored in a *Tree*, and this Creature ſtopt up therein, ſo as to Starve and Dye, the *Leaves* and *Bark* of that *Tree*, ever after, infuſed in *Water*, and given as a *Drench*, Cures the affected *Beaſt*; and ſeveral will repair to ſuch a *Tree*, 10. *Miles* for a Cure. Another Fancy (and as ill Grounded) they have, that if a Man *Bruiſe* this *Worm* between his

his Hands, and let the *Expreſſed Juice* dry thereon, ever after the *Water* he *Firſt* Waſhes in in the Morning, given to the Beaſt to drink, *Cures* it.

But I am very apt to ſuſpect, That this *Worm* is no more *Poyſon* than other *Caterpillars*. But the *Uglineſs* of the *Worm* (it being of a *Dark*; *Fuſcous*, and as they ſay, *Poiſonous Colour*,) together with its *Largeneſs* beyond *Common Caterpillars*, has wrought ſo upon the Fearful and Ignorant *Vulgar* People, that they have given it the Name of *Venomous*. Yet I will not conceal, what *I* have from another Gentleman, (but with ſome Diffidence of the Experiment) he Gave the *Juice* of One of theſe *Worms* to *One Dog*, which ſhewed No Alteration thereon, but *Another Dog*, to whom he gave the *Skin* of the Creature, was found *Dead* 3 Days after.

But whether his *Death* proceeded from the *Poyſonous Skin*, he could not Aſſert, for the *Dog* ran at Liberty, and might have been *Kill'd* (for ought as he knew) by ſome other Accident; tho' no External Sign of any Violence Offered to him did appear.

AB. is the *Worm*, lying on its *Belly*, long $2\frac{1}{2}$ *Inches* almoſt; *c.* his *Head*; *dd.* Two *Variegated Spots*, miſtaken by the People of our Country for *Eyes*; *e.* a ſmall Protuberance towards its *Tail*, from Whence ariſes a Part in Shape af a *Horn*, miſtaken for a *Sting*. *Fig.* 181.

Fig 182 Repreſents the *Worm* Reclined almoſt on his *Back*; *F.* his *Mouth* formed like that of Other *Caterpillars*, as it appeared in the *Microſcope*; *ggg.* *Six* ſmall *Horny Feet* or *Claws*, three on each ſide, as in other *Caterpillars*; *hh. Eight Papillæ*, with which he Faſtens himſelf to what he goes or hangs on, as Childrens *Suckers* are Faſtened to *Wet Stones*; *ii. Two* Larger *Papillæ*, with Which he does both *Suck* himſelf Faſt, and moſt commonly therewith, he Graſps the *Stems* of *Graſs* and *Herbs*, to which he clings with the Other. *Fig.* 182.

IV. The *Bearers* of *Fruit-Trees* are full of Aſperities, and not ſo ſmooth in their *Bark* as the other Parts of the *Tree*. If after the *Harveſt*, and any Time all the *Winter* over, you look upon theſe *Bearers*, through an Ordinary *Microſcope*, you will find the *Cavities* there full of *Eggs*, of an Oblong *figure*, and *Citron Colour*; eſpecially in thoſe *Years*, and *Trees*, wherein the *Caterpillars* have been numerous: Out of theſe they are *Hatcht* in the *Spring*. The Seaſons which uſually deſtroy them are, when there comes an Early Heat, ſuch as is ſufficient to *Hatch* them, before the Coming Forth of the *Buds* and *Bloſſoms*, and when immediately there ſucceeds a *Nipping Froſty Air*, which ſoon *Kills* them. *The True Origin of* Caterpillars; *by Dr.* George Garden. n. 237. p. 54.

The Diſcovery of this Manner of their *Propagation*, ſeems to give Light to Theſe Conjectures. 1. That we ought not to Conclude, that any *Inſects* are *Bred* of *Corruption*, and Not *Ex Ovo*, becauſe we cannot Diſcern the particular manner of their *Propagation*: For, the Diſcovery of this, you ſee, is by *Accident*, and not Diſcernible by the *naked Eye*. 2. That the *Female Inſects* of all Kinds of *Flies* and *Butterflies* do probably put their *Spawn* Near thoſe Places where the *Eruca's*, which are *Hatcht* of them, are to have their *Food*: *The* Generation *of* Inſects. *Vid. Inf.* §. IX.

So that they are to be ſearched for in ſuch Places, by Thoſe who Enquire into the Manner of their *Propagation*. 3. They ſeem to be fixed into the Cavities of the *Bearers* by a *Gluten*, ſo as that *Rains* do not Waſh them off. 4. The Greateſt *Froſts*, it ſeems do No Hurt to the *Small Eggs* of *Inſects*; for I have ſeen the *Caterpillars Hatch*, after moſt *Cold* and *Froſty Winters*, of thoſe *Eggs* which *I* have obſerved on the *Bearers* all the *Winter* over.

Obſervations on a Glow-Worm; *by Mr.* J. Templer. n. 72. p. 2177.

V. *May.* 27. 1671. I put a *Glow-worm* into a Small Thin *Box* (ſuch as *Pills* are ſent in;) between 11 and 12 at *Night*, I ſaw her *Shine*, through the *Box*, very Clearly on One ſide, the *Box* Shut; putting *White Paper* into the *Box*, and the *Worm* into the *Paper*, it *ſhined* through the *Paper* and *Box* both.

28. In the Morning about 8 of the Clock, ſhe ſeemed *Dead*, and holding her in a very dark place, I could perceive but very little *Light*, and that only when ſhe was Turned upon her *Back*, and by Conſequence put into ſome little *Voluntary Motion*. After Sun-ſet that Night, ſhe *Walked* Briskly Up and Down in her *Box*, *ſhining* as Clearly as the Night before; and that, when there was ſo much Day-Light, that I could Read without a *Candle*.

29. In the *Morning* ſhe ſeemed *Dead* again; at *Night* Recovered her ſelf, and *ſhined* as well as ever, through the *Box*, and holding a Large *Candle* in my Hand, the *Light* of it did not Senſibly Diminiſh that of the *Glow-worm*.

30, 10. *h. v.* I ſet the *Box* with the *Worm* in it, about 4 *Yards* from me, in a *Window*, where *I* perceiv'd it *ſhine* through the *Box*, for almoſt an *Hour*.

31. 4. *h. m.* I found it *ſhining*, and obſerved it in plain *Day Light*, for about ½ an *Hour*, and then wholly *ceaſing*. At 5 in the *Evening*, the *Worm ſhined* pretty Clear, in a very lightſome Room; at which time the Sun ſhined glorioufly into the Room. Some time after ſhe *ſhined* little, having Contracted her Body into a Bending Poſture, the *Light* ſcarcely ſo big as a Great *Pin*'s *Head*: But upon Touching of her, ſhe Extended her ſelf, walked in her *Box*, and at firſt Extent *ſhined* as glorioufly as ever.

N. B. I never ſaw her *Shine* without ſome *Senſible Motion*, either in her *Body* or *Legs*, in her *Cleareſt Shining* ſhe Extends her *Body* a 3*d.* part beyond its Uſual Length; and, if my Senſes Fail me not, ſhe Emits a *Senſible Heat* in her *Clear Shining*.

Jun. 1. Upon ſeveral *Tryals* of *Different Poſitions*, I find her not to *Shine* ſometimes when *in Motion*: But *I* could never yet, ſee her *Shine*, when not in *Motion* of ſome part. n. 78. p. 3035.

Jun. 8. Putting her into an *Urinal* of *White Glaſs*, at 9 a *Clock* at *Night*, ſhe Crawled Nimbly in it, and Extended her ſelf beyond an Ordinary Length, yet her *Shining* was not ſo Clear, as in her Box when Opened. Putting the *Urinal* into the *Water* for about ½ an *Hour*, it gave a very Delightful *Irradiation* of the *Water*. When this *Light* ſeemed Wholly *Extinct*, although ſhe was in *Motion*, if *I* Depreſſed the *Urinal* into the *Water*, till the *Bottom* almoſt touched the *Bottom* of the *Baſon*, *I* could (upon looking in at the *Top* of

the

the *Urinal)* ſee a very *fair Light*: but upon Lifting the *Glaſs* out of the *Water*, *I* could Diſcern very little *Shining*. Then Putting her into her *Box*, ſhe did in about a *Minutes* time (for *I* tryed it twice Over,) by a *Watch*, almoſt 10. times increaſe her former *Shining* in the *Urinal*.

14. The *Worm* ſeem'd *Dead*, and being Shut in a *Box*, would give *No Light*, though it was betwixt 9 and 12 a Clock at Night: But in the Uncovered Box, or in the Urinal, ſhe did *ſhine faintly*, and the *Light* was of a far *different Colour* from what it was formerly.

15. I Touched her with a *Needle* Gently; whereupon ſhe ſtretched out one of her *Legs*, and by it (when *I* inclined the Poſition of the *Box*) ſhe ſtayed her whole *Body* from Falling. Before I *Prickt* her, ſhe did give a little *ſhining* in her *Uncovered Box*, but none through the *Urinal*: Only if you looked in at Top, a *little ſhining* was ſeen: Upon *Pricking* her, I did not ſee her *Shining* Encreaſed.

16. I diſcerned a *little ſhining* only within her *Box*: Upon *Pricking* I could Diſcern *No Motion* in her; but the *Scale* next her *Tail*, was ſenſibly more Extended a $\frac{1}{4}$ of an *Hour* after I Pricked her, than Before.

NB. Theſe laſt 3 *Days*, ſhe lay continually upon her *Back* with her *Legs* Contracted, except only the Time mentioned *June* 15. of my *Pricking* Her. *I* am afraid to Conclude her *Dead*, *June* 16, having been informed by Mr. *Th. Hallebeck* of *Cald-Newton* near *Melton Mawbury*, that he kept a *Glow-Worm* near 6 *Months* in his *Parlour Window*, which would ſometimes ſeem *Dead* for many *Days* together (if *I* miſtake not, he ſaid *Weeks*) and afterwards both *walk* and *ſhine* again.

The Flying Glow-worm; *by Mr.* Rich. Waller. n. 176. p. 841.

VI. The *Cicindela Volans*, or *Flying-Glow-Worm*, is very Rare in *England*, yet *I* have happened to Catch of them twice at *Northaw* in *Hertfordſhire*: *Firſt* about *Midſummer* 1680, and for a Fortnight in *June* 1684. They flew about the *Candle* as ſoon as it grew Dark; at both which Times, the *Weather* was very *Hot*; and it may be it *ſhines* only at ſuch Seaſons, tho' the *Animal* be eaſie enough to be Met withal *Winged*, when it *ſhines not*, and *without Wings ſhining*, which is the Common *Glow-worm*.

The Deſcription of it by *Aldrovandus* agrees very well with the *Animal*: But both *Moufet* and *Tho. Bartholin* are Miſtaken, in allowing the *Male Only* to have *Wings*. The contrary was known to *Julius Scaliger*: And *I* once Caught the *Male* and *Female* Coupled, and could obſerve no difference between them, except in *Size*, (the Female being a little the *Larger*) for they Both *Shined* alike. It's *Light* was very *Vivid*, ſo as to be ſeen plainly when a Candle was in the Room: but the *Vibrations* thereof were Unequal, and the Colour *Greeniſh*, like that of the *Creeping Glow-worm*. The *Luminous Part* was two ſmall Specks on the *Underſide* of the *Tail*, at its *End*. The *Shining* continued for a little while after the *Tail* was cut off, tho it ſenſibly Decayed, till at laſt it went Quite out. Poſſibly, the Uſe of this *Light* is, to be a *Lanthorn* to the *Inſect* in catching its *Prey*; and to direct its Courſe by, in the Night: Which is made probable, by the *Poſition* of it

Lib. 4. c. 8. *c.* 15. p. 108. *De Luce Animalium.* Lib. 2. *c.* 12.

on the *Under Part* of the *Tail*, ſo that by Bending the ſame Downward (as I always obſerved it to do) it gives a *Light* forward upon the *Prey* or *Object*, the *Luminous Rays*, in the mean time, not being at all incommodious to its Sight, as they would have been, if this *Torch* had been carried before it. This Conjecture is alſo favoured by the placing of the *Eyes*, which are on the *Under Part* of the *Head*, not on the *Top*. I obſerved alſo, that it could, and did, by ſome Contrivance, cover its *Light*, and make a kind of *Dark-Lanthorn*.

Fig. 183. *Fig.* 183 ſhews the *Inſect* upon its *Feet*, with the *Back* Upwards; where it appears to be of the *Beetle*-kind It is of a *Dark-Brown* Colour, Unpoliſht: when the *Caſe-wings* are Opened, it Extends two very *Large Membranous Wings*, faſtened to the Upper part of the *Thorax*. It's *Head* is Covered, as it were, with a *Shield*, or *Broad-brimm'd Hat*.

Fig. 184. *Fig.* 184. Repreſents it laid on the *Back*, to ſhew the *Two Eyes* under the *Broad Covering*. They are *Black*, and very Large, making almoſt the whole *Head*; there being little elſe to be ſeen. Theſe are *Moveable*, ſo that the *Animal* can thruſt them forward to the Edge of its *Hat*. From between Theſe, are Diſcovered the 2 *hairy Feelers*, or perhaps *Bruſhes* to *Cleanſe* the *Eyes*. Between theſe *Eyes* and the *Thorax*, lies the *Mouth*. On the *Thorax* are 6 *Legs*, almoſt all of a Length. The *Tail* is made of Seven *Shelly Rings*; at the *Laſt* of which are Viſible, the two *Shining-Points*.

Fig. 185. *Fig.* 185. Shews the *Inſect* on its *Back*, as it was ſeen through a *Microſcope* when *Dead*; where *A A*. Repreſents the two Long *Horns*, *Feelers*, or *Bruſhes*, conſiſting of Ten *Roundiſh Joints*, beſides the *firſt*, which is as long as Two of the reſt; they are all *Hairy*, and like Thoſe of ſome *Butter-flies*; for all have them not. *B B*. The *Broad Covering*, or *Hat*, over the *Head*, which ſhewed of a *Speckled Brown*, and *Yellowiſh* Colour, like *Tortois ſhell*. *C C*. The two *Eyes* Compoſed of Innumerable ſmall *Glaſſy Hemiſpheres* in *Rows*; as hath been obſerved by the Ingenious Mr. *Hook*, in his *Micography*, to be the Make of *Inſects Eyes*, ſo to ſupply the Defect of *Motion* in their *Eyes* by the Number of *Pupilla's*. I have ſeen theſe *Spherical Bodies* in the *Eyes* of ſome *Butterflies*, ſet in *Circles* not *Rows*; with Long *Hairs* growing out of each ſpace, left by the Connexion of Three *Hemiſpheres*. *DDDDDD*. The *Legs* of a *Shelly-make* like *Lobſters*, and ſo *Jointed*. As well in This as other *Flyes*, they are Covered with many *Stiff Hairs*, tho' not ſo Full as thoſe of the *Blew Fly*, Figured by Mr. *Hook*. The *Mechaniſm* of the *Feet*, as *I* take it, are much the ſame; Only what is there call'd the *Pattens*, were here *wanting* (if not Broken off, as I believe they were not,) and their Uſe ſupplyed by the *Gibbous Part*, Repreſented by *d d d*. The *Talons e e e e e e*. of the *feet* were *ſhining*, and very *Sharp Pointed*. The *Legs* were of two *Long Joints*, and the *feet* of 4 more, beſide that which was Armed with the *Talons*. Theſe ſeemed to be *Joynted* One into Another, and were all Thick beſet with *Hairs*,

Microg. Sch. 26.

or

or *Briſtles* E The *Thorax* of but one *Shell*, of a Poliſht *Copper Colour*, Stuck full of *Tapering Briſtles*, a ſmall *Dent* being Diſcernable in the *Shell* wherein Each Grew. F. The *Tail*, Conſiſting of 7 *Rings* of the ſame *Browniſh* Colour; without *Hairs* except on their *Edges*, which were ſet with them like a *Thin Fringe*, as the *Tails* of *Lobſters*, &c. are. Theſe *Rings* were of an Unequal *Shining Shell Cover*. *f f*. The *Back*, or Upper Part, of two or three *Rings*, of the *Tail*, turned Up to ſhew the *VVork* of the *ſhell* on That Side. On the Inſide of the *Laſt* of Theſe, was the *Light* placed, tho' there was now Nothing to be ſeen, except that Part being a little *Lighter Colour'd* than the Reſt of the *Tail*. *G G G*. The *Membranous wings*, in every particular like Thoſe of the *Blew-fly*, with *Hairs* upon the *Veins*, or *Quilly Parts*. *H H*. The *Inſides* of the *Caſe wings*, which were *Hairy*, pointing all Downwards; The *Outſide* of theſe *Caſes* is alſo very *Briſtly*.

VII. In the *Harveſt Time*, 1666. (the *Sickneſs* raging then at *Cambridg*) at *Baſſenburn* in *Cambridgſhire* there were Millions of *Maggots* on the *Corn Lands*; and in their *Barns* too, the Floor would be *Cover'd* with them that Fell from the Carts. The *Maggots* were about *half* an *Inch* Long, no Thicker than a *Pigeons Feather*, of a *VVhite* Colour, ſomewhat ſhaded with an *Iſabella*, or *faint Yellowiſh* ſtripes, the Length of the *VVorm*; they had 14. *feet*, after the manner of many *Caterpillars*; and *I* was almoſt Confident would have produced ſome ſort of *Moath*. I took up about a *Score* of them, and put them into a *Box*: but they immediately Offended me with an Ungrateful and ſtrong *Stink*; which yet is not Uſual to the *Caterpillar-Kind*. After Two Days *I* Rid my ſelf of them, and Only Obſerv'd, that the *Excrements* which they Voided, were little Hard *Pellets* of pure White *flower*, like that of *Barley*.

An odd Sort of Maggots; *by Dr.* M. Liſter, n. 162. p. 595.

VIII. Some Few Years ſince there was ſuch a *Swarm* of a certain ſort of *Inſects* in *New England*, that for the ſpace of 200 *Miles* they poyſoned and deſtroyed all the *Trees* of the Country; there being found innumerable little Holes in the Ground, out of which thoſe *Inſects* broke forth in the form of *Maggots*, which *Turned* into *Flyes* that had a kind of *Tail*, or *Sting*, which they ſtuck into the *Tree*, and thereby Envenomed and Killed it.

Swarms of Strange and Miſchievous Inſects, *in* New England; by ... n. 8. p. 137.

IX. The *Libella* is a *flying Inſect*, called in *France*, *Demoiſelle* from the Variety of its *Colours*, Tranſparency of *VVings*, and its Stately *Flight*. They alſo call it *Pearle*, from the Figure of its *Head*, or rather from the Roundneſs and Colour of its *Eyes*. *It* is divided from ſpace to ſpace into *Rings*, by means of Which it Compoſes *Angles* with its *Body*, whoſe *Lines* it can make Longer or Shorter as it finds Occaſion.

The Libella; *by M.* Poupart, n. 266. p. 673.

Theſe different *Sections* ſerve to the *Motion* of this *Inſect*, as we know the *Tail* doth in *Birds*, and as they are Lengthned or Contracted, they Carry themſelves according to their Various *Inclinations*, the *Point* or *Center* being Fixed between their *VVings*. All *Modern Naturaliſts* know

the Greater ſort of *Libellæ* are Generated *Under Water*, Wrapt up in a *Membrane*, which at length Diſſolves and Turns to Nothing.

When the Young *Libella* is ready to Quit its *Caſe*, it *Dilates* its *Belly*, that the *Water* may Enter in at the *Anus* upon the *Inteſtines*; then it *Compreſſes* it ſelf to *Circulate* the *Water*, which it *Expels*, and ſhoots out a Great way. It Receives more *Water* into its *Inteſtines*, and Ejects it after the ſame Manner. It Continues this Action with great Force for ſome time, and makes the *Water Circulate* in the *Veſſel*.

To ſatisfy my ſelf that it Took the *Water* in at the *Anus* and Not at the *Mouth*, *I* put a *Libella* upon my *Finger*, which *I* held faſt by the *Legs*; *I* dipt it *Under Water* with its *Head* Downwards, the *Anus* being even with the *Water*, ſo that it might get into the *Inteſtines*, which it Caſt out a good Way; *I* Drew my Finger a little further Out, ſo that the *Water* could not Enter at the *Anus*, and the *Fly* Continued its *Motion*, but Ejected *No Water*. My Opinion is, ſhe does this in order to Cleanſe her ſelf from all *Excrements* in that Element, where ſhe Leaves her *Old Robes*, to appear in a more *Glorious* and *New Form* in the *Open-Air*.

There are a great Number of Small *Veſſels* which Cloſely Unite the *Body* of the *Libella* to its *Caſe*: It is neceſſary that theſe be *Dry*, that they may the ſooner Break when it makes its Efforts to Get out of its *Caſe*, which cannot come to paſs as long as there is any *Aliment* in the *Inteſtine* to afford *Nouriſhment* to the *Caſe*, and its *Strings*. And perhaps this is the Reaſon, why no *Inſects* will take any *Food*, when they are going to *Change* their *Forms*: And if they do not Cleanſe themſelves, as the *Libella*'s do, yet they Stay a great While Longer, before they *Change*, without any Aliment; the *Libella* is no Longer than *Half* a *Day* in Quitting its *Caſe*, and taking its *Flight*.

To know the *Cauſe* of its exceeding *Swift* and *Whirling Motion*, we muſt Cut the *Skin* of the *Libella* (which is very Fine) all along the *Back*, and be ſure to bear the *Point* of the *Scizzars* Upwards, leſt we Cut the *Interiour Parts*. We muſt alſo Draw the *Skin* to the Right and Left Hand, and Fix it with *Pins* upon a *Table*, that we may Diſcover the 16 *Muſcles*, which lye between the *VVings* and the *Legs*, (8. of Each Side) of the Thickneſs, Length, Colour, and almoſt Figure or Shape of a Grain of *Barly*, Contiguous to one another, and without *Adherence*. We may obſerve that Each *Muſcle* is Compoſed of many *Fleſhy Fibres*, which do not ſeem to be Joyned together, but Terminate Round at the Ends of the *Muſcle* where they Compoſe a *Common-Tendon*; ſo that one might Diſcern any of theſe *Fibres* to be a Small *Muſcle*, of which the Chief is Compoſed. The uſe of theſe *Muſcles* ſeem to me very Particular: For the ſame *Muſcles* which Flutter the *VVings*, ſerve alſo to Stir the *Legs*. The *Upper Tendons* of the *Muſcles* enter into the *VVings*, *I* believe the ſame which the *Fibres* Compoſe, and the Lower Enter a good Way into the *Legs*; yet the Contrary Motions of theſe *Organs* are not at all Hindred, for as long as the *VVings* Play, the *Feet* lye Still, and ſerve for a *Prop* to the *Muſcles* which Stir the *VVings*; and when the *Feet* are

in

in Action, the *VVings* are Quiet, and in their turn ſerve to ſupport the *Tendons* which Direct the *Feet*.

The *Eyes* are like two Thick Oblong *Pearls*, which begin at the Fore-part of the *Head*, and End in the Hinder Part. Their *Outer Membrane* is Dry, Thin, Tranſparent, and incloſes a Small Soft Ball, filled with a very *Black Liquor*: Two ſmall Canals, fill'd with *Air*, enter into Each of theſe *Eyes*, and Run along to the great *Channel*, alſo furniſhed with *Air*, which accompanies the *Inteſtine* from the *Head* to the *Tail*. This *Structure* made me think, that the *Libella* could *Drive* the *Air* Contain'd in theſe *Canals* into the *Eyes*, to give it a greater *Convexity* to behold Objects that are Very Near: And on the Contrary, the *Air* is Forced out of the *Eyes* again to *Flatten* them, when they look at Remote Objects. And my Conjecture is not altogether Frivolous: for having Blown into the Thick-Canals which are about the Middle of the *Body*, the *Eyes* became Conſiderably *Tumified*, and by Letting the *Air* Return they became *Flat* Again. If we leave a *Libella* Dead for ſome *Days*, the *Internal Parts* will *Putrify*, and come to Nothing: But theſe *Canals* will Remain Entire, and as Solid and Firm as they were Before.

X. Whether there be any *Spontaneous*, or *Anomalous Generation* of *Animals*, as hath been the *Conſtant Opinion* of *Naturaliſts* Heretofore, *I* think there is Good Reaſon to Queſtion. It ſeems to me at preſent moſt probable, that there is *no ſuch Thing*: but that even all *Inſects* are the *Natural iſſue* of *Parents* of the ſame *Species* with themſelves.

Of Spontaneous Generation; *by Mr.* Ray. n. 74. p. 2219.

Fr. Redi hath gone a good Way in Proving this: Having Cleared the Point concerning *Generation ex Materia Putrida*. But ſtill there Remain two Great *Difficulties*; the *Firſt* is, to give an Account of the *Production* of *Inſects* Bred in the *By-Fruits* and *Excreſcencies* of *Vegetables*, which the ſaid *Redi* Doubts not to aſcribe to the *Vegetative Soul* of the *Plant* that Yields thoſe *Excreſcencies*; But for this, *I* refer you to Mr. *Liſter*. The *Second* is, to render an Account of *Inſects Bred* in the *Bodies* of other *Animals*.

Gener. degl' Inſetti.

XI. 1. M. *Verney*, a *French* Apothecary at *Montpelier*, having Deſcribed the *Grain* of *Kermes* to be an *Excreſcence* Growing upon *VVood*, and often upon the *Leaves* of a *Shrub* Plentiful in *Languedock*, and Gathered in the End of *May* and the beginning of *June*, full of a *Red* Juice; Subjoyns two *Uſes*, which that *Grain* hath, the One for *Medicine* the other for *Dying* of *VVool*. For the Latter *Uſe*, they take the *Grain* of *Kermes*, when Ripe, and Spread it upon *Linnen*; and at *firſt*, whilſt it abounds moſt in *Moiſture*, 'tis Turned Twice or Thrice a Day, to Prevent its *Heating*; and when there appears *Red Powder* amongſt it, they Separate it, Paſſing it through a *Searce*; and then again they Spread abroad the *Grain* upon the *Linnen*, until there be perceived the ſame *Redneſs* of the *Powder*; and at the End, this *Red Powder* appears about, and on, the Surface of the *Grain*, which is ſtill to be paſſed through a *Searce*, till it Render no more.

The Grain *of* Kermes, *its uſe, and the* Fly *form'd* Out *of it; by M.* Verney. n. 20. p. 362.

In

In the Beginning, when the *Small Red Grains* are ſeen to *Move* (as they will do) they are *Sprinkled* over with *Strong Vinegar*, and Rubb'd between ones *Hands*. If this *Red Powder* ſhould be let alone, without Pouring *Vinegar* or ſome Other *Acid Liquor* upon it, out of *Every Grain* there would be Formed a *Little Fly*, which would Skip and Fly up and Down for a Day or Two, and at Laſt, Changing its *Colour*, fall down Quite Dead, Deprived of all the *Bitterneſs*, the *Grains*, whence they are *Generated*, had before.

The *Grain* being altogether Emptied of its *Pulp* or *Red Powder*, 'tis waſh'd in *VVine*, and then *Expoſed* to the *Sun*; being Well *Dried*, 'tis *Rubb'd* in a *Sack* to render it *Bright*, and then 'tis Put Up in *Small Sacks*, putting in the Midſt, according to the Quantity the *Grain* has afforded, 10 or 12 *Pounds* (for a *Quintal*) of the *Duſt*, which is the *Red Powder*, that came Out of it. And accordingly, as the *Grain* affords More or Leſs of the ſaid *Powder*, *Dyers* buy more or leſs of it

'Tis to be *Noted*, that the *firſt Red Powder*, which appears, iſſues out of the *Hole* of the *Grain*, that is on the ſide, where the *Grain* adhered to the *Plant*; and that that which about the end appears Sticking on the *Grain* hath been *Alive* in the *Husk*, having Pierced its *Cover*, though the *Hole*, whence it commonly iſſues remains Cloſe, as to the *Eye*.

The Inſect-Husks *of the* Kermes-Kind; *by Dr.* M. Liſter. n. 71. p. 2165. n. 72. p. 2177.

2. Some Years ago, I Gathered off our *Engliſh Oak*, Round *Worm-Husks* very like *Kermes Berries*; And *I* have Often Obſerved on *Plumb Trees*, and *Cherry-Trees*, alſo on the *Vine* and *Cherry-Laurel*, certain *Patellæ*, or *Flat-Husks*, containing *Worms*, which, (or at leaſt the *Husks*) will Strike a *Carnation* with *Ly* and *Stand*. In *May*. 1671. *I* obſerved the ſame *Patellæ*, or *Husks*; indifferently on *Vine-Branches*, *Cherry-Laurel*, *Roſe-Buſhes*, *Plumb-Trees*, and the *Cherry-Tree*. The Figure of the *Husks* is *Round*, ſave where it *Cleaved* to the *Branch*; for *Bigneſs*, ſomewhat more then *Half* a *Gray Pea*: Theſe, *I* ſay, *Cleave* to their *Branches*, as *Patellæ* do to *Rocks*; for *Colour*, they are of a very Dark *Cheſnut*, extreamly Smooth, and Shining *Membrane-like*. They Adhere moſt commonly to the Underſide of a *Branch*, or *Twig*, and ſo are Beſt ſecured againſt the Injuries of the *Weather*; as too much *Sun* and *Rain*. They are well *Faſtened* to the *Branches* ſingle, and ſometimes many in Company. They are ſeldom found without *Vermine*, as *Piſmires*, *&c.* which *I* gueſs, Pierce them, and *Prey* upon them. If you Cut off Dexterouſly the *Top* of the *Husk* with a *Razor*, youl find ſometimes 5 or more *Small White Maggots* of the *Waſp*, or *Bee Kind*, that is, *Sharp* at *Both Ends*. If when you have Clear'd the *Husk*, you Rub the Empty *Membrane* upon *White Paper*, it will Freely and Copiouſly *Tinge* the *Paper* with a *Beautiful Purple*, or *Murrey*.

n. 73. p. 2196. n. 76. p. 2294.

Jun. 10. 1671. *I* found ſeveral of theſe *Patellæ Kermiformes* Hatched in a *Box* where *I* had Purpoſely put them; they prove a ſort of *Bees*, but certainly the Leaſt that ever *I* yet ſaw of that *Tribe*, as not much exceeding in their whole *Bulk* the *Half* of a *Piſmire*. They are very compact and Thick for the *Bigneſs*; of a *Cole-Black Colour* There is a Remarkable *Spot* on their *Backs*, *White* or *Straw colour*, Large and Round. The *Upper Pair* of their *VVings* are Shaded or Dark ſpotted, the *Undermoſt Pair* are clear. We may Entitle them, according to our cuſtom, *Apiculæ Nigræ*, *Maculâ ſuper Humeros ſubflaveſcente inſignitæ*,

é Patellis ſive Favis membranaceis, veri Kermes ſimilibus, ſuaque itidem Purpura Tingentibus, Cereſi aut Roſæ aliarumve Arborum Virgis adtextis, Excluſæ.

It is to be further Obſerved

1. That thoſe that look the *Blackeſt* yield the Deepeſt and Beſt *Purple*

2. That as the *Bees* come to *Maturity*, the *Dye* ſeems to be ſpent, and the *Husks* Grow Dry.

3. That the *Young* Ones make their Way Out at *Several* ſmall *Holes*; that *Hole* in ſome of the *Shop Kermes*, being *Accidental* only and Ever on the Bottom Part Cleaving to the *Branch*; and the Time of Gathering them for *Colour*, is without Doubt before they are *Pierced*, and whilſt the *Animal* is yet in *Vermiculo*, and Conſequently the *Husk* Entire.

We Compared theſe *Purple-Kermes* with the *Scarlet Kermes* or *Grains* of the *Shops*, and found them in every Point to agree, ſave in the *Colour* of their *Juices*: and Particularly (finding in ſome Parcels of the *Shops*, many yet ſticking to little Twigs of the *Ilex*) we confidently affirm, that *Thoſe* as well as *Ours*, are only *Contiguous* to the *Ilex-Branches*, and are not *Excreſcencies* of the *Tree*, much leſs *Fruit* or *Berries*, (by which abuſive Names they have been too long Known;) but that they are the Artifice and ſole Work of the *Mother Bee*, in order to the more Convenient *Hiving* and *Nouriſhment* of her *Young*.

Theſe things are alſo Certain; *viz.*

1. That we have ſeen the very *Gum* of the *Apricock* and *Cherry Laurel Trees* Tranſudated, at leaſt ſtanding in a *Chryſtal-drop* upon ſome (though very Rarely) of the Tops of theſe *Kermes*.

2. That they *Change colour* from a *Yellow* to a *Dark Brown*: and that they ſeem to be Diſtended, and to Wax Greater, and from ſoft to become Brittle.

3. That they are filled with a ſort of *Mites*: Concerning which I am pretty well aſſured by my Own, and alſo by Dr. *Johnſon* of *Pomfret*'s more Accurate *Microſcopical Obſervations*.

4. That the *Bee Grubs* actually *Feed* on *Mites*: there being no other Food for them.

5. That there are other *Species* of *Bees*, or *Waſps*, beſides thoſe by me Deſcrib'd, which are ſometimes found to make Theſe *Mites* their *Food*: Dr. *Johnſon* having opened *One Husk*, with One only Large *Maggot* in it.

6 That there are Probably, Different ſorts of *Mites* in theſe *Husks*, Making Poſſibly Different *Species* of *Kermes*: For ſome *I* have found to hold *Carnation Colour'd Mites* Encloſed in a Fine *White Cotton*, the Whole *Husk* ſtarting from the *Twig*, ſhrivelling up, and ſerving Only for a *Cap* or *Cover* to That Company of *Mites*. Other *Mites I* have ſeen *white*, and (which is moſt Uſual) the *Husks* Continuing *Entire*, and not Coming away from the *Twig* they adhere to, and but little *Cotton* at the Bottom.

7. That the ſhrivell'd *Cap*, to be found upon the *Mites*, Incloſed in the *Cotton*, as alſo to the Whole *Husk* it ſelf, if taken Early in *April*, While Soft, will

will (Dryed in the *Sun*) ſhrink into the very Figure of *Cochineel*: Whence we Gueſs, that *Cochineel* may be a ſort of *Kermes*, taken thus Early and Sun-Dried.

I conceive that the ſmall *Scarlet Powder*, mentioned by M. *Verney*, is to be underſtood of Thoſe *Mites*; and that they are to be Diſtinguiſht from the *Bee-Grubbs*, which are *Changed* into the *Skipping-Fly*, that is, the *Bee*, (for Kind at leaſt) here Deſcrib'd by us.

Obſervations on Vegetable-Excreſcencies, *and* Inſects *Generated in them*; *by Dr.* M. Liſter, n. 75. p. 256.

XII. 1. The Account *I* have given of the *Purple-Kermes*, both gives a Clear Light to the Diſcovery of the Nature of the *Scarlet-Kermes*, a thing wholly Unknown to the *Ancients)* and alſo is an Evident Inſtance, that ſome Things Confidently Believed *Vegetable Excreſcencies*, are No ſuch Matter, but *Artificial Things*, meerly *Contiguous* to the *Plant*, and which have No Other Relation to it, than the *Patella Shell-Fiſh* to the *Rock* it Cleaves to.

n. 76. p. 2284.

2. Generally, *Inſect Eggs* Laid upon the *Leaves* of *Plants*, or their Reſpective *Worms*, Feeding on them, do not Occaſion or Raiſe *Excreſcencies*.

n. 77. p. 3003.

Thus, for Example, the *Eggs* of the *Common-Red-Butter-Fly* Laid upon the *Nettle*, are thereon *Hatched* without *Bliſtering* the *Plant* into an *Excreſcence*; and the *Stiff Haired*, or *Prickly Caterpillers*, Hatched from theſe *Eggs*, Feed upon the *Leaves* without any ill Impreſſion, Puncture, or Prejudice, ſave that they make Clean Work, and Eat all before them.

3. Some *Inſect Eggs*, Laid upon the Leaves or other part of *Plants*, do as ſoon as *Hatched*, Pierce and Enter within the Plant to *Feed*. *I* had a Convincing Inſtance to the Truth of this *Propoſitton*.

May 22. 1671. when *I* obſerv'd on the Back or Underſide of the *Leaves* of *Atriplex Olida*, certain ſmall Milk-White Oblong *Eggs*; on ſome *Leaves* 4, on others fewer, or more. Theſe *Eggs* were on ſome *Plants* yet *Unhatched* but on many of the ſame *Plants I* found the *Egg ſhells*, or *Skins*, yet adhering to the *Leaves*, and the little *Maggots* already *Entered* (through *I* know not what Inviſible Holes) within the Two *Membranes* of the *Leaf*, and *Feeding* on the *Inward Pulp* or Subſtance of the *Leaf*: in other *Leaves* of that Plant *I* found thoſe *Maggots* Grown very great, and yet the Two *Membranes*, that is, the Uppermoſt and Undermoſt skin of the *Leaf* Entire, but *Raiſed* and Hollow like a *Bladder*. *Note*, 1. That thoſe *Maggots* were of a *Conick* ſhape. 2. That in *July* they ſhrunk into *Fly Chryſalis's*, and accordinly came to Perfection; And to this Unobvious way of *Feeding* we think we may Refer all *VVorm Eaten Fruits*, *VVoods*, &c

4. *VVorms Feeding* Within ſome of the Parts of ſome *Plants* do Cauſe *Excreſcencies*; Thus the *Heads*, or *Seed Veſſels*, of *Papaver. Spart. Sylv. Ger. Emac.* &c. are Diſfigured for having *VVorms* in them, and Grow thrice as big as the not Seiſed ones. This is alſo plain in the *Excreſcencies* of *Pſeudo Teucrium*, and *Barbarea*, &c.

5 The *Subſtance* or *Fibrous* part, of many *Vegetable Excreſcencies* ſeems not to be the *Food* of the *VVorms* found in them; that is, the *VVorms* in thoſe *Vegetable Excreſcencies* which produce *Ichneumons*, (to which Kind of *Inſect* we would Limit this Propoſition,) do not ſeem to *Devour* the *Subſtance* or *Fibrous*

Fibrous part of them, as other *Worms* Eat the *Kernels* of *Nuts*, *&c* but whatever their manner of *Feeding* is (and we doubt not but they are Nouriſht in and upon ſome Part of them,) the *Vegetable Excreſcencies* ſtill mightily Encreaſe in Bulk, and *Riſe*, as the *Worms* Feed. And it is Obſervable (to endeavour a *Solution*) that ſome of the *Ichneumons* Delight to *Feed* on a *Liquid* Matter, as the *Eggs* of *Spiders*, and the *Juices* (if not *Eggs*) within the Bodies of *Caterpillars* and *Maggots*. Whence we Conjecture, that thoſe of the ſame *Genus*, to be found in *Vegetable Excreſcencies*, may in like manner Suck in the *Juices* of the Equivalent parts of *Vegetables*. And this the Dry and *Spongy Texture* of ſome of thoſe kind of *Excreſcencies* ſeems to Evince. For if you Cut in pieces a *Wild Poppy Head*, for Example, (or the great and ſoft *Balls* of the *Oak*,) you'l find, in thoſe Partitions wherein theſe *Worms* are lodged, nothing but a *Pithy Subſtance* like that of *Young Elder*: and if there chance to be any *Cells* yet *Unſeiſed*, (which *I* have ſometimes Obſerv'd) the *Seeds* therein will be found yet Entire and Ripe; Whence 'tis very probable that they *Feed* upon, or Suck in by little and little, the yet *Liquid Pulp* of the Tender *Seeds*, and leave the *Subſtance*, or *Fibrous* part, to be Expanded into an *Excreſcence*.

Vid. inf. §. XIV.

XIII. In ſome *Aleppo-Galls*, which the *Inſects* had not Eat their Way out of, *I* found a ſort of *Bee* reſembling the ſmall ſort of our *Wild-Bees* which *Earth*: they have Long Wings, a Deep Belly, and on the Back, near the Comiſure to the Body, it is of a *Greeniſh Black*, the reſt *Reddiſh*, near a *Cinnamon-Colour*.

The Gall-Bee; *by Mr.* Benj. Allen n. 245. p. 375.

Theſe *Galls* were very *Gummy*, and the Cavity round them was ſo extreamly *Gummy*, that not the leaſt Room or Entrance of it appeared, though the *Bee* was begining to make its Way out. Some of the *Galls* had a *Stem* to them, and may give ſome Light to the Reaſon of *Life*, that the *Atmoſpherical-Air* is not Neceſſary to the Eſſence, before the *Organs* of the Body are Employed; but that that is maintain'd by a *Subtiler Air*, that Pervades more Minute Pores, as it is Conveyed to *Fiſh* through the *Water*.

I have alſo found in the *Grayer* ſort of *Galls*, not ſo rich in *Gum*, a ſmall *Ichneumon* of a *Bright-green*.

XIV. 1. As *I* remember, Mr. *Liſter's* Opinion is, that the *Muſcæ Ichneumones* lay their *Eggs* in the *Bodies* of *Caterpillars*; which *I* look upon as very Ingenious and True. Theſe *Ichneumones* have all 4 *Wings*, *Autennæ* like *Bees*; their Body hanging to their Breaſt by a ſlender Ligament, as in *Waſps*; moſt, if not All, have *Stings*, and are made of a *Maggot*, that Spins her ſelf a *Theca* before ſhe Turns into a *Nympha*. There is great Variety of them; ſome *Breed* as *Bees* do, laying an *Egg* which produceth a *Maggot*, which they *Feed* till it comes to its full Growth; others, as we gueſs, Thruſt their *Eggs* into *Plants*, the *Bodies* of *Living Caterpillars*, *Maggots*, *&c*. For, it is very ſurprizing to obſerve, that a great *Caterpillar*, inſtead of being *Changed* into a *Butter-Fly*, (according to the uſual Courſe of Nature) ſhould produce ſometimes *one*, ſometimes *two* or *three* and ſometimes a whole *Swarm* of *Ichneumones*. *I* have obſerv'd this *Anomalous Production* in a great many Sorts of *Caterpillars*, both *Hairy*, and *Smooth* in ſe-

Ichneumon Waſps *and the manner of laying their* Eggs *in the Bodies of* Caterpillars; *by Mr.* Fr. Willoughby, n. 76. p. 2279.

veral ſorts of *Maggots*, and, which is moſt Strange, in one *VVater-Inſect*. When there come many of theſe *Ichneumon Maggots* out of the Body of the ſame *Caterpillar*, they Weave all their *Theca*'s together into one Bunch; which is ſometimes Round, with a *VVeb* about it juſt like a Bag of *Spiders Eggs*. But none of them *Feed* upon *Spiders Eggs*; but it is the Similitude of thoſe *Theca*'s, Conglobated together: to the *Eggs* of *Spiders*, that hath occaſioned that Conjecture.

One of the *green Caterpillars*, common in the Heaths in the *North*, went ſo far on to her *Natural Change*, that ſhe made herſelf up into a great Brown *Theca* almoſt of the Shape of a Bottle, which was Filled with a *Swarm* of *Ichneumones*, And *I* have Obſerved in one or two other ſorts, that from the very *Aurelia* itſelf hath come an *Ichneumon*; which is very odd, that the *Caterpillar*, *Stung* and *Impregnated* by the *Ichneumons*, ſhould be yet ſo far Unhurt, and Unconcerned, as to make her ſelf a *Theca*, and to be *Turned* into an *Aurelia*.

I have often ſeen a Great *Ichneumon* Dragging a *Caterpillar* in the highway. This Year 1671. Mr. *VVray*, in company with another ingenious Neighbour, obſerved one Haling a Large *green Caterpillar*, much Bigger than herſelf, which after ſhe had Drawn the length of a *Pearch*, ſhe laid down, and then takes out a little Pellet of Earth, with which ſhe had ſtopped the Mouth of a ſmall *Hole* like a *VVorm hole*; then ſhe goes down into it, and ſtaying a very little comes up again, and draws the *Eruca* down with her into the *Hole*, and there Leaves her, and afterwards not only ſtops but fills up the Hole, ſometimes carrying in little Clods, and ſometimes Scraping Duſt with her Feet, and Throwing it backwards into the Hole, Going down after it her ſelf, to Ram it cloſe. Once or twice ſhe Flew up into a *Pine-Tree*, which grew juſt over her *Hole*, perhaps to fetch *Cement*. When the *Hole* was Full and Even with the ſuperficies of the Ground about it, ſhe Draws 2. *Pine-Tree Leaves*, and lays them near the Mouth of the Hole, and Flyes away. Not taking Notice that ſhe came any more in 3. or 4. Days, we Digg'd for the *Caterpillar*, and found it pretty Deep. I put it into a Box, expecting it would have Produced an *Ichneumon*: but it dried away and nothing came of it.

We lately obſerved a ſort of *Ichneumons*, or rather *Veſpæ*, which Prey upon ſeveral ſorts of *Flyes*; when they fly with them, they hold them by the Heads, and carry them under their Bellies. Theſe make *Holes* a great depth in the Ground, in which they lay their *Young*, and *Feed* them with the *Flyes* they Catch, Creeping Backwards into the Ground, and Drawing the *Flyes* after them. I ſuſpect they may at firſt lay their *Eggs* in the very Body of a *Fly*: but one being not enough to bring the *Young one* to its Full Growth, they *Feed* it with more. The *Theca*'s are at laſt all Covered over with the *VVings*, *Legs*, and other *Fragments* of *Flies*.

By Dr. Liſter *ib.* p. 2281. p. 2284.

2. This kind of *Inſect* is one of the greateſt Puzzles in Nature; there being Few *Excreſcencies* of *Plants*, and very many *Births* of *Inſects*, wherein theſe *Slender VVaſps* after divers Strange ways are concerned.

'Tis true the *Swarms* of theſe *Ichneumons*, coming out of the Sides of *Caterpillars*, do immediately make themſelves up into Bunches, and each particular *Theca*, from the *Cabbage Caterpillar* (for Example,) is wrought about with *Yellow Silk*, as thoſe from the *Black* and *Yellow Jacobæa*

Caterpillar

Caterpillar with *White*: but as for *VVeb* to Cover those Bunches of *Theca's* I never observed it but in the *Green-Caterpillars*, so Common in our *Lincolnshire Heaths*, which are Fixed to *Bents* or other *Plants*. These in truth never but deceived my Expectation, for *I* verily thought *I* had found, when *I* first Observed them, a *Caterpillar* Equivalent to the *Indian Silk VVorm*; but having Cut them in two, and Expected to have found a *Caterpillar's Chrysalis* in the middle, there presented themselves a *Swarm* of *Ichneumons*. These are as Large, many of them, as my Thumb; that is, at least four times Bigger than the *Folliculus* or *Egg-Bag* of any *English Spider* I ever Saw yet. *I* have had them in several Boxes, some 8. some 10. some 12. *Days* in *Vermiculo*, *Feeding* upon the very *Cakes* of *Spiders-Eggs*, before they wrought themselves *Theca's* for further *Change*; and they Seldome exceeded the Number of Five to One Cake of *Eggs*, *&c.* So that you may assure Mr. *VVilloughby*, this is no Conjecture, but a Real Observation.

Concerning the Name ἰχνεύμων *I* refer you to Mr. *Ray*, who is another *Hesychius*: and we have Observations enough to make us believe, that those very *Insects*, we have here Treated of, are, for *Kind*, the *Ichneumones* of the *Antients*. n. 77. p. 3005.

XV. It hath been credibly reported, that *Horse-Hairs* thrown into Water will be *Animated*; and yet *I* shall shew you by an unquestionable Observation, that such things as are vulgarly thought *Animated Hairs* are very *Insects*, Nourished *within the Bodies* of their *Insects*, even as *Ichneumones* are *within the Bodies* of *Caterpillars*. *I* find many Particulars collected by the industry of *Aldrovandus* concerning this *Insect*: But our own Observation is this. Hair-Worms; *by Dr.* Mart. Lister, n. 83. p. 4064.

Apr. 2. 1672. There was thrown up out of the Ground of my Garden a certain *Coal black Beetle* of a Middle size, and Flat shape, and which *I* have observed elsewhere Common enough. *I* Dissected some of them, and was surprized to find in their *Swollen Bellies* of these *Hair VVorms*; in some 3. in others but only one. These Particulars we carefully *Noted*.

1. That upon the Incision they *Crawl'd* forth of themselves.

2. That putting them into Water, they *Lived* in it many *Days*, and did seem to Endeavour to Escape by Lifting up their Heads out of the Water, and Fastening them to the sides of the Vessels; very plainly Drawing the rest of their Body forward.

3. That they cannot be said to be *Amphisbena*, but do *Move forward* only by the *Head*, which is fairly Distinguishable from the *Tail* by a Notable Blackness.

4. That the 3. *I* took out of the Body of one *Beetle*, were all of a *Dark Hair Colour* with *whitish Bellies*, somewhat Thicker than Hog's-Bristles: but *I* took out of the Body of Another *Beetle* one that was much Thicker than the Rest, much Lighter Coloured, and by measure just $5\frac{1}{2}$ *Inches* long; whereas all the rest did not Exceed $3\frac{3}{4}$ *Inches*.

Some Observations about Bees; by Dr. Geo. Garden. n. 175. p. 1157.

XVI. M. *Leewenhoeck* in 1673. took notice of five little *Instruments*, which are on the *Head* of the *Bee* before; *four* whereof are two Pairs, the one being called by him *Scrapers*, the other *Arms*, the *fifth* he calls the *Wiper*, supposing that by it they wipe off the *Honey* from the *Flowers*. This *last* is truly the *Sucker* or *Proboscis*, being Hollow and made up of all Circular Fibres, wherewith the *Bees* suck the *Honey* from the *Flowers*.

The Globulets which break forth from the *Attire* of *Flowers*, Described by Dr. *Grew* and *Malpighius*, which are for the most part of an Oval Figure, and of different Colours (some *White*, some *Yellow*, some *Red*) seem to be Bags of *Liquors*, and are the Materials which the *Bees* carry in for their *Wax*, as is evident not only from the different Colours of the *Wax* upon their Legs, according to the different Colours of the *Globulets* of the Respective *Flowers* we see them light upon; but for that also if you take them gathering *Wax* from any particular *Flower*, and view a small parcel of that *Wax* with a *Microscope*, you will find it to consist of the *Globulets* of the same *Flower*; tho' it is not so easie to Discover what *Liquor* they make use of, to cause them to stick together.

On the Inner side of the *Hinder Legs* of *BEES*, on the Joint towards the Toe, next to that on which they curry the *Wax*, there are a great many Rows of Yellow Sharp Pointed Stiff *Bristles*, set all in order like the Teeth of *Combs* for *Lint*; which I look upon as the *Instruments* wherewith they Break these *Globulets*, and Prepare their *Wax*.

The Generation *of a sort of* Bees *in* Old Willows; *by Sir* Edm. King. n. 65. p. 2098.

XVII. 1. About the Beginning of *May*. 1670. Sir *J. Bernhard* sent me a piece of *Old Willow-Wood* out of *Northamptonshire*, in which were lodged many *Insects* curiously wrapt up in *Green Leaves*, in several *Channels* or *Burrows*, each with 12, 14 or 16 *Leaves* Round the Body, and several of them with as many little round bits of *Leaves* at each End, to stop them up close These, thus made up, are near an *Inch* long, or the best part of an *Inch*, put in one after another into a Bore made in the *Wood* fit for their Reception. They are in the manner of *Cartrages* of *Powder*, wherewith *Pistols* are wont to be Charged. In some part of those *Burrows*, they are placed so near one another as to Touch; in others, at some considerable Distance. These *Insects* observe this Method in placing themselves, that sometimes they make a direct way into the Length of the Wood, sometimes they Bore out into the side, and run another way; those *Channels* being not unlike the *Burrows* of *Rabbets*, all which they fill up with these Round appearances of *Wrapt-Leaves*, all regularly wrought. In which *I* find either something *Alive*, or Appearances of something that hath *Dyed* there, and is Putrify'd: In some a great Number of *Mites*, of a *Dark-Ash Colour*, shaped not unlike Common *Mites*; in others *I* find seeming *Excrements* of some small *Insect*, with the Decayed Parts of the *Dead Insect*; in others, *White Maggots*. Some of these *Maggots I* took out of their *Theca*,

or

or Bagg, and put them in warm Places in the Sun, and they thereupon grew ſomething Bigger, but changed not Shape nor Colour, but Dyed. The reſt I kept cloſe in a Box till the 8 of *July*. Then I took one of them out of the *Wood*, and opened the *Leaves*, and felt ſomething ſtir, Hearing alſo an Humming Noſe like that of a *Bee*; and as ſoon as I had opened the *Theca*, a Perfect *Bee* did fly out againſt my Window, as ſtrongly as a *Common Bee* out of an *Hive*, having much of the Colour and Bigneſs of thoſe when they are New Flyers. The reſt, being diſturbed, Eat themſelves out. They have all *Stings* like *Bees*; and I am of the Opinion, that they are *Common Bees*.

2. I have had the good Luck to find a great many of theſe *Cartrages* in a *Rotten Willow*; and, by the Shape of the *Maggot*, was confident, they would produce *Inſects* of the *Bee-Tribe*. Mr. *Snell*, an Ingenious Gentleman, brought of them to the *Wells* at *Aſtrop*, and directing me to the Place where he got them, I there found great Plenty in the Trunk of a dead *Willow*: Beginning to unfold ſome of them, Mr. *Wray* immediately judged them to be made up of pieces of *Roſe-Leaves*; and called to Mind, that this very Spring Mr. *Fr. Geſſop* brought him a *Roſe leaf*, out of which himſelf ſaw a *Bee* bite ſuch a piece, and fly away with it in her Mouth. Whereupon, ſearching the *Roſe-Trees* thereabout, we found a great many *Leaves*, with ſuch pieces bitten out of them, as theſe *Cartrages* are made up of. The *Cuniculi*, or *Holes*, never croſs the Grain of the Wood, excepting where the *Bee* comes in, and where they open one into another. From the Place of Entrance, they are wrought both upwards and downwards; ſo that ſometimes the *Bee-Maggot* lies under her Food, and ſometimes above it. One End of the *Cartrage*, *viz.* That which is next the Entrance, is always a little *Concave*; the Other End, which is fartheſt from the Entrance, a little *Convex*, and is received into the *Concave* of the next beyond it. The ſides of the *Cartrage* are made up of Oblong pieces of *Leaves*, and paſted together; the Ends of Round ones; and where ever they do not lie cloſe one to another, the intermediate ſpace is filled up with a Multitude of theſe little Round Pieces, laid one upon another.

By Mr. Fr. Willouby. *ib.* p. 2100.

The *Cartrages* contain a Pap, or Batter, of the Conſiſtence of a Gelly, or ſomething thicker; of a Middle *Colour* between *Syrup* of *Violets* and the *Conſerve* of *Red Roſes*; of an *Acid Taſte*, and Unpleaſant *Smell*. In each of theſe, at the *Concave* End there lies one *Bee-Maggot*, which *feeds* upon the foremention'd matter, till it grows to its full Bigneſs, and then makes and Encloſeth her ſelf in a *Theca*, or *Husk*, of a *Dark-Red* Colour, and Oval Figure; in which ſhe is *Changed* into a *Bee*. The Remainder of her Food you may find dried into Powder at the *Convex* End; and her *Excrements* at the *Concave* without the *Theca*.

The *Bees* were of a ſhorter and thicker Shape, than the *Common Honey Bee*, more *Hairy*, *&c.* But the ſureſt Mark to Diſtinguiſh them is, that the *Forcipes* or *Teeth* of theſe are Bigger, Broader, and Stronger; in Shape like thoſe of a *Waſp*, or *Hornet*; from which ſhe alſo ſufficiently Differs, in having a *Tongue* like a *Bee*, which they want.

They

They made their way out along the Channel thorough all the intermediate *Cartrages*, and not through the Solid Wood. Of the Corruption of the Matter within the *Caſes*, when the *Bee Maggots*, or *Nymphæ*, happen to Miſcarry are *Bred*, *Firſt*, little *Hexapods*, which produce *Beetles*; *Secondly*, *Maggots* which produce *Flies*; *Thirdly*, *Mites*, *&c.*

From what hath been obſerved concerning this *Bee*, and by a great many more Parallel inſtances, it appears that it is the *Bee Maggot*, and not the *Old Bee*, that *Covers* the Cells before the *Change:* For here the *Old Bee*, when ſhe hath left Proviſion enough with an *Egg*, *Cloſes* up the *Cartrage*, and hath no more to do; the *Maggot* a great while after making the *Theca*, which is Analogous to the *Cover* of the Cells.

By Dr. Liſter. n. 160. p. 594.

3. I have obſerved that the *Bees* breeding in *Caſes* of *Leaves* are not very ſcrupulous in the choice of thoſe *Leaves*, but will make uſe of *Exotick Plants*; ſuch as *Blew-Pipe* or *Syringe Tree*. Here is a very ſtrange *Oeconomy* of Nature yet Unſolved: The furthermoſt *Bee*, ſays Mr. *Willoughby*, makes her way out along the *Channel through all the intermediate Cartrages:* And according as theſe *Channels* run Upwards or Downwards in the Body of the *Tree*, the *Maggot-Bee* at the far or Upper End of each Channel is Firſt Laid, and it ſhould ſeem both Hatched and Perfected *Firſt*. But I take it otherwiſe, that that *Bee* which is Neareſt Day, although it be *Laſt* laid, is yet the *Firſt* Hatched; and I ground my Conjecture upon this, that 'tis Probable, that the *Eggs* in the *Mother* are all fit for Laying, or equally Ripe or Forward (as we ſay) at the time that the Firſt of them was Laid, but are not therefore all laid by the *Dam*, until ſhe has Provided them of *Meat* and a *Houſe*, each ſeparately, as is the Nature of *Bees:* and yet in Recompenſe, the Warmth of her Body, or rather the Daily Encreaſing Heat of the Summer-ſeaſon, to which the *Mother Bee* is continually Expoſed, (whilſt the *Firſt* laid *Eggs* are ſheltered in their Deep *Channels*,) haſtens their Vitality ſo much, that they are Hatched *Worms*, and begin to *Feed*, before the *Firſt* laid, and conſequently are *Firſt* Perfected into *Bees*. But this is Conjecture only, and not Obſervation.

By Mr. Fr. Willoughby. n. 74. p. 222.

4. The *Cartrages* that I got at *Aſtrop* in *Auguſt.* 1670. do now in *July.* 1671. almoſt every Day afford me a *Bee*: And I can hear them Gnawing out their way before *I* ſee them. So that there is nothing irregular in the way of *Breeding* of theſe *Bees:* But the Contrivance of God and Nature in it is very Admirable. Having ſhut their *Young* ones in thoſe Cells with ſufficient *Proviſion*, they all, as well the Uppermoſt as Lowermoſt, before *Winter*, come to Full Growth, or are *Turned* into *Nympha*'s; in which Condition they are Deſigned to lye all *Winter*, as the moſt of *Inſects* do. The next *Summer*, thoſe muſt neceſſarily be *firſt* Excited out of their *Torpor*, and *Changed* into *Flyers*, by the *External* Heat and Air, that lye next it. If any be Laid ſo Late, that they have not time enough to come to the State of *Nympha*'s before *Winter*, they will moſt certainly Dye; and then it is no loſs nor inconvenience, though their Cells be *Perforated.*

A strange sort of Bees *in the* West-Indies; *by* M. Villermont. n. 172. p. 1039.

XVIII. M. *Villermont* has received from *America* a sort of *Honey-Comb*, (of a different Make from the *European*) which is Composed of small *Bottles*, or *Bladders*, of *Wax*, of a *Brownish Colour*, inclining to *black*; being as Big as *Olives* and shapt like the *Spanish Olives*. They Hang together in Clusters, almost like a Bunch of *Grapes*, and are so Contrived, that each of them has an Aperture during the Time of *Work*, but it is Clos'd up as soon as the Vessel of *Wax* is Fill'd with *Honey*; and then the *Bees* go to Work with another Vessel.

Fig. 186.

Their Lodgings are ordinarily taken up in a *Hollow Tree*, or the Cavity of a *Rock*, by the Sea side; these being the Propereſt places to secure them from such Animals as are Greedy of their *Honey*, and therefore likely to Molest them: And they have the more Need of this Caution, because they are more lyable to be Disturbed than *Ordinary Bees*, as having no *Stings*, and being Capable of doing good, but no Hurt to any thing, as the Party that Lived at *Cayenne*, very well knows. When the *Combs* are *Removed*, they must be carried gently, and in the same Position they lay in, till you come to the Place where you Design to take out the *Honey*.

The *Honey* it self is Clear and Liquid as Rock-Water, and hardly to be Distinguisht from it by the sight. When you would take it out, you must Pierce every *Bottle* a little more than $\frac{1}{3}$ from the Bottom; for if you Pierce it Lower, you find a Bottom, or Sediment, whose Thickness would hinder it from Running: and as you Prick every *Bottle*, you must have some Vessel ready to receive what comes from it. This Gentleman says, that he thinks the *Liquor* is one of the most Agreeable things in the World. If you Drink *Fasting* the Quantity of a good Glass, or about *half* a *Pint*, it will give you 2 or 3 *Stools* in about 2 *Hours* time; according to the Temperament of the Party: but if you Drink it at *Meals*, it does not *Purge* at all.

An Early Swarm of Bees; *by Mr.* Rich. Reed. n. 70. p. 2128.

XIX. On *Thursday Mar.* 9. 167$\frac{9}{1}$ there was at the next house to mine (in *Herefordshire*) a *Swarm* of *Bees*. It was a very Fair Day to Entice them: but else we never have them till the middle of *May*. *I* had it from the Owner, one *Parry*, now in my Work: And *I* enquired of him, whether they did not all Leave the *Hive* (as sometimes they do unseasonably,) either for Want of *Food*, or out of Distaste? He told me, no, but there are as many Left behind as came forth. But *I* (who have some time studied the Regiment of that little industrious Wise Creature) do conceive, that Poverty drew them Abroad to seek their Fortunes; the infinite Wisdom having imparted such a *Providence* to that little *Common Wealth*, as to send *Part* of their Company abroad to Shift, before their whole Stock of *Food* shall be consumed to the Destruction of them *all*.

A Bee-House *used in* Scotland; *by Mr.* H. Oldenburg. n. 96. p. 6076.

XX. *A*. The *Bee House*, lying on *One Side*, with the *Frame* placed in it.
BBBBBBBB The *Frame*.
CCCC. The *Screw Pinns* that hold the *Frame* Fast.
D. The *Square-Hole* at Top Open.

E. The *Windows.*

Fig. 187. *F.* The *Door*, for the *Bees* to go in and out.

G. The Place by which the *Knife* Enters to *Cut* the *Honey-Combs* aſunder upon Occaſion.

HH. The inward *Creaſe* at the *Bottom.*

Fig. 188. *A.* The *Bee-Houſe* ſet *Upright.*

B. The *Square-Hole*, through which the *Bees* work Downward.

C. The *Shutter* that Covers the *Hole* upon Occaſion.

D. The *Door* for the *Bees.*

E. A Sliding *Shutter* that Covers the *Door* in Winter.

F. The *Window.*

GG. The *Handles* for Lifting all.

HH. The *Outward Creaſe* at the *Top*, for Faſtening one *Bee Houſe* over another.

Fig. 189. *A.* The *Frame* for the *Bees* to Faſten their *Work* upon.

BB. The *Screw Nails.*

This *Bee Houſe*, (which was ſent by Sir *Will. Thompſon,*) is made of *Wainſcot*, about 16 *Inches* in Height, and 23 in Breadth between the oppoſite ſides. It hath 8 ſides; each almoſt 9 *Inches* in breadth. It is cloſe covered at Top with Boards, having a *Square Hole* in the Middle, 5 *Inches* long, and about 4 *Inches* broad; with a *Shutter* that ſlides to and fro in a *Grove* about *half* an *Inch* Longer than the Hole. It hath 2 *VVindows*, Oppoſite to one another; and may have more of any Figure, with Panes of *Glaſs* and *Shutters.* The *Door* for the *Bees* is Divided into 3 or 4 *Holes*, about *half* an *Inch* Wide, and as High with a *Shutter* that Slides in a *Grove* to cover them in Winter. It hath 2 Iron *Handles* with Joynts, to be placed about the Middle, if there be No *VVindows* on the ſides where they are, or above them, if there be. At the *Top* it hath a *Creaſe* all round it, about *half* an *Inch* in Depth on the Out ſide, and $1\frac{1}{2}$ *Inch* High; and another on the *Inſide* at the *Bottom*; which ſerves to Fix them when ſet apon one another. It hath alſo a *Hole* about 2 *Inches* in Height and as much in Breadth on one ſide at Bottom, by which the *Knife* is put in to *Cut* the *Bees VVork*, that paſſes through the *Hole* from one *Bee Houſe* into another, as they work Downward into the *Empty Houſe*; which hath a *Sliding Shutter* to cover it. Within the *Bee Houſe* there is a *Square Frame* made of 4 Poſts joyned at Top, at Bottom, and in the Middle, with 4 Sticks, for the *Bees* to Faſten their *VVork* upon: Which though they will ſerve, yet it may be Securer to have 2 more added in every of their Places, Croſſing the *Frame* either from the middle of the Oppoſite ſide Sticks, or from the Angles where the Poſts are placed.

This manner of *Bee Houſe* is uſeful for preventing the *Swarming* of *Bees:* For, when the *Bee Houſe* wants *Room* for the *Young Bees*, 'tis known that they *Swarm* and Fly away to find a *Houſe* for themſelves: Which is prevented by placing an *Empty* one made thus, under the *Full* one, having the *Door* at the Top Open, that they may Work Downwards into it. And when both are Full, the *Bees* will all be in the Loweſt *Houſe*: and then to get the *Honey*

and

Fig. 166.

Fig. 167.

d d d d

Fig. 170.

c

a a a a a a

b

Fig. 172. D

Fig. 173. F

Fig. 173

Fig. 169.

Fig. 168

Fig. 171.

Fig. 172. C

Fig. 173. L M

Fig. 172

Fig. 173.

Fig. 174.

Fig. 175.

Fig. 183.

Fig. 185.

Fig. 184.

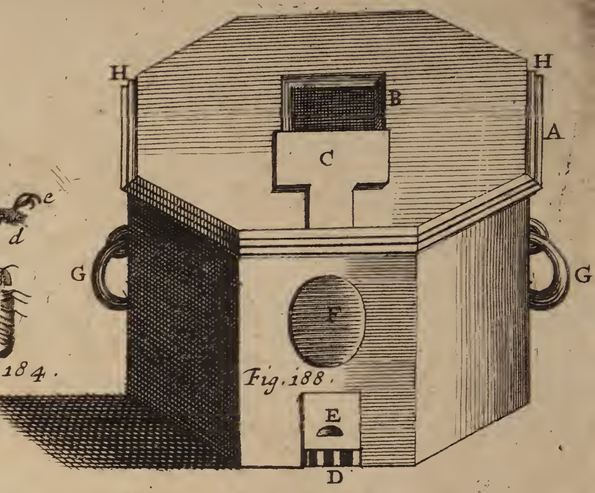
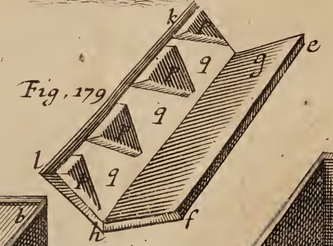


Fig. 188.

Fig. 179.



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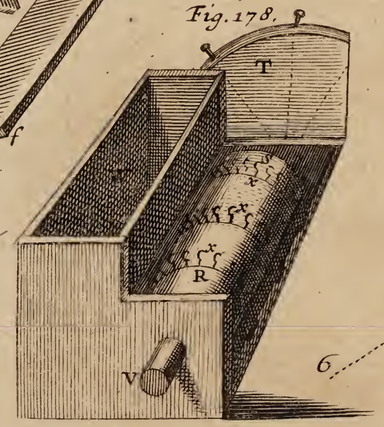


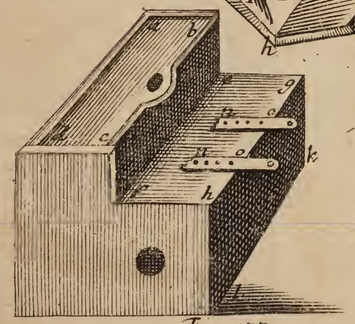
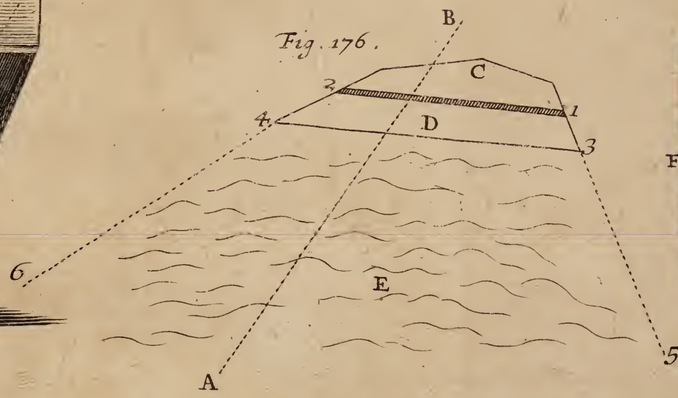


Fig. 177.

Fig. 176.



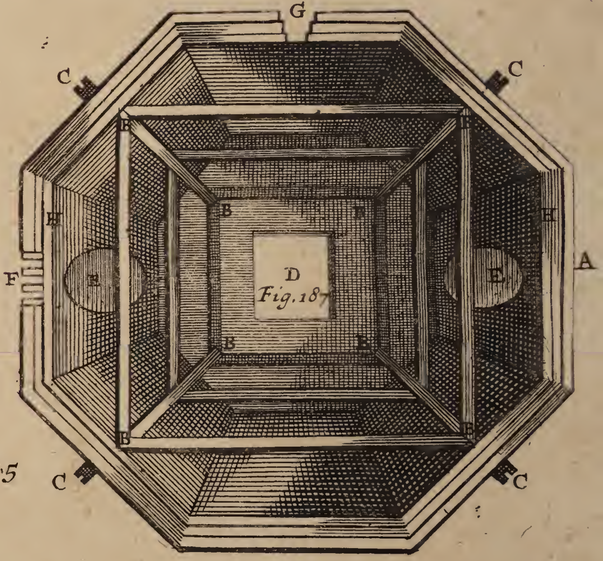


Fig. 180.

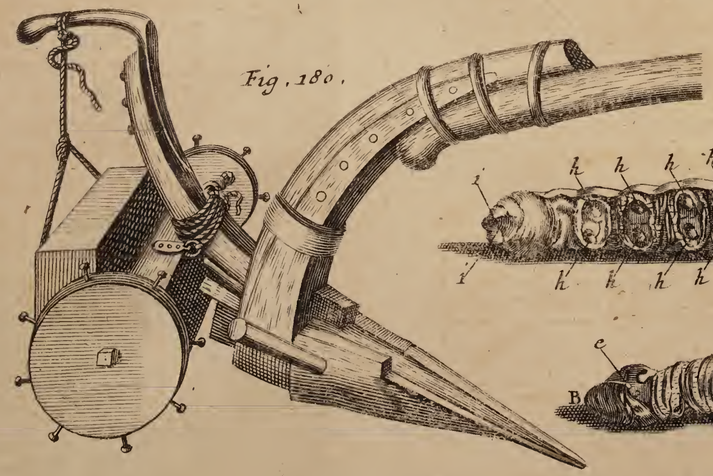


Fig. 182.

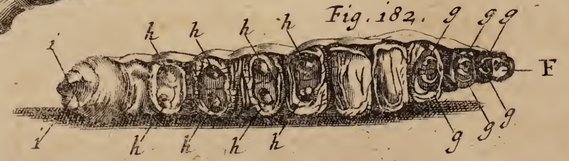


Fig. 181.

Fig. 186.

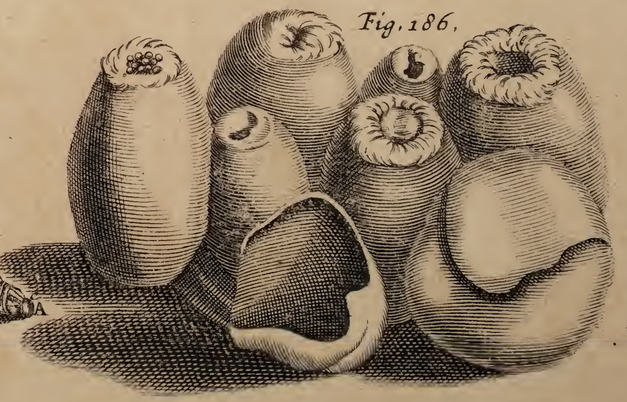
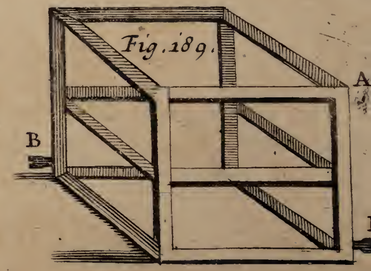


Fig. 189.



and *Wax* without Deſtroying or Troubling the *Bees*, with a Thin Long *Knife*, broad at the End and Sharp on both Sides, the *Bees-Work* is to be *Cut* as Low as can be, and the Uppermoſt *Bee Houſe* to be Lifted off by the *Handles*; and being Reverſed, the *Screws* are to be taken out, and then the *Frame*, with all the *Bee's Work* upon it, will eaſily Slip out, and ſo the *Empty Bee Houſe* may be forthwith ſet Under the Other, if need be, and the Uppermoſt having the *Square-Hole* above Covered with the *Shutter*, ſome other *Cover* may be ſet over it, to keep the *Bees* from the Injuries of the Weather. And if this Separation be made in the Spring, or Summer, the *Bees* will love their New Houſe the better that it hath been uſed before.

XXI. I am inform'd that great *Swarms* of *Locuſts* have Lately appeared in *Wales*. They were firſt ſeen about the 20, of *October* 1693. Scattered about the Fields in *Marthery* Pariſh in *Pembrokeſhire*: Where they were generally taken notice of at firſt, becauſe of the Unſeaſonableneſs of the Time for *Graſhoppers*; but afterwards, for that upon further Examination, they found them Diſtinct from our *Engliſh Graſhoppers*, in Bigneſs, Colour, *&c.* I could not Learn, that any of them have been ſeen *Flying* in that Country: But from *North-Wales* I am informed, that two Vaſt *Swarms* of them had been ſeen in the Air not far from *Dol-gelheu*, a Market Town of *Meriony dh-ſhire*, and I gueſs by the Date of my Friend's Letter, that it was near the ſame time that thoſe others of *Pembrokeſhire* had been taken Notice of in the Fields.

Swarms of Locuſts *in* Wales, *by Mr.* Edw. Floy'd. n. 208. p. 45.

They are of the ſame *Species* with ſome *African Locuſts* in my Cuſtody in the *Muſæum Aſhmol.* for which we are obliged to Mr. *J. Aubrey*, who received them ſome years ſince from *Tangier*. This *Pilgrim-Locuſt* I call *Locuſta Erratica, Alis Ichthyocollæ adinſtar Pellucidis, Reticulatis Maculis conſperſis.* It is in length (from the *Head* to the tips of the *Wings*) 3. *Inches* and $\frac{1}{4}$ of a *Reddiſh* Colour all over, except the *Wings*. As to the *Head* and *Caputium*, it reſembles the *fourth Fig.* of *Mouſett*. The *Eyes* are Prominent and very Large, ſomewhat of the Form and Bigneſs of *Gromwel-Seeds*, of a *Reddiſh* Colour, Elegantly Streaked.

The *Antennæ* are about the Bigneſs of a *Hog's Briſtle*, and Curiouſly *Geniculated*. The *firſt* pair of *Legs* are not quite an *Inch* long; the *Second* ſomewhat above that length; but the 3*d.* 2. *Inches* and $\frac{1}{4}$. Theſe *Hind-Legs* are very Beautiful; for the *Thighs* are *Hexangular*, and Elegantly *Sealed* on the Outſide, with a black Liſt extended Length ways through the midſt of them. The *Shanks* are of a Lively *Red* Colour, adorned on the Hinder part with 2 orders of ſmall Sharp *Prickles*, placed not Oppoſite to each other, but Alternately. The *Wings* are about 3 *Inches* long, reſembling very much thoſe of the Larger *Libellæ*, or *Dragon-flies*, but all over Garniſhed (the Outer *Wings* at leaſt) with *Reticulated Black Spots*.

I ſee not much Reaſon to doubt but that theſe are the very ſame *Species* of *Locuſts*, ſo Famous in *Hiſtory* for their Wandring over, and Depopulating whole Regions.

Plin. Lib. xi. c. 29. Jul. Obſequens *in Lib.* Prodigiorum, *Mouſett.*

Green-Worms *in* Wales; *by Mr.* Edw. Floyd. n. 208. p. 45.

XXII. I find in a *MS. Hiſtory* of *Pembrokeſhire* (written about the Year, 1603. by one Mr. *Geo. Owen*, a Gentleman of that Country, who ſeems to have been a Perſon of conſiderable Accuracy and Veracity) that about the Beginning of *June* 1601. a piece of Ground to the Quantity of 200 *Engliſh Acres*, was Covered ſuddenly (as if the ſame had Fallen in a Shower out of the Air) with a kind of *Caterpillars* or *Green Worms*, having many *Legs*, and Bare without *Hair*. They were found in ſuch Abundance, that a Man treading on the Ground ſhould tread upon 20 or 30. of them: And in this ſort they continued for the ſpace of 3. *Weeks* or more, no Man knowing how they came, nor any of the like ſort were ever ſeen in the Country before nor ſince, and being Opened there was nothing found within them but *Graſs*. The Place was on a Hill in the Pariſh of *Maen-Clochog* above *Hynnon-Dhewi*, or *Phynnon Dhewi*. They were found as it were with one accord to go one way, *viz.* up the Hill, and went Over the Hill a *Quarter* of a *Mile* and more: And as they went they Devoured and Conſumed the *Graſs*, that the Ground appeared *Bare* and *Red* like *Tallow*. And after they had Continued there 3 *Weeks*, there reſorted thither an Infinite Number of *Sea-Maws* and *Crows*, as if all of many Countries had been Summoned thither, who in Few Days Conſumed them all. Alſo *Swine* fed upon theſe *Worms* eagerly, and Waxed very fat.

Swarms of Beetles *in* Ireland; *by Dr.* Tho. Molyneux. n. 234. p. 741.

XXIII. According to the beſt account I can get of the vaſt *Swarms* of *Inſects* which of late Years have much Infeſted this Kingdom of *Ireland*, I find that this *Flying Army* was Firſt taken Notice of in the Year 1688. They appeared on the *South Weſt* Coaſt of the County of *Gallway*, brought thither by a *South-Weſt-Wind*, one of the Common, I might almoſt ſay *Trade winds*, of this Country. From hence they made their way into the more Inland Parts, towards *Heddford*, a place belonging to Sir *George* St. *George*, *Baronet*, about 12 *Miles* North from the Town of *Gallway*. Here and in the adjacent Countrey, Multitudes of them ſhewed themſelves among the Trees and Hedges in the Day time, hanging by the Boughs Thouſands together in *Cluſters*, ſticking to the Back one of another, as in the manner of *Bees* when they *Swarm*. In this Poſture, or Lying ſtill and Covert under the Leaves of the Trees, or Clinging to the Branches, they continued Quiet with little or no Motion during the Heat of the Sun: But towards Evening or Sun ſet, they would all Ariſe, Diſperſe, and Fly about, with a ſtrange *Humming Noiſe*, much like the *Beating* of *Drums* at ſome Diſtance, and in ſuch Vaſt Incredible Numbers, that they darkened the Air for the ſpace of 2 or 3 *Miles* ſquare.

Thoſe that were Travelling on the Roads, or abroad in the Fields, found it very Uneaſy to make their way through them, they would ſo Beat and Knock themſelves againſt their Faces in their Flight, and with ſuch a Force, as to Smart the place where they Hit, and leave a Slight Mark behind them.

A ſhort While after their *Coming*, they had ſo entirely Eat up and Deſtroy'd all the *Leaves* of the *Trees* for ſome *Miles* round about, that the whole Country though it was in the Middle of Summer, was left as Bare and Naked as if it had been in the Depth of Winter: And the Grinding of the Leaves in the Mouths of this Vaſt Multitude altogether, made a *Sound* very much reſembling the *Sawing* of *Timber*.

They came alſo into the *Gardens*, and Deſtroy'd the *Buds*, *Bloſſoms*, and *Leaves* of all the *Fruit-Trees*, that they were left perfectly Naked: nay, many of them that were more Delicate and Tenderer than the reſt, Loſt their *Sap* as well as *Leaves*, and quite *Withered* away, ſo as they never Recovered it again, particularly ſeveral *Trees* in the Curious Plantation of one Mr. *Martin*.

Nay their Multitudes ſpread ſo Exceedingly, that they got into the *Houſes*; where Numbers of them Crawling about, were very Irkſom: and they would often Drop on the Meat as it was Dreſſing in the Kitchin, and frequently fall from the Ceiling of the Rooms into the Diſhes as they ſtood on the Table while they Eat; ſo extreamly Offenſive and Loathſom were they.

Their Numerous *Creeping Spawn*, which they had lodged *Under Ground* next the Upper Sod of the Earth, did yet more Harm in that Cloſe Retirement, than all the *Flying Swarms* of their Parents had done abroad: for this young Deſtructive Brood lying Under-ground fell a Devouring the *Roots* of the *Corn* and *Graſs*, and Eating them up Ruined both the ſupport of *Man* and *Beaſt*. This *Spawn*, when firſt it gave ſign of *Life*, appeared like a Large *Maggot*, and by taking Food and increaſing every Day, became a Bigger *Worm*, till at length it grew as big as a great *White Caterpillar*; from whence according to the uſual *Transformation* Natural to theſe ſmaller Animals, came forth this our *Flying Inſect*.

The Rage of this *Plague* of *Vermin* was fortunately *Checkt* ſeveral Ways; *High Winds*, *Wet* and *Miſling Weather* Deſtroyed many Millions of them in one Days time: Whence I gather, that though we have them in theſe *Northern Moiſt Climates*, they are more Natural, and more peculiarly belonging to *Warm* and *Dry* Countries. Whenever theſe ill Conſtitutions of the Air prevailed, their Bodies were ſo Enfeebled, they would let go their Holds, and Drop to the Ground from the Branches where they ſtuck, and ſo little a fall as this, at that time, was of ſufficient force quite to Diſable, and ſometimes perfectly Kill them. Nay, it was Obſervable, that even when they were moſt Agile and Vigorous, a ſlight Blow or Offence would for ſome time hinder their Motion, if not Deprive them of Life.

During theſe Unfavourable Seaſons of Weather, the *Swine* and *Poultry* of the Countrey Watched under the Trees for their *Falling* and Eat them up in abundance being much Pleaſed with the Food, and Thriving well upon the Diet. Nay I have been aſſured, that the Poorer ſort of the *Native Iriſh* (the Country then labouring under a Scarcity of Proviſion) had a way of *Dreſſing* them, and Lived upon them as *Food*.

In a little time it was found that *Smoak* was very Offenſive to theſe *Flies*: and by *Burning Heath*, *Fern*, and ſuch like *Weeds*, in this or that Corner of their *Gar-*

dens or *Orchards*, which lay moſt convenient for the Wnd to Diſperſe it among the *Trees*, they would ſecure their *Gardens* and Prevent their Incurſions; or if they had Entered, Drive them out again.

But towards the Latter End of the Summer, they conſtantly *Retired* of themſelves; and ſo wholly *Diſappeared*, that in a few Days you ſhould not ſee one of them Left. Some think that they take their *Flight* like *Swallows*, and other *Birds* of *Paſſage*, as they are called, to a more Diſtant Country and *Warmer Climate*. But the True Reaſon of their *Diſappearing* I take to be, that after their *Coition* is over, (for 'tis about this time they are ſeen to *Couple* by faſtening to one another by their *Tails*.) they Retire *Under-Ground*, in order to lay their *Spawn* there, for a Succeeding *Generation*; and likewiſe to Compoſe and Settle themſelves to *Sleep* for the Reſt of the Enſuing Year, as ſeveral other Animals are known to do: for inſtance, *Snails* among *Inſects*; the *Hedg-Hog* among the *Beaſts*; and as *I* have good Reaſon to think, the *Ortygometra*, or *Rail*, among the *Birds*. And what further Confirms in this Opinion, concerning theſe *Inſects*, is, that *I* am certainly informed by ſeveral good Hands, that in the *Spring* time, by accidental Digging and Ploughing up the Ground, great *Hollows* or *Neſts* of them are frequently diſcovered and broken up, where they find whole *Buſhels* together in one Heap, but in ſuch a Quiet Condition they ſeem to have but little *Life* and *Motion*: for they do not *Stir* unleſs you Touch or Diſturb them, and then Move but little and Feebly, as if they had been *Aſleep* and were wakened out of it. Theſe Large *Caverns* to which they *Retire* are often met with under a Firm ſolid Surface of Earth, that has not been Stirred or Ploughed in many Years before: and no manifeſt *Paſſage* can be Diſcovered How they got there.

In the Summer (1695 or 96.) all along the *South-VVeſt* Coaſt of the County of *Gallway*, for ſome *Miles* together, there were found Dead on the ſhoar ſuch Infinite Multitudes of this *Vermine*, and in ſuch Vaſt Heaps, that by a Moderate Eſtimate, one Computed there could not be leſs than 40. or 50. *Horſe-Loads* in all. Theſe (as *I* take it) were a *New Colony*, or a *Supernumerary Swarm* from the ſame place whence the *Firſt* ſtock came to us in 1688. Driven by the *VVind* to Sea from their *Native* Land: which *I* conclude to be *Normandy* or *Brittany* in *France*, it being a Country much Infeſted with this *Inſect*, and that lies very Open and Expoſed to all theſe Parts of *Ireland*; and from whence *England* heretofore has been Peſter'd in the ſame manner with *Swarms* of this *Vermin*. But theſe meeting, by good Fortune, with a Contrary Wind before they could Reach Land, their Progreſs was ſtopt, and Tired with their Voyage, they were all Driven into the *Sea*, which by the Motion of its *VVaves* and *Tides* Caſt their Floating Bodies in Heaps upon the ſhore. And this was a moſt Lucky Accident: for had this *Second* ſupply Arrived, they would have exceedingly Encreaſed the Numbers of thoſe which are already very troubleſome to us.

Mouſes de Inſect. P. 160.

It is Obſerved that they ſeldom keep above a *Year* together in a Place: and they Compute their uſual *Stages*, or *March*, to be about 6 *Miles* in a *Year*. Hitherto they have directed their Progreſs *VVeſterly*, following the Courſe of that *VVind* which Blows moſt Commonly in this Country.

And

And this Laſt Year, 1697 they reached as far as the *Shannon*, and ſome of the ſcatter'd looſe Parties *Croſt* the *River*, and got into the Province of *Leinſter*; but they were met there by a ſtronger Army of *Jackdaws*, which devour'd great Numbers of them. They begin to be Apprehenſive of them in the *Queen's County*: but they hope to divert their Paſſage thither by *Firing* the *Heath* upon the Mountains between them and the *King's County*.

Wherever the Country has been Infeſted with this *Vermin*, by one Conſent, though Erroneouſly, they have given them the Name of *Locuſts*. But the true *Locuſt*, much reſembling in Shape a common *Graſhopper*, though Larger, is quite a Different ſort of *Inſect* from this, which belongs to that *Tribe* call'd by the Naturaliſts Κολεόπτερος, or *Vagini pennis*, the *Scarabeus* or *Beetle-Kind*, that has ſtrong Thick *Caſes* to Defend and Cover their Tender Thin *Wings*, that lie out of Sight and next the Body. And this *Species* is certainly that Particular *Beetle*, called by *Ariſtotle* in his *Hiſt. of Animals* Μελολάνθης, from its Devouring the *Bloſſons* of *Apple-Trees*; and is the *Scarabeus Arboreus* of *Mouſett* and *Charleton*; call'd, by the *Engliſh*, *Dorrs*, or *Hedge Chaffers*. They are much of the Bigneſs of the *Common Black Beetle*, but of a *Brownish Colour*, ſomething near that of *Cinnamon*; they are Thickly beſperſed with a Fine ſhort Downy *Hair*, that ſhews as if they were Powdered all over with a Fine ſort of *Duſt*; The *Caſes* of their *Wings* do not entirely Cover All the *Back*, for their long Picked *Tails*, (where lie the *Organs* for *Generation*) reach a good way beyond them; And the *Indentures* or *Joynts* of each ſide their Belly, appear much *Whiter* than the reſt. They are exactly *Figured* by Dr. *Liſter Scarab. Tab. Mut.*

Hiſt. Animal. Adrovand. *de Inſect.* l. 4.

I am fully Convinced that this *Inſect* is that ſelf ſame to which the *Septuagint*, and the *Vulgar Latin Tranſlation* retaining the *Greek* word, give the *Name* Βρῦχος, or *Bruchus*, Derived from Βρύχω *Frendo* vel *Strideo*, Intimating the Remarkable *Noiſe* it makes both in its *Eating* and *Flying*. It is often mentioned in *Holy Scripture*; *Lev.* 11. 22. *Joel* 1. 4. and 2. 25. *Nah.* 3. 16, 17. But *I* find our *Engliſh Verſion* almoſt conſtantly Tranſlates this word Βρῦχος, though Improperly, as *I* think, *Cancer VVorm*; ſince this Denotes only a *Reptile*, or *Creeping Vermin*, whereas that Word imports certainly a *Flying-Inſect*; For the Βρῦχος *Nah.* 3. 16, 17. is expreſly ſaid to *Fly*, and have *VVings*: and its Nature and Properties are moſt truly and particularly Deſcribed in theſe Words, *It ſpoileth and flieth away, they Camp in Hedges in the Day, and when the Sun ariſeth they flee away, and their Place is not known where they are*; That is, they then *Retire* again to the *Hedges* and *Trees* where they lie Quiet and Concealed till the Sun *ſets* again.

I find indeed the Word Βρῦχος, better Tranſlated, *Locuſt* or *Beetle*, in that Odd Clauſe of the *Jewiſh Law*, *Lev.* 11. 22. Where *Moſes* permits the *Iſraelites* to *Eat* the *Locuſt* after his Kind, and the *Bald-Locuſt* after his kind, and the *Beetle* after his kind, and the *Graſhopper* after his kind. I muſt confeſs, it long Seemed to me very *Unaccountable* that here among the *Pure wholſome Creatures*, Proper for Humane Nouriſhment, *Beetles* and thoſe other *Naſty*, *Dry*, and *Unpromiſing Vermin*, ſhould be thought Fit to be reckoned up as *Clean* and *Proper* for the *Food* of a *Man*: But ſince *I* have had ſome little Experience of what has happened

pened among our ſelves, *I* cannot but Admire the Sagacious Prudence of that *Divine-Law-Giver*. 'Tis certain *Paleſtine*, *Arabia*, *Ægypt*, and the other Neighbouring Countries about them, were all extreamly Subject to be Infeſted with theſe ſorts of Pernicious *Vermin*: And therefore *Moſes*, foreſeeing the great *Dearth* and *Scarcity* that they might one Day bring upon his People, gives them here a *Permiſſive Precept*, or a ſort of *Hint* what they ſhould do, when the *Corn*, *Graſs*, *Olive-Trees*, *Fruit-Trees*, *Vines*, and other *Proviſions* were deſtroyed by the *Locuſt* and Βρῦχοι, or *Beetles*, ſwarming in the Land; why then, for want of other *Nouriſhment*, and rather than *Starve*, he tells them, they might Eat and Live upon the Filthy Deſtroyers themſelves, and yet be *Clean*. And thus we ſee the *Native Iriſh* were Authors of a Practical Commentary on this Part of the *Levitical Law*, and by Matter of Fact have Explained what was the True ſenſe and meaning of this otherwiſe ſo Dark and Abſtruſe a Text. It is alſo more than probable that this ſame *Deſtructive Beetle* we are ſpeaking of, was that very Kind of *Scarabeus*, the Idolatrous *Ægyptians* of old had in ſuch High *veneration*, as to pay Divine Worſhip to it, and ſo frequently Grave its *Image* upon their *Agulios* and *Obelisks*, as we ſee at this Day. For nothing can be Suppoſed more Natural, than to imagine a Nation addicted to *Polytheiſm*, as the *Ægyptians* were, in a Country frequently ſuffering great Miſchief and Scarcity from *Swarms* of *Devouring Inſects*, ſhould from a Strong Senſe and Fear of *Evil to come*, (the Common Principle of *Superſtition* and *Idolatry*) give *Sacred Worſhip* to the Viſible Authors of theſe their Sufferings, in hopes to render them more *Propitious* for the Future. Thus 'tis Allowed of all Hands, that the ſame People *Adored* as *Gods*, the *Ravenous Crocodiles* of their River *Nile*; and thus the *Romans*, though more Polite and Civilized in their *Idolatry*, *Febrem ad minus Nocendum venerabantur*, *eamque variis* Templis *Extructis colebant*; ſays *Valerius* Maximus. L. 2. c. 5.

The Vaſa Teſticularia *of a* Beetle; *by Dr.* Swammerdam, n. 94. p. 6041, 6042.

XXIV. *Scarabæi Naſi-cornis* Genitalia, quoad *vaſa Teſticularia*, adamuſſim cum *Humanis* convenire *Teſticulis*, atque ex Unico tantum Funiculo, Longo, Cavo, innumerabiliter Flexo, atque (quod nondum in *Homine* mihi viſum,) Principio ſeu Apice Cæco, conſtare, non ſine aliquo Stupore Luſtravi.

Non alienum itaq; fore duxi eorum Delineationem Cl. Tuæ tranſmittere; in qua imprimis exhibentur non modo *Teſticuli* ex Unico Funiculo *Duos pedes* & *ſex pollices* Longo; ſed & *Vaſa Deferentia*, ſemen Copioſum ac Album, quando Læduntur, ſtillantia; nec non *Veſiculæ* ſeu potius *Glandulæ Seminales ſex*, admodum Elegantes; *Glandularumq; Seminalium* Ductus protenſi, materiam ſeminalem Sub-flavam (ut in *Hominibus* ac *Brutis* quoque obſervantur) continentes.

A Flying Hart; *by* ..... n. 127. p. 652.

XXV. *I* here ſend you the *Figure* of a Large *Flying-Beetle*, of a Dark ſhining Brown, with a Huge pair of *Horns*, (in proportion to the Body,) ſhaped and Branched exactly like a *Stagg's* or *Hart's*, from which laſt it hath its Denomination; our People in *Virginia* and *New England* calling it a *Flying Hart*. It flies High and Swift, and reſts moſt commonly upon Branches

or Trunks of ſtanding Trees, where, as ſoon as it has taken up its Station; it begins with a ſhrill Chirping Voice, which it raiſes by little and little till it makes the whole Woods Ring again, and then leſſens gradually till it ceaſeth with a kind of ſilent Murmur, as if the little Creature had Rung it ſelf aſleep; then it flies to ſome other place, and begins the ſame Tune again.

The *Horns* are of a ſhining Hard Subſtance, and the Tips of them touch the ſame Plane with the *Belly*.

A Musk-Scented Inſect, *feeding upon* Henbain; *by* Dr. M. Liſter. n. 72. p. 2176.

XXVI There is a *Cimex* of the largeſt Size, of a *Red* Colour, ſpotted *Black*, and which is to be found very frequently, and Plentifully, at leaſt in its Seaſon, upon *Henbain*: I therefore in my private Notes, intitle it *Cimex Ruber, Maculis Nigris Diſtinctus, ſuper Folia Hyoſcyami frequens.* This *Inſect* in all Probability doth *Feed* upon this *Plant* (on which only we have yet Obſerved it) if not upon the *Leaves*, by Striking its *Trunk* (the Note of *Diſtinction* of this Kind of *Inſect* from the reſt of the *Beetle* kinds) into them, and *Sucking* thence much of its *Subſtance*, like as other ſorts of *Cimices*, will upon the Body of *Man*, *&c*; yet upon the *Unctuous* and *Greaſy Matter*, with which the *Leaves* ſeem, to the Touch, to Abound. It is farther Obſervable, that that *Horrid* and *Strong Smell*, with which the *Leaves* of this *Plant* do affect our *Noſtrils*, is very much Qualified in this *Inſect*, and in ſome meaſure *Aromatick* and Agreeable, and therefore we may Expect, that that *Dreadful Narcoſis*, ſo Eminent in this *Plant*, may likewiſe be Uſefully Tempered in this *Inſect*.

About the Latter End of *May*, and ſooner, you may find Adhering to the Upper ſide of the *Leaves* of this *Plant*, certain Oblong Orange Coloured *Eggs*, which are the *Eggs* of this *Inſect*. Theſe *Eggs* yet in the *Belly* of the *Females* are *White*, and are ſo ſometime after they are *laid*: But as the *Young Ones* grow near the Time of their being *Hatched*, they acquire a *Deeper Colour*, and are *Hatched Cimices*, and not in the Diſguiſe of *Worms*. If the *Riper Eggs* be Cruſhed upon White Pepper, they *Stain* it of Themſelves (without any Addition of *Salt*) with as *Lively* a *Vermilion*, or *Coleur de Feu*, as any thing I know in Nature; *Cochineel* ſcarce excepted, when aſſiſted with *Oyl* of *Vitriol*.

Other Musk-Scented Inſects, *by Mr.* J. Ray. n. 74. p. 2229.

XXVII. 1. *I* have ſeen Two ſorts of *Inſects* which Smell of *Muſk*. The *One* is like the common *Capricornus*, or *Goat Chafer*, which is mentioned by all Naturaliſts that write of *Inſects*, and which Smells ſo ſtrong of that *Perfume*, that you may *Scent* it at a good Diſtance, as it *flies* by, or ſits near you. The *Other* is a ſmall ſort of *Bee*, which in the *South* and *Eaſt* parts of *England* is frequently to be Met withal in *Gardens* among *Flowers* in the *Spring-time*.

By Dr. M. Liſter. n. 76, p. 2281.

2. The two *Inſects* mentioned by Mr. *Ray* Smell of *Muſk* to an High Degree. The ſmall *Bees* are very frequent in the *Wooles* in *Lincolnſhire*, and about the latter End of *April*, are to be found in *Paſtures* and *Meadows*, upon the Early Blown *Flowers* of a ſort of *Ranunculus*; but it is ſomething Improper

per to say *Bees feed* on *Flowers*: And likewise the same *Bees* are no less Frequent on the *Flowers* of *Dens Leonis*, *&c.*

The *Sweet Beetle*, is a very large *Insect*, and well known about *Cambridge*. All the Trials I have made to preserve them with their *Smell*, have proved ineffectual: For both sorts of these *Insects*, will of themselves, in a very few Weeks become almost Quite *Sentless*.

To these I shall add Another *Sweet smelling Insect*, which is a *Hexapode Worm* feeding on *Gallium Luteum*.

n. 77. p. 3003. Mr. *Willoughby* informs me, that he hath found the *Goat-Chaffer*, or *Sweet Beetle*, out of Season as to that *Smell*. Perhaps it might be at the time of the *Coit*: for as much as at that Time, when *I* took them *Highly Perfumed*, I had observed the *Female* full of *Eggs*.

The Cochineel Fly *by* ..... n. 40. p. 796.

XXVIII. 1. It is generally Believed, that the *Cochineel* Comes out of a *Fruit* called the *Prickle Pear*, Bearing a Leaf of a Slimy Nature, and a Fruit *Blood Red*, and full of *Seeds*, which give a *Dye* almost like to *Brasiletto-Wood*, that will *Perish* in a few Days by the *Fire*: But the *Insect* Ingendred of this *Fruit* or *Leaves*, gives a *Permanent Tincture*, as is generally known.

There grows a *Berry* (by report) both in *Bermudas* and *New England*, Call'd the *Summer Island-Reedweed*, which *Berry* is as *Red* as the *Prickle Pear*, giving much the like *Tincture*; out of which *Berry* come out first *Worms*, which afterward turn into *Flies*, somewhat bigger than the *Cochineel-Flye*, feeding on the same *Berry*: In which we Read there hath been found a *Colour*, No whit Inferior to that of the *Cochineel Flye*; and as to *Medicinal Vertue*, much Exceeding it.

To Generate Other Flyes *for Like uses.*

'Tis also probable that *Insects* may be engendred, out of Other *Vegetables*, either *Herbs*, *Berries*, and other *Fruit*, and *Woods*, giving the *Tincture* of its *Original*, which will hold in *Grain*.

To *Breed Insects* out of *Herbs*; Dry them, (for they yield the Best *Tincture*; Otherwise stamp them, and let them Dry, till they will suffer no more *Juice* to Run from them, (this in the *Sun* or in a *Proportionable Heat*:) or if *Dryed*, infuse them with *Water*, in a *Heat* for 24 *Hours*; then *Vapour* away the *Water*, till the *Dissolution* be as Thick as a *Syrup* (but for this use Strain them not from their *Fæces*;) take this *Masse* and put it into an *Earthen* or *Wooden Vessel* Covered with some *Straw*, or something else of that *Nature*, that it Lye not too Close, and so Proportion the Quantity to the *Vessel* that the *Air* may come about and into the *Masse* (yet not too Much.) Then set this Vessel in a *Ditch* or *Pit* made in the *Earth*, in a *Shady Place*, and put about it some *wet Leaves*, or some such *Putrifying Rubbish*, and over it a *Board*, and on that some *Straw*, or the Like; and it will produce first a *Shelly Husky Worm*, and then a *Fly* of the *Tincture* of the *Concrete*, but *Durable* and somewhat more *Advanced*.

And as for *Berries*, *Stamp* and *Boil* them, Evaporating them to the Consistence of a *Rob*, and then use them as the Former.

Lastly

Laſtly, for *Woods*, *Infuſe* them in *Water* being firſt *Pulveriz'd*, and *Boil* out their *Tincture*, and then Evaporate alſo the *Water* to ſuch a *Thickneſs*, as the other, and Handle them in the Like Way.

The *Flies* will play about the ſide of the *Veſſel*, and the Surface of the *Matter*; which taken, are to be Killed in a Warm Pan or *Stove*, and ſo *Dryed* and *Kept*.

2. An Old *Spaniard* at *Jamaica*, who lived many Years in that Part of the *Weſt-Indies*, where great Quantities of *Cochineel* is made, affirms that the *Inſect* whereof it is made is the very ſame which we call the *Lady-Bird*, or *Cow-Lady*. It Appears, he ſays, at firſt, 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*, or ſmall *Grub*. Theſe *Grubs* in Proceſs of time become *Flies*, 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 *Cloaths* under the *Plants*) whereby all the *Inſects* being *Smother'd* and *Kill'd*, by *ſhaking* the *Plants*, will tumble down upon the *Cloaths*; thus they are Gathered in great Quantities, 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 rubb'd gently betwixt ones Hands, will Crumble into *Grains*, and the *Wings* ſeperate 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.

By-- n. 193. p. 502.

The *Tree* or *Shrub*, on which they *Breed*, Call'd the *Prickle-Pear*, or *Indian-Fig*, is 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. 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 *Sanguine Colour*, Whereon, or on the *Bloſſoms*, ſome ſay the *Inſects* do *Feed*; which haply may be the Occaſion of that *Rich Tincture* within their *Bowels*.

3. The *Figures* 191, 192, 193. Repreſent the *Cochineel Fly*, as ſeen on its *Belly* by the help of the *Microſcope*; and by the *Naked Eye*; and as ſeen on its *Back* through a *Microſcope*.

Figures of the Cochineel-Fly; *by Dr.* Tyſon. n, 176. p. 1202.

XXIX. In *Auguſt* 1695. I traced a *Death Watch* by the Noiſe, and found it in a *Copper*-Body; it reſembled Dry Dirt in Colour. I found another, ſome Years before on a *Rotten Poſt*. This ſmall *Beetle* had another *Anſwered* it, in the ſame Room; and after a *Minutes* diſtinct *Beating*, would forbear for the other to *Anſwer*.

The Death-Watch; *by Mr.* Benj. Allen. n. 245. p. 376.

The part it *Beats* with is the Extream Edge of the Face; which *I* may call the *upper Lip*, the *Mouth* being protected by this *Bony* Part, and lying underneath out of View.

It was $\frac{5}{16}$ of an *Inch* long; the Colour a *Dark Brown*, with *Spots*, something lighter, irregularly Placed, which would not rub off readily. They seemed to lie rather athwart the *Back*, and Direct on the *Head*; as in the small *Figure* 194, which is much of the same size with it, and the *Maculæ* are designed for the *Grayish Spotts*. Under the *Vaginæ*, are Pellucid *Wings*, and the Body is of a Pullous Colour. The *Head* appeared Large, by reason of a large *Cap* or *Helmet*, which Cover'd it round, only at the Ear turned up a little; from under this appeared the *Head*, which was Flat and Thin; the *Eyes*, forwards: the Lip Hard and Shining; the *Ears* of the *Helmet* Greyish. Two *Antennæ* proceeded from under the *Eyes*, which, by their Meeting on the Breast, I conjectured to assist their *Feeding*, and to be rather *Probosces*; and the *Helmet* to be *Turned up* for Hearing sake; and the *Belly* Plicated as other *Beetles*.

Fig. 194.

The other *Beetle* that *Answered* it was Less, and the *Marks* on the *Back* not so distinct.

By the *Microscope I* discovered the *Marks* to be thick set Spots of *Hair*, of a *Castor Colour*; the *Head* all *Hairy*, and the *Face* Thick of *Curled Hair*. On the *Belly* was a little but thin set *Hair*. The *Eyes* appeared Large, as in the *Figure*, the superficies consisting of many small *Squares* furrowed deep between, and these lay in Lines Transversly descending towards the *Nose*. These *Eyes* were not *Moveable* but Contiguous to the *Face*, without any Cavity to Receive them; and they were very *Opake*. The *Antennæ* proceeded from under the *Eyes*; the First large *Joint* having a *Cavity*, out of which it proceeds at the sides of the *Lip*. Between the *Eyes* the *Face* Rises in a little Ridge, which is the *Nose*, and is signified by the *Light* part of the *Face*. And just below it, the *Nostrils* are Covered by strait *Pendulous Hair*, proceeding from the lower Ridge of the *Nose*. Under this *Hair* the Cavity is Dark. Below the *Nose* the *Lip-shades* shew the more depress Places. Under this *Lip* are Visible 4 *Forcipes*, 2 of each side, to lay hold on its *Food*.

Fig. 195.

The Musca Lupus *in* Virginia; *by Mr.* J. Banister. n. 198. p. 670.

XXX. 1. *I* have observed, that that sort of *Flies* which *Mouffett* calls *Musca Lupus*, and some others, (as the *Tabani*, *Asili*, *&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 *Æquilibrio*, as the *Dancer on 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.

A Note; by---- ib. p. 691.

2. Dr. *Hook* has Observed these *Pendulums*, and Described them in his *Micrographia Obs.* 38. *p.* 273.

XXXI. I

XXXI. I here ſend you a *Viviparous Fly*: which is one, if not the very Biggeſt, of the *Harmleſs Tribe* that *I* have met with in *England*. *I* call them *Harmleſs*, becauſe that they are without that *Hard Tongue*, or *Sting*, in the *Mouth*, with which the *Æſtrum kind*, or *Gad-Flies*, trouble and Offend both Man and Beaſts. This *Fly* is ſtriped upon the Shoulders *Grey* and *Black*, and as it were Checkered on the *Tail* with the ſame two *Colours*. The *Female* may be known by a *Redneſs* on the very Point of the *Tail*. The very latter End of *May* 1666 I opened ſeveral of them, and found two Bags of *Live* White *Worms*, of a Long and Round Shape, with Black Heads; they *moved* both in my Hand, and in the Unopened Veſicles, backwards and forwards; as being all diſpoſed in the *Cells* Length-ways the Body of the *Female*, like a Sheaf. Some ſuch thing is Hinted by *Aldrovandus*: And *I* ſuſpect all of this *Tribe* to be in ſome Meaſure *Viviparous*.

A Viviparous Fly; *by Dr. M.* Liſter. n. 72. p. 2170. n. 160. p. 595.

Lib. 1. *de Inſect.*

XXXII. 1. In a Great and very Ancient Wall of *Free-ſtone* in the *Benedictins* Abbey at *Caen* in *Normandy*, facing Southward, there are to be found Many *Stones* ſo *Eaten* by *Worms*, that One may run his Hand into moſt of the Cavities which are variouſly Faſhioned, like the *Stones* which I have ſeen Wrought with ſo much Art in the *Louvre*: In theſe *Cavities* there is Abundance of *Live-Worms*, their *Excrement*, and of that *Stone Duſt* they *Eat*. I have taken ſome of theſe *Living Worms*, which I found in the *Eaten-ſtone*, and Put them into a Box with ſeveral Bits of the *Stone*; leaving them there together for the ſpace of Eight *Days*; and then Opening the Box, the *Stone* ſeemed to me *Eaten* ſo ſenſibly, that *I* could no Longer Doubt of it.

A kind of Worms *Eating out* Stones; *by M.* de la Voye. n. 18. p. 321.

Theſe *Worms* are Encloſed in a *Shell*, which is *Grayiſh* and of the Bigneſs of a *Barly-Corn*, Sharper at one End than the Other. By the means of an Excellent *Microſcope*, I have Obſerved, that 'tis all Overſpread with *Little Stones*, and *Little Greeniſh Eggs*; and that there is, at the Sharpeſt End a little *Hole*, by which theſe *Creatures* Caſt out their *Excrement*, and at the Other End, a ſomewhat Bigger *Hole* through which they put out their *Heads*, and faſten themſelves to the *Stones* they *Gnaw*. They are not ſo ſhut Up, but that ſometimes they come out, and walk Abroad. They are all *Black*, about two *Lines* of an *Inch* Long, and 3 *quarters* of a *Line Large*. Their *Body* is Diſtinguiſht into ſeveral *Plyes*, and near their *Head* they have 3 *Feet* on each Side, which have but two *Joints*, reſembling Thoſe of a *Louſe*. When they *Move*, their *Body* is Commonly Upwards, with their *Mouth* againſt the *Stone*. They have a Big *Head*, ſomewhat Flat, and even of the Colour of a *Tortoiſe-ſhell*, *Brownish*, with ſome ſmall *White-Hair*; Their *Mouth* is alſo Big, where may be ſeen 4 kinds of *Jaw Bones*, lying Croſswiſe, which they *Move* continually, Opening and Shutting them like a Pair of *Compaſſes* with 4. *Branches*. The *Jaws* on both ſides of the *Mouth* are all *Black*; the *Nether-Jaw* hath a *Point* like the *Sting* of a *Bee*, but Uniform. They draw *Threads* out of their *Mouth* with their *Fore-feet*, Uſing that *Point* to Range them, and to Form their *Shells* of them. They have 10 *Eyes*, very Black and Round, which appear to be Bigger than a *Pin*'s *Head*. There are 5 of them on each ſide of the *Head*, ſtanding as in the Figure *Fig.* 196.

Another sort Eating Mortar. *ib. p.* 322.

2. I have also found that *Mortar* is *Eaten* by an infinite Number of *Small Creatures*, of the Bigness of *Cheese-Mites*. These have but 2 *Eyes*, and are *Blackish*. They have 4 *Feet* on each side pretty Long. The *Point* of their *Muzzle* is very Sharp, as that of a *Spider*. In *Old-Mortar* betwixt *Stones*, that is found in *Walls* made with *Rubbish*, there is a great store of them, together with great Plenty of their little *Eggs*. You may observe more of them in *Walls* exposed to the *South*, than in Others; and that the *Worms* that *Eat* the *Stone*, Live longer than those that *Eat* the *Mortar*; which keep not above 8 *Days* Alive. Without a very good *Microscope* and a Great Deal of *Attention*, 'tis Difficult to see them Well.

I have seen Other very *Old Walls* altogether *Eaten*, as those of the *Temple* at *Paris*, where I could find *No Worms*: But the Cavities were full of *Shells* of Various kinds, Diversly Figured, and Turn'd; all which *I* believe to be *little Animals Petrify'd*.

A Scolopendra; *by Mr.* J. Ray. n. 74. p. 2221.

XXXIII. The *Scolopendra* which is by *Bruerus* ascribed to *Muffett*, in the later part of his Chapter *de Julis*, p. 202. *I* saw in the Cloysters of *Trinity-Colledge* in *Cambridge*, 12 or 13 Years ago.

A Swarm of Flying Grashoppers *in* Languedoc; *by* ..... *Communicated by M.* Justel. n. 182. p. 147.

XXXIV. These *Insects* appear to Sight, in Nothing Different from the *Common* sort of *Grashoppers*: But they take their *Flight* like *Birds*, which is particular to them. They are much about an *Inch* in Length, of a *Grey* Colour. In the *Year* 1685 the Earth in some places about *Aramont* in *Languedoc*, near *Avignon*, was Covered 4 *Fingers* thick with them, in the Morning before the *Heat* of the *Sun* was Considerable: But as soon as it began to be *Hot*, they *took Wing* and Fell upon the *Corn*, Eating up both *Leaf* and *Ear*, and that with such *Expedition*, by reason of their great Number, that in 3 *Hours* they Devour'd the *Corn* of a Whole *Field*; after which they again *Took Wing*, and their *Swarms* were so *Thick* that they Covered the *Sun* like a *Cloud*, and were Whole Hours in Passing. They Flew Against the *Wind*, and Went over the *Castle* which is very High, and Seized upon another *Field* of *Corn*, which they Destroyed like the Former. After having *Eaten* up the *Corn*, they fell upon the *Vines*, the *Pulse*, the *Willows*, and Even the *Hemp*, notwithstanding its Great *Bitterness*. Afterwards, about the End of *August*, they Ceased *Flying*, and *Copulated*, and the *Female* Stuck her *Tail* into the Hard Earth, where she Cast a *Foam*, and made therewith, in the *Ground*, a *Hole* as Big as that of a *Goose-Quill*, and about an *Inch* Long, wherein she *Laid* her *Eggs*; which are Much of the Size of *Millet-Seed*. There would be sometimes 50 of these *Eggs* in a *Hole*, which are so Covered Over with the same *Earth*, that the *Water* does not Get in. After this, all these *Insects Died*, and *Stunck* very Much. They Began to *Hatch* in *April*, 1686. In *March*, we thought upon *Destroying* their *Eggs*, which lye not above a Fingers Breadth in the *Earth*: and we took of them 180 *Quintals*, being 9 *Tuns*. Since their *Hatching*, they have taken above 15 *Tuns* of the *Young Grashoppers*; which are not yet Bigger than *Flyes*! And there are yet a Multitude

Vid. Sup. §. XXI. XXII. *&* §. XXIII.

titude that have Escaped us. If this Care had not been taken, there would have been enough of them to have *Eaten up* the *Corn* of the Whole Province.

XXXV. *Fleas* bring forth *Eggs*, (or a sort of *Nitts*;) from these *Eggs* are hatched *Worms*; these *Worms* make to themselves *Bags* like *Silk Worms*; and from out of these *Bags*, come *Fleas*. The *Eggs* they Deposite on *Dogs*, *Cats*, *Men*, or other *Animals*, infested with them; or in the Places where they Sleep, which, for being Round and smooth, Slip Ordinarily straight to the Ground, or fix themselves in the *Plyes*, or other Inequalities, of the *Coverlets* and *Cloaths*. From these are brought forth *White Worms*, of a Shining *Pearl Colour*, which feed themselves on the *Bran like Substance* which sticks in the *Combs* when *Puppies* are Combed to take out the *Fleas*; or with a certain *Downy Substance*, that is found in the *Plyes* of *Linnen Drawers*; or other such like *Excrement*. They come in a Fortnight, to the Bigness of Fig. 197 and are very Lively and Active and if they have any *Fear*, or if they be *Touched*, they suddenly Roul themselves up, and make as it were a *Ball*. A little after, they come to *Creep*, after the manner of the *Silk Worms* that have no *Legs*, with a Brisk and very swift Motion. When they are come to their usual Bigness, they Hide themselves, the most they can, and Bringing out of their Mouths the *Silk*, they make round themselves a small *Bag*; *white* within as *Paper*, but without always *Dirty*, and *Foul'd* with *Dust*. The *Bags* are to the *Naked Eye* of the Bigness of Fig. 198. without *Magnifying*. In other two *Weeks*, in the *Summer-time*, the *Flea* is perfectly formed: without that the *Worm* Quits its *Exuviæ* in its *Bag*; as do the *Silk Worms*, and as do all *Caterpillars*, which Leave in the same their *Exuviæ*. The *Flea*, so long as it is inclosed in the *Bag*, is *Milk-White*, although it has its *Legs*, but two Days before it comes out, it becomes *Coloured*, grows *Hard*, and Gets *Strength* so that coming speedily out, it straight *Leaps* away.

The Generation of Fleas; by S. D'Iacincto Cestone. n. 249. p. 42.

Fig. 197.

Fig. 198.

Fig. 199. Represents the *Eggs*; Fig, 200. The *Worm*; Fig. 201. The *Bag*; Fig. 202. The *Flea*: But all *Magnify'd* by the *Microscope*.

XXXVI. There have Occurred to my Observation but 3 sorts of *Ants*, Commonly without *Wings*; *viz.* Very *Black*, *Dark-Brown* and *Philemort*. Each Kind inhabit by themselves in their several *Banks*, two sorts seldom or never being found together; and if Either of the Other two sorts be put into the *Black Ants-Bank*, 'tis Worth observing what Enmity there is betwixt these little Creatures, and with what Violence the *Black Ones* will Seize on the *Red*, Never Leaving to *Pinch* them on the *Head* with their *Forceps*, or *Claws*, till they have *Killed* them upon the Place: which done, they will carry them *Dead* out of the *Field*, from their *Bank*. But if you put *Black Ants* into a *Bank* of the *Red*, the *Black* seem to be so Sensible of the Strangeness of the Place they are in, that there they will not Meddle with the *Red*: But as if they were Frighted, and Concerned for nothing but self-Preservation, Run away.

The Emmet or Ant; by Sir Edmund King, n. 23. p. 425.

Upon Opening of these *Banks*, I Observe first, a *White Substance*, which to the Bare Eye looks like the Scattering of fine White *Sugar* or *Salt*, but very Soft and Tender. And if you take a Bit of it, as Big perhaps, as a *Mustard-Seed*,

and

and lay it on the *Object Plate* of a Good *Microſcope*, you may by Opening it with the Point of a *Needle* Diſcern many Pure, White, and Clear Appearances in Diſtinct *Membranes* all Figured like the Leſſer ſort of *Birds-Eggs*, and as Clear as a *Fiſh's Bladder*. This *Subſtance*, as it hath been juſt now Deſcribed, *I* find in the *Ants* themſelves; which *I* take to be the True *Ants-Eggs*; It being Obvious to the Obſervation, that Wherever this is Uncovered, they make it their Buſineſs to Carry it away in their *Mouths* to ſecure it, and will, after you have Scattered it, Lay it on a Heap Again, with what Speed they can. *I* Obſerve they lye in Multitudes upon this (if *I* may ſo call it) *Spawn* of Theirs: And after a Little Time, every one of theſe ſmall Adherances is Turned into a little *Vermicle*, as ſmall as a *Mite*, hardly Diſcerned to *Stir*. But after a Few Days More, you may Perceive a *Feeble Motion* of *Flexion* and *Extenſion*, and they begin to look *Yellowiſh* and *Hairy*, Shaped very like a *Small Maggot*: And ſo, Keeping that Shape, grow almoſt as Big as an *Ant*, and have Every One a *Black-Spot* on them. Then, they get a *Film* over them, *Whitiſh* and of an *Oval-Shape*: for which Reaſon, *I* ſuppoſe, they are Commonly called *Ants-Eggs*; which yet (to ſpeak Properly) they are Not.

I have Opened many of theſe, Vulgarly call'd *Ants-Eggs*, *I* mean the *leſſer Sort*, (for there are ſome as Big as a *Wheat-Corn*, others leſs than a *Rye-Corn*) and in ſome *I* find only a *Maggot*, to appearance juſt as was Deſcribed Before. In others, *I* find a *Maggot*, beginning to put on the Shape of an *Ant* about the *Head*, with two little *Yellowiſh Specks*, where the *Eyes* are Deſigned; in others a further Progreſs, and Furniſht with every thing to Compleat the *Shape* of an *Ant*: But wholly *Tranſparent*, the *Eyes* only excepted, which are then, as *Black* as *Black Bugles*. But when they Newly put On this *Shape*, *I* could never Diſcern the Leaſt *Motion*, in any one part of the little Creature; whereof the Reaſon may perhaps be, the *Weakneſs* of their *Fibres*: for after a little more time, when they begin to be *Browniſh*, they have Strength to Stir all their Parts. At laſt, *I* met with ſome of theſe Reputed *Eggs*, which being carefully Opened by me, *I* took out of ſeveral of them every way Perfect and Compleat *Ants*: Which did immediately Creep about, among the Reſt, no way Differing from many Other *Ants*, but by a more *Feeble Motion* of their *Limbs*. And this *I* took for a Clear Demonſtration of what *I* Deſigned, which was to know, that the *Film* does Only Cover the *Maggot*, while ſhe is *Transforming* into an *Ant*, and fit to Shift for Herſelf. The *Black-Speck*, that is at One End of Every ſuch Reputed *Ants-Egg*, *I* ſuppoſe to be Caſt out of the *Maggot*, in her *Tranſformation*: Since after it puts on the Shape of an *Ant*, the *Speck* is quite Gone, and the Whole Body of the *Ant* pure *Clear*; ſince alſo this *Speck* at the End of the ſaid *Egg*, lies always Cloſe to the *Anus* of the *Included Ant*.

It is Obſervable how upon a Breaking up of their *Banks*, they make it their Buſineſs immediately to Carry their *Young* out of Sight again; laying the *Several Sorts* of them in *Several Places* and *Heaps*: the which if you *Mingle* again, or *Scatter*, you ſhall, laying but ſome Bits of *Slate*, or the like, in any place they may Come to and Get Under, after a Few Hours ſee all the *Vermicles*, and

Vulgarly

Vulgarly call'd *Eggs*, Laid in their ſeveral and diſtinct Parcels under ſuch Pieces of *Slate*, *&c.* Provided the place be not ſo *Cold* as to *Chill* their *Limbs*; which if it be, by being brought to the *Fire*, they will ſoon Recover their Strength, and fall to their Buſineſs again, of Securing their *Little Ones*. They know all the ſorts of their *Young* ſo Well, that you cannot Deceive them though you may with *Fine Sugar*, *Salt*, or the *Crums* of very *White Stale Bread*, ſcattered in the *Mould*, where their *Firſt True Eggs* are (as I call them) be Miſtaken your ſelf, yet the *Ants* will Not, nor touch a Bit, of what is not their Own *Offspring*.

I have Obſerved in *Summer*, that in the Morning they bring up thoſe of their *Young* (that are Vulgarly call'd *Ants-Eggs*) towards the *Top* of the *Bank*: ſo that you may, from 10 in the *Morning* until 5 or 6 *Afternoon*, find them Near the *Top*; eſpecially about *One*, *Two*, or *Three* of the Clock, and Later, if the *Weather* be *Hot*; when for the moſt part they are found on the *South Side* of the *Bank*. But towards Seven or Eight at *Night*, if it be *Cool* or likely to *Rain*, you may Dig a *Foot* Deep before you can find them.

XXXVII. Dr. *Hulſe* in *Aug.* 1670. ſent me theſe Obſervations; Bare an "*Ant-Hill* with a *Stick*, and then caſt *Cichory Flowers* upon it, and you ſhall "ſee the *Ants* Creep very thick Over them: Now as they Creep, they let fall "a *Drop* of *Liquor* from them, and where That Chanceth to Light, there you "ſhall have in a Moment a Large *Red Stain*. Sometimes they will be a pret-"ty While before they *Diſcolour* them, and at other times, they will do it ſud-"denly. At the firſt *I* gueſſed that being Vext, by ſtirring their *Hill*, they "might thruſt their *Stings* into the *Flowers*, and thorow them Convey that "*Sharp Liquor*: But by Bruiſing them, and Rubbing the *Expreſſed Juice* againſt "the *Flowers*, *I* find they will be equally *Stain'd*. 'Tis a thing well Known, "that *Ants*, if they Get into Peoples Cloaths, and ſo to their *Skin*, will "cauſe a *Smart* and *Tingling*, as if they were *Nettled*; which *I* Conceive is "done by Letting fall the Forementioned *Corroſive Liquor*, rather than by "*Stinging*.

"To what ſort of *Liquor* to refer this *Juice*, *I* know not. *I* Dropt *Spirit* "of *Salt*, and *Oyl* of *Sulphur* upon the *Flowers*: but they did not Cauſe them "to *Change Colour*. *I* likewiſe put *Salt* of *Tartar* Upon them, and Dropt "thereon a little *Spirit* of *Salt*, which Cauſed a ſufficient *Fermentation*: but "Prevailed not, to *Change* the *colour* of the *Flowers* in the Leaſt.

"This Obſervation holds True not Only in *Cichory Flowers*, but al-"ſo *Lark-Spur*, *Borage*, and, *I* ſuppoſe, All Others of a *Blew Co-*"*lour*.

Some years ſince Mr. *Sam. Fiſher* of *Sheffield*, made me acquainted with theſe Experiments, *viz.* If with a ſtaff, or other Inſtrument you ſtir an *Heap* of "*Ants*, (eſpecially *Horſe-Ants*,) ſo as to Anger them, they will let Fall there-"on, a *Liquor*, which if you preſently *Smell* to, will Twinge the *Noſe* like "Newly Diſtilled *Spirit* of *Vitriol*.

The Acid-Juice *of* Piſmires; *by Mr.* J. Wray, n. 68. p. 2063.

"A

A Weak *Spirit* of *Piſmires*, will turn *Borage Flowers Red* in an Inſtant; " *Vinegar* a little Heated, will do the Like. *Piſmires Diſtill'd* by themſelves, " or with Water, yield a *Spirit*; like *Spirit* of *Vinegar*, or Rather like the *Spirit* " of *Viride Æris*, *Lead* put into this *Spirit*, or *Fair-Water* with the *Animals* " themſelves being *Alive*, maketh a Good *Saccharum Saturni*. *Iron* put into " the *Spirit*, Affords an *Aſtringent Tincture*, and by *Repetition* a *Crocus Martis*. " Take *Saccharum Saturni* Thus Made, and *Diſtill* it, and it will afford the " ſame *Acid-Spirit* again, which the *Saccharum Saturni* made with *Vinegar* " will not Do; but Returns an *Inflammable Oil* with *VVater*, and Nothing " that is *Acid*. *Saccharum Saturni* made with *Viridi Æris*, doth the ſame (in " This Reſpect) with that made with *Spirit* of *Piſmires*. When you put the " *Animals* into *VVater*, you muſt *Stir* them to make them *Angry*, and then " they will ſpirt Out their *Acid Juice*. No *Animal* that Ever We *Diſtilled* " (he ſpeaks of his Brother and Himſelf) except this, Yields an *Acid Spirit*, but " Conſtantly an *Urinous*; and yet we have *Diſtilled* Many, both *Fleſh*, *Fiſh*, " and *Inſects*.

In Dr. *Hulſe's* Account, where he ſaith that *ſpirit of Salt*, *and Oil of Sulphur*, *Dropped upon Cichory Flowers*, *did not Cauſe them to change Colour*, it is to be Underſtood of the Flowers *Entire*, and *Unbruiſed*: For any *Blew Flowers*, being a little *Bruiſed*, and then a Drop of *Spirit* of *Salt*, or any Other *Acid. ſpirit*, let fall thereon, will turn inſtantly *Red*. The Reaſon is Obvious; for that the *Leaves* of the *Flowers* (as all the Other parts of the *Plant*) being Inveſted with a *skin* or *Membrane*, the Liquor Dropp'd thereon cannot Eaſily penetrate it, and ſo Commix it ſelf with the *Interiour Juice* or *Pulp*. Hence it is, that if theſe *Flowers* be put into *Cold Vinegar*, eſpecially if the Weather be *Cool*, they will not *Change Colour* for a Conſiderable Time: but if you *Heat* the *Vinegar*, they will *Change* Immediately.

Another Inſect *yielding an* Acid Juice; *By Dr.* M. Liſter, *ib.* p. 2067.

2. Having Obſerved that a *Piſmire* bruiſed and ſmelt to, Emits a ſtrange *Fiery* and *Piercing ſavour*, like the *Leaf* of the *Herb*, by *Botaniſts* call'd *Flammula*, Broken at one's Noſtrils, *I* have by this means found an *Inſect*, which, *I* ſuſpect, may yield an *Acid Liquor*, as well as the *Piſmire*; and that is the *Long* and *Round Bodied Red Colour'd Julus*; Diſtinguiſhed from all Other *Multipeds*, in that their *Innumerable Legs* are as ſmall as a *Hair*, and *VVhite*, and in Going they are Moved like *VVaves*; not Rare amongſt Dry Rubbiſh; No *Scolopendra*, Ours being an *Harmleſs Inſect*, and that armed wit *Dangerous Forcipes*. The *Body* of this *Julus* being *Bruiſed*, ſtrikes the Noſtrills Exceeding *Fiercely*.

Musk-Scented Ants; *by Dr.* Liſter, n. 77. p. 3002.

Vid. Sup. §. XXVI. & XXVII.

XXXVIII. *Sep.* 2. 1671. *I* found in a *Sandy Ditch-Bank* about a *Mile* and an *half* from *York*, in the High Road to *London*, a ſort of exceeding *ſmall Piſmires* (by which Note alone *I* think they may be ſufficiently Diſtinguiſht from all, at leaſt, that *I* have ſeen.) Thoſe *without VVings*, were of a *Light Yellow*, or *Flaxen*, and being Broken at ones Noſtrils they Emitted, like Others, an *Acid* or *ſowre ſcent*; but thoſe of the ſame Bank *with VVings*, were *Cole Black*, and theſe Bruiſed and *ſmelt* to, Emitted a *Fragrant ſmell* like *Musk*; And an Apothecary in *York*, Famous for his Diligence in *Chymical Operations*, did

Compare

Compare them (Unſeen and not yet made Known to him) to an Excellent *Balſom*, he is wont prepare.

A Table of Spiders found in England; by Dr. M. Liſter, n. 72. p. 2175.

vel *Fila mittunt*; ut ſunt qui
aut *Prædandi* cauſa *Texunt*
vel *Reticula Orbiculata*, Numero *IX.*
1. *Araneus Subflavus*, Alvo paululum Acuminata inflexaque.
2. *Araneus Rufus, Cruciger*, cui utrinque ad Superiorem Alvi partem velut Singula Tubercula eminent.
3. *Araneus Cinereus*, Pictura Clunium in 5. fere partes divulſa, iiſque plenis admodum.
4. *Araneus Flavus*, 4. Albis præter Picturam Foliaceam, in Clune Maculis inſignitus.
5. *Araneus Nigricans*, Clunibus ad Similitudinem *Querni* Folii pictis.
6. *Araneus ex Viridi Inauratus*, Alvo prætenui proceraque.
7. *Araneus Cinereus*, Sylvarum incola, alvo in Mucronem faſtigiata, ſeu Triquetra.
8. *Araneus Viridis*, Cauda *Nigris* Punctis ſuperne notata, ipſo Ano *Croceo.*
9. *Araneus Pullus, Cruciger* in alvo plena.
vel *Plagas Globatas*, N. *IV.*
10. *Araneus Variegatus*, alvo Orbiculata.
11. *Araneus Rufus*, Clunium Orbiculatorum faſtigio in modum *Stellæ* Radiato.
12. *Araneus Pullus*, Domeſticus.
13. *Araneus Cinereus* Macula *Nigra* in ſummis Clunibus inſignitus, Minimus.
vel *Telas* ſive *Linteamina*. N. *VIII.*
14. *Araneus Subflavus*, Piloſus, prælongis pedibus, Domeſticus.
15. *Araneus Nigricans*, Prægrandi Macula in ſummis Clunibus, cæterum iiſdem oblique virgatis, Domeſticus.
16. *Araneus Fuligineus* è *Craven*, inſigni *Candore* diſtinctus, Cauda Bifurca.
17. *Araneus Subflavus*, *Nigricantium* Macularum Quadratarum Catena in Clunibus inſignitus; item cui utrinque ad Clunium Latera ſingulæ obliquæ Virgulæ *Flaveſcentes.*
18. *Araneus Cinereus*, Maximus, Cauda Bifurca.
19. *Araneus Niger* aut *Caſtaneus*, Glaber, Clunibus ſummo *Candore* interſtinctis.
20. *Araneus Cinereus*, Mollis, cui in alvo, oblique virgata, Macula latiuſcula è *Nigro Rubens.*
21. *Araneus* plerumque *Lividus*, ſine ulla Pictura alva Acuminata.
aut *ideo Nihil Texunt* (niſi *filorum Ejaculatio* ac *Volatus* illorſum ſpectet:) cum tamen *alias* poſſint; nimirum *Telas* ad *Tutandum Fœtum* aut ad *Hyberna*; ſed Aperto Marte *Muſcas* Venantur, atque ii ſunt

vel *Lupi dicti*, N. V. Hi vero, cum Superioribus ſingulis 8 habent *Oculos*.

22. *Araneus Subrufus*, Parvus, Citiſſimo Pede.

23. *Araneus Cancriformis*, oculis è *viola Purpuraſcentibus*, Tardipes.

24. *Araneus Cinereus*, Alvo undulatim Picta, inſigniter Procera, Acuminata:

25. *Araneus Fuſcus*, alvo Oblique virgàta.

26. *Araneus Niger*, Sylvicola.

vel *Phalangia*, ſive Aſſultim ingredientes, N. *III.* Hi vero 6. tantum *Oculos* habent.

27. *Araneus Cinereus*, ſive ex *Argento Nigroque* Varius.

28. *Araneus Subflavus*, Oculis *Smaragdinis*; item cui ſecundum Clunes 3. virgulæ *Croceæ*.

29. *Araneus Subrufus* è *Craven*, ſive Ericetorum ſive Rupium.

vel omnino *Nulla Fila mittunt*; ut ſunt qui plerique Longiſſimis Tenuiſſimiſque *Pedibus* donantur: atque Hi *duos* tantum *Oculos* habent, *Telaque* ſive *Brachia Digitata*. N. *IV.*

30. *Araneus Rufus*, non Criſtatus, Gregatim Vivens.

31. *Araneus Cinereus*, Criſtatus.

32. *Araneus* è *Candido Nigroque* Varius, Minima Beſtiola, Sylvicola.

33. *Araneus*, ut puto, *Coccineus*, vulgo dictus, *a Tant*, *Anglicé*.

Spiders darting *their Threads into the* Air *and* Swimming *in it*; *by Dr.* Liſter, n. 50. p. 1014.

XL. 1. I have diſcover'd that all *Spiders* that *Spin* in a *Thread*, (thoſe which we call *Shepherds*, or *Long legg'd Spiders*, never do,) are the Makers of thoſe *Long Threads*, *in the Air in Summer* and eſpecially towards *September*, ſo much wondered at, and in ſuch Infinite Quantities every where. *I* exactly Marked all the ways of *Weaving*, uſed by any ſort of them, and in thoſe Admirable works, *I* ever Noted, that they ſtill let down the *Thread* they made Uſe of, and drew it after them.

At length in nearly attending on One, that wrought a *Net*. *I* ſaw him ſuddainly in the mid work to Deſiſt, and turning his *Tail* into the *Wind* to *Dart out a Thread*, with the Violence and Stream we ſee *Water* ſpout out of a *Spring*. This *Thread*, taken up by the *Wind*, was in a Moment Emitted ſome *Fathoms* Long, ſtill iſſuing out of the *Belly* of the *Animal*: by and by the *Spider* lept into the *Air*, and the *Thread* Mounted her up ſwiftly. After this firſt Diſcovery, *I* made the like Obſervation in almoſt all the ſorts of *Spiders*, *I* had before Diſtinguiſhed: and *I* found the *Air* filled with Young and Old, *Sailing* on their *Threads*, and Undoubtedly ſeizing *Gnats* and other *Inſects* in their *Paſſage*; there being often as manifeſt ſigns of ſlaughter, as *Legs*, *Wings* of *Flyes*, *&c.* on theſe *Threads*, as in their *Webs* Below.

One thing yet was a Wonder to me, *viz.* that many of theſe *Threads*, that *Came Down* out of the *Air*, were not *Single* but *Snarled*, and with *Complicable Woolly Locks*, now More now Leſs; and that on theſe I did not always find *Spiders*, though Many Times *I* had Found Two or Three upon One of them:

them: whereas when they Firſt *Flew Up*, the *Thread* was ſtill *Single*, or but little *Tang'ed*, or it may be Thicker in one place than another. In the End by Good attention. *I* plainly found them, to get to the *Top* of a *Stalk* or *Bough*, or ſome ſuch like thing, where they Exerciſe this *Darting* of *Threads* into the *Air*; and if they had not a Mind to *Sail*, they either ſwiftly Drew it Up again, winding it up, with their Fore-Feet over their *Head* into a *Lock*, or break it off ſhort, and let the *Air* carry it away. This they will do many times together: and you may ſee of them that have *Chains* of theſe *Locks* or *Snarled Thread* before them, and yet not taken *Flight*.

Again, *I* found that after the *Firſt Flight*, all the time of their *Sailing*, they make *Locks*, ſtill *Darting* forth freſh ſupplies of *Thread*, to *Sport* and *Sail* by.

It is further to be Noted, that theſe *Complicated Threads*, are much more tender, than our *Houſe VVebs*.

In *VVinter* and at *Chriſtmaſs*, *I* have Obſerved them buſy a *Darting*: but few of them *Sail* then, and therefore but *Single Threads* only are to be ſeen. And beſides, they are but the *Young Ones*, of laſt *Autumns Hatch*, that are then Employed: and it is more than probable, that the Great *Ropes* of *Autumn* are made Only by the *Great Ones*, and upon Long Paſſages, and *Summer* Weather, when Great Numbers of *Prey*, may Invite them to ſtay Longer Up.

2. *I* have ſeen *Spiders* ſhoot their *Webs* 3. *Yards* Long before they begin to *Sail*: and then they will (as it were) *Fly* away incredibly Swift. Which *Phænomenon* doth ſomewhat Puzzle me: ſeeing ſometimes the *Air* doth not *Move* a Quarter ſo *Faſt* as they ſeem to *Fly*. Moſtly they Project their *Threads Single*, without *Dividing* or *Forking* at all to be ſeen in them. Sometimes they will *Shoot* the *Thread* Upward, and will *Mount* with it in a *Line* almoſt *Perpendicular*: and at other times, they *Project* in a *Line Parallel* to the Plain of the *Horizon*; as you may Often ſee by their *Threads* that Run from One Tree to another, and likewiſe in *Chambers* from One *VVall* to Another. *By Dr.* Hulſe, n. 65. p. 2103.

I Confeſs, this Obſervation at Firſt made me think, that they could *Fly*: becauſe *I* could not Perceive, how a *Thread* could be Drawn ſo *Parallel* to the *Horizon* between two *Walls* or *Trees*, as aboveſaid, unleſs the *Spider flew* through the Air in a *Straight Line*.

The way for *forking* their *Threads*, is Expreſſed by the *Figure*. What Reaſon ſhould be given of this *Dividing*, *I* know not, except that their *Threads* being thus *VVinged*, become better Able to ſuſtain them in the *Air*. *Fig.* 203.

They will often *faſten* their *Threads* in ſeveral Places to the Things they Creep upon: The manner is, by beating their *Tailes* againſt them as they Creep along, which may be underſtood by the *Line a. b.* By this Frequent *Beating* in of their *Thread* among the Aſperities of the Place where they Creep, they either ſecure it againſt the *VVind*, that it be not Eaſily Blown away: or elſe whilſt they Hang by it, if one ſtick Breaks, another Holds Faſt; ſo that they do not Fall to the Ground. *Fig.* 204.

By Mr. J. Wray. *ib.*

3. *I* had the *Firſt* Notice of this *Darting of Spiders* from Dr. *Hulſe*, which was not long after Communicated to me by Mr. *Liſter*; Nor is it any Great Wonder, that inquiſitive Perſons, applying themſelves to Obſerve and Conſider the *Same Subjects*, ſhould make the *Same Diſcoveries*.

By ..... *ib.* p. 2104.

4. Mr. *Liſter* intimates in a Later Letter, That Mr. *Wray* knew nothing of his having Obſerved the *Darting* of *Spiders*, no more than he knew that either Mr. *Wray* or any body elſe had Obſerved it, until ſuch time as he occaſionally ſent Mr. *Wray* a Catalogue of our *Engliſh Spiders*; Upon which Subject Mr. *Wray* put this among other Queſtions, whether he had Obſerved this *Darting* of *Spiders*.

Whence it appears that this Obſervation is as well Mr. *Liſter's* as Dr. *Hulſe's*.

By Dr. Liſter. *N.* 160. p. 592.

5. *I* take the *Forking* of *Some Threads* (for Dr. *Hulſe* Excepts the *Moſt*) to be meerly *Accidental*; even as it is to our *Hair*: Neither do *I* think that any ſuch thing is Deſignedly done by the *Animal*, and for as much as *I* have Obſerved, *Spiders Threds* of themſelves are exceeding Slick and Smooth. There is indeed a *Dividing* in the *Projection* of the *Threds* of many Sorts of *Spiders*, and eſpecially among thoſe which we Diſtinguiſh by the name of *Lupi*, which Tribe is moſt Frequent, and particularly Delighted in *Sailing*, yet this *Dividing* is much of another Nature than *Forking*. Theſe *Lupi* will *Dart* a whole *Stamen* or *Sheaf* at Once, Conſiſting of many *Filaments*: Yet all of one Length, all divided each from the Other, and Diſtinct until ſome Chance either Snap them Off, or Entangle them. But for the moſt part you may Obſerve, that the Longer they Grow, the more they Spread, and appear to a Diligent Obſerver like the Numerous *Rays* in the *Tail* of a *Blazing-Star*. As for that which Carries them away in the *Air*, ſo *Swift* off hand, it is as *I* have already Hinted partly their *Sudden Leap*; and partly the Length and Number of the *Threads* Projected, the *Stream* of the *Air* and *Wind* Beating more Forceably upon them: And thus we ſee a *Rope* that Unexpectedly Slips, Comes home with a Seeming Violence; and partly (and that much too) the Poſture and *Management* of their *Feet*, which, at leaſt by ſome ſort of them, *I* have Obſerved to have been Uſed very like *Wings* or *Oares*, the ſeveral *Legs* (like our Fingers) being ſometimes Cloſe Joyned, and Other times Opened, again Bent, or Extended, *&c.* according to the ſeveral Neceſſities and Will of the *Sailer*. To *Fly* they cannot be ſtrictly ſaid, they being Carried into the *Air* by *External Force*; but they can, in caſe the *Wind* ſuffer them, *Steer* their *Courſe*, and perhaps *Mount* and *Deſcend* at Pleaſure: and to the Purpoſe of *Rowing* themſelves along the *Air*, 'tis Obſervable that they ever take their *Flight Backwards*, that is, their *Head* looking a Contrary Way, like a *Sculler* upon the *Thames*. It is Scarce Credible to what *Height* they will *Mount*: Which yet, is preciſely True, and a thing Eaſily to be obſerved by one that ſhall Fix his *Eye*, ſome Time on Any Part of the *Heavens*, the *White Webbs* at a *Vaſt Diſtance* very Diſtinctly *Appearing* from the *Azure Sky*; but this is in *Autumn* Only, and that in very *Fair* and *Calm Weather*.

XLI. S *Redi* having affirm'd, that Creatures reputed *Venemous* are indeed *No Poysons*, when *Swallowed* tho' they may Prove so, when put into *Wounds*, Mr. *Nath. Fairfax*, for Confirmation thereof, alledges Examples of Several Persons well known to him, (Himself also having been an Eye-Witness to some such Experiments) who have Frequently *Swallow'd Spiders* even of the *Rankest Kind*, without any more More Harm than happens to *Hens*, *Robin-Red Breasts*, and other *Birds*, who make *Spiders* their *Daily Commons*. And having made Mention of some Men that Eat even *Toads*, he Adds, that though a *Toad* be not a *Poyson* to us in the *Whole*, yet it may *Invenome Outwardly* according to some parts so and so stirr'd: An instance whereof he alledges in a *Boy*, who Stumbling on a *Toad*, and Hurling Stones at it, some *Juice* from the *Bruised Toad* chanced to Light upon his *Lips*, whereupon they *Swell'd*, each to the Thickness of about 2 *Thumbs*; and he neglecting to Use, what might be Proper to Restore them, they have Continued in that Mishapen Size ever since.

The Innocuousness of Spiders *and* Toads; *by Dr.* Nath. Fairfax. n. 22. p. 391.

XLII. Mr. *Nath. Fairfax* relates, that a *Spider* Bruised into a Small Glass of *Water*, *Tinged* it somewhat of a *Sky-Colour*: And he is informed, that a *Dozen* of them being put in, they would Dye it to almost a *Full Azure*.

Spiders Tinge, *Water of a* Sky-Colour, *by Dr.* Fairfax. n. 22. p. 391.

XLIII. Upon the Diffection of a *Rattle Snake* which was sent *Alive* from *Virginia* to Mr. *Hen. Loades*, a Merchant in *London*, I find both its *External* and *Internal Parts* so conformable in almost all Respects to those of a *Viper*, that *I* have taken the Liberty of placing it in that *Class*, and from the *Rattle* which sufficiently Differences it from other *Serpents*, of Naming it *Vipera Caudisona*.

The Anatomy of a Rattle Snake, *by Dr.* Edw. Tyson. n. 144. p. 25.

It was 4 *foot* 5 *inches* long; the Girth of the Body in the Largest place, which was the *Middle*, was $6\frac{1}{2}$ *Inches*; the Girth about the *Neck* 3 *Inches*, near the *Rattle* 2 *Inches*; the *Head* Flat on the Top as is the *Viper*, and by the Protuberance of the *Maxillæ* somewhat representing the *Head* of a *Bearded Arrow*; at the Extremity of it were the *Nostrils*; between them and the *Eyes* but somewhat lower, were 2 other Orifices, which *I* took for the *Ears*, but after found they only led into a Bone that had a pretty large Cavity, but no *Perforation*.

Fig. 209. *a.*

Fig. 209. *b.*

The *Eye* was round, about $\frac{1}{4}$ of an *Inch* Diameter: There was a large *Scale* Jetting over the *Eye*, which seem'd to serve as a *Palpebra* for defending it from any thing falling on it; but I could not perceive 'twas capable of *Closing*, tho' *Inwards* it seem'd to have a *Membrana Nictitans*, which removes any Dust that might adhere to the *Eye*.

The *Scales* on the *Head* were the smallest of any; those on the *Back* Larger; and so proportionably Greater to the Biggest part of the Body; and so Diminishing thence again to the setting on of the *Rattle*; all in Figure, somewhat resembling *Parsnip-Seeds*. Their *Colour* was Various, those on the *Head* like

like the Colour of the *Feathers* on the Back of a *Green-Finch*, ſpeckled with ſmall *Black Spots*; whereof there were 4 larger and more remarkable: Thoſe on the *Back* were a *Dark Feuillemorte* a *Black* and a *Darkiſh Yellow*, and ſpeckled, making a curious *Chequer* or *Dappling* on the Back by this intermixture of Colours; but as they grew nearer the *Tail* they became *Darker*, and at laſt almoſt *Black*. The *Scales* on the *Back* had an Edged Riſing in the Middle, which was ſtill Leſs Protuberant as they grew nearer the *Sides*, where they were Flat.

The *Belly* ſeem'd Flat, covered with Long *Scales* of a *Yellowiſh* Colour, Speckled *Black*. From the *Neck* to the *Anus* we Numbred 168. beyond the *Anus* were 2 *half Scales*; thence 19. *Whole Scales* of a *Black Lead-Colour* with *Yellowiſh Edges*; from thence to the *Rattle* 6. Orders or Rows of ſmaller *Scales* of the ſame Colour. The *Scales* of the *Belly* were Joyned to each other by Diſtinct *Muſcles*; the Lower *Tendon* of each *Muſcle* being inſerted into the upper Edge of the Following *Scale*, and the other *Tendon* of the ſame *Muſcle* inſerted about the middle of the Foregoing *Scale*. Theſe *Muſcles* were more *Fleſhy* towards the Middle of the *Scale*; and then its *Fibres* did run Obliquely Aſcending. To each *Scale* was appropriated a *Rib*, whoſe Point did joyn with the Extream of it, which muſt much Advantage the Uſe Nature ſeems to Deſign them for, by ſtrengthning them to perform their *Reptile Motions*; for the *Scales* are ſo many *Feet*, which being Free and Open Downwards, they thereby take Hold of the Ground, and ſo *Contract* their Body *Forwards*, and then *Shoot* out again; and ſo perform their *Motion*. Hence it is, that on *Rocks* their *Motion* is much Quicker, than on the *Earth*, or *Plains*, becauſe here they have the Firmer Footing. But in *Soft* Ground, tho' their *Belly* be *Flat*, yet they can Contract it to an *Ellipſis*, or an *Acute Angle*, that ſo they may take the Deeper Hold; as *I* have obſerved in a *Viper*. This *Coat of Armour* (for their Defence,) is ſo Curiouſly contrived that though it Covers the Whole Body yet by its frequent Joyntings it admits of all *Motions*.

Fig. 205. *ssss.*

Having placed this *Rattle-Snake* on its *Back*, we *Opened* it: and obſerved that the *Tendons* of the *Abdominal Muſcles* made a *Linea Alba* in the midſt of the *Scales* of the *Belly*; where likewiſe did run a large *Blood Veſſel*, ariſing from the *Vena Cava*, towards the lower part of the *Liver*.

Fig. 205. *rrr.*

Fig. 205. *aaa.*

The *Wind Pipe* (which is Common to it with the *Viper-Kind*) as ſoon as it enters the *Breaſt*, preſently meeting with the *Lungs*, conſiſts only of *Semi-Annular Cartilages*; which being Joyned at both ends to the *Membrane* of the *Lungs* inwardly is quite Open, and immediately Tranſmits the Air to the *Veſiculæ* of the *Lungs*: For Dividing the *Wind Pipe* we perceived it eaſily extended above $1\frac{1}{2}$ *Inch* Wide; whereas before it Meets with the *Lungs* the *Cartilages* are *Annular*. The *Trachæa* or *Wind-Pipe* was 20 *Inches* Long, Terminating near the *Heart* and Beginning of the *Liver*, and Reaching to that part of the *Lungs* which made the Great *Bladder*. The *Cartilages* of the *Trachæa*, near the Beginning were $\frac{3}{8}$ of an *Inch*, but

Fig. 208. *aaaa.*

but toward the *End* $\frac{1}{2}$ of an *Inch*, and lying Flattiſh from End to End. Theſe *Cartilages* were not ſo Diſtinct as in other *Animals*, but often running into one another.

The *Lungs* begin from the *Throat* and run down 3 *Foot* in length: The Upper part of them that lay in the Fore part of the Body for the Length of a Foot, and did reach to the *Heart*, was made of ſmall *Veſiculæ*, or *Cells*, like the *Lungs* of a *Frog*; but, from the frequent Branchings and Chequer of the *Blood Veſſels* there, appeared of a *Florid-Red*. This Part Tapers proportionably to the Body: The loweſt part of it near the *Heart*, moderately Blown, was in Compaſs $5\frac{1}{2}$ *Inches*; a little Lower, for the ſpace of 4 *Inches*, the *Cells* gradually diſappeared, ſo that they ſeemed at laſt to form only a *Reticular Compages* of *Valvulæ Conniventes* on the Inſide of the *Membrane* of the *Lungs*; and the Compaſs of the Greateſt place here, was about $6\frac{1}{2}$ *Inches*; but from thence to the End of the *Lungs*, was only a *Large Bladder*, without any *Cells*, compoſed of a Thin, but ſtrong Tranſparent *Membrane*, the Compaſs of which, Blown as the former, was $8\frac{1}{2}$ *Inches*. *Fig.* 205. *b.* *Fig.* 205. *cccc.*

The *Lungs* of the *Salamandra Aquatica*, and ſome other Animals, are only 2 large *Bladders*; In the *Frog*, *Crocodile*, *&c.* are two large *Lobes*, fill'd with *Membranous Veſiculæ*, or *Cells*: Our *Rattle-Snake*, and all that *Family*, tho' they have but one *Lobe* of *Lungs*, yet in that they compriſe the 2 former ſorts; the Fore part being fill'd with Numerous *Veſiculæ*; the latter an Entire large Bladder.

In the *Land Tortoiſe* there are 2 *Lobes*, one on each ſide; but theſe are ſubdivided into ſeveral others, according to the Partitions of the *Ribs* that are fixed to the *Shell*; and they lie chiefly in the *Belly*, that is, the Lower part of the Body. But what I would Remark is, that where the *Bronchiæ* firſt Enter theſe Subdiviſions 'tis *Reticulous*; then they form a large Cavity: ſo that in theſe *Animals*, where the *Nixus* of *Reſpiration* is not ſo frequent; Nature provides a ſufficient Store-Houſe for this (ſo neceſſary a *Pabulum Vitæ*) in theſe *Larger Bladders*, whence 'tis Diſpenſed, according to the Exigency of the *Oeconomia Animalis*. For the *Tortoiſe*, *Viper*, *Rattle Snake*, *Frogs*, *Toads*, *&c.* which *Sleep* a great part of the Year, as before they betake themſelves to this Repoſe, they take in their *Store* of *Food*, ſo perhaps that of *Air* too; a more Conſtantly Requiſite ſupply of *Life*. For when thus ſtupidly *Aſleep*, and ſometimes to all appearance *Dead*, it may be queſtioned whether they have any Motion of thoſe Parts, which is required for drawing in Freſh Air in *Inſpiration*. But ſince their *Life* here is ſo Imperceptible and ſmall, this *Stock* may be ſufficient, the Decay being ſo little. So the *Salamandra Aquatica*, that Lives under Water, for *Lungs* has 2 *Large Bladders*, not unlikely for this Reaſon, that it might not be forced ſo often to Raiſe it ſelf out of the Water to *Breath* in freſh Air when the former is ſpent and decayed.

In a *Viper I* lately Diſſected, (which remained *Alive* ſome *Days* after the *Skin*, and moſt part of the *Viſcera* were ſeparated) *I* obſerved the *Lungs* all this while not Riſing and Falling, as in *Inſpiration* and *Expiration*, but Conſtant, Equally Extended with *Air*; and that as ſoon as it *Dyed*, it *Expired* and they

they *Fell*. But the *Stomach* was *Empty*, and *I* doubt not was ſo ſome conſiderable time before; as was the *Rattle-Snake*'s, which for 4 *Months* at leaſt had Eaten nothing; ſo that although they can live ſo long without *Food*, yet Nature is mighty Provident in ſupplying them with *Air*, in Beſtowing on them ſo large Receptacles for receiving it. So the *Ephemeron*, the *Silk-worm* and other *Butterflies*, which all their Life-time, when in that State, do not *Eat*, or take in any *Food*, yet have their *Bronchiæ*, or *Lungs*, Remarkably large, and Numerous; as if they were ſufficient alone for Maintaining their *Life*; for if they be Occluded with *Oyl*, or otherwiſe, they are ſtrait *ſuffocated*, and Dye *Convulſed*.

The *Oeſophagus*, or *Gula*, which ſerves only in moſt other *Animals* for Tranſmitting the *Food* into the *Stomach*, ſeems here to be intended by Nature for ſomething more; for upon blowing up this Part, I obſerved two
Fig. 205. *df.* large *Swellings*; nor was the True *Stomach* capable of that *Extenſion* as theſe were. The whole length of the *Oeſophagus*, was 2 *Foot* $3\frac{1}{2}$ *Inches*; the length
Fig. 205. *g.* of the *Proper Stomach* 5 *Inches*, lying in a ſtrait Line with the *Oeſophagus*, but Thicker than it, having a remarkable *Coat* more on the Inſide, eaſily Diſtinguiſhable by its Colour, Subſtance and *Plicæ*, and jetting over the inſide of the *Gullet*; and in all reſpects as in the *Viper*. From the *Pylorus* the *Ductus*,
Fig. 206. *eee.* ſtreightned again for $1\frac{1}{2}$ *Inch*, and then formed a large *Inteſtine*, which afford-
ed a Pleaſant Sight, by the Weaved *Rugæ* of its *Inward Coat*; which *Gut*,
Fig. 206. *ff.* after ſome ſmall *Windings*, Ended at laſt in the *Rectum*, whoſe Capacity was much leſs than the former. In the *Stomach* and *Guts*, *I* obſerved abundance of *Lumbrici Teretes*; which is a Diſeaſe *Vipers* likewiſe are ſubject to. *I* take the *Swellings* in the *Gullet* to perform the ſame Uſe in theſe *Animals* as the *Crop* in *Birds*, and the *Paunch* in *Quadrupeds*: they being convenient Receptacles for retaining what *Food* the *Stomach* cannot yet well receive; and here it ſeems the more Requiſite, ſince they *Feed* but at *One* time of the *Year*. And ſince in that Promiſcuous *Food* they take in, which they ſwallow always *Whole*, there are often ſome parts unfit to be *digeſted*, and therefore to be returned again, the *Gullet* here being very long, and upon that Account, Incommodious for this Action; Nature has provided theſe *Swellings* in it, where they may be reſpited till Recruiting its Force, it gives them another Liſt, and upon a third Effort at laſt wholly Ejects them. And if what is confidently Reported by many be true, That on Occaſion of Danger, they Receive their *Young* into their *Mouths*, theſe are fit places for Receiving them.

The *Food* before it can prove *Aliment*, muſt be *Comminuted*, and broken into the ſmalleſt Particles, which in theſe *Membranous Stomachs*, I cannot ſee how it can be performed, but by *Corroſion*. A Principal *Menſtruum* in doing this, I take to be that *Liquor*, which is diſcharged by the *Glands* that are ſeated, in ſome at the Beginning of the *Throat*, and are called *Salival*; or juſt above the *Stomach* or *Gizzard* of *Birds*, and called the *Echinus*; or in others in the *Stomach* it ſelf, and called the *Glandulous Coat*, and ſuch I take the *Inward Coat* of the *Stomach* of our *Rattle-*

Rattle Snake to be. When *Comminuted* 'tis Diſcharged into the *Guts*: Which, that the *Chyle* might not paſs off with the *Fæces*, are often *Convoluted*, or Winding as here; that ſo by impeding a too quick Deſcent of it this Way, or by *Valves*, a ſeparation may the better be made; and then the *Fæces*, as uſeleſs, cannot quicker be diſcharged than by the *Rectum*; which where the *Fæces* are *Hard*, is furniſhed with a Stronger *Muſcle* the better to help its Action; and ſuch ſeem'd the *Rectum* here, and the *Fæces Harder* than Uſual in *Vipers*. *Fig. 205. eee.*

The *Heart* was Placed near the bottom of the *Trachæa*, on the Right ſide of it. The Length of it was $1\frac{1}{2}$ *Inch*, its Figure rather Flat than Round; encompaſſed with a *Pericardium*, and the *Auricle* Larger than the *Heart* it ſelf. It hath but one *Ventricle*, the *Valves* ſmall, and Fleſhy, and the Inſide of the *Ventricle* diſtinguiſh'd by 4 or 5 Croſs Furrows. Why *Charas* ſhould make the *Heart* of the *Viper* to have two *Ventricles*, *I* ſee no Reaſon; *I* ſhould much more eaſily allow a *Double Auricle*, one at the Entrance of the *Vena Cava*, of which there are *two Branches Deſcending*, and *one Aſcending*; the other for the *Arteria Aorta*, which has *Two Aſcending* and *One Deſcending*. *Fig. 205. k.* *Fig. 205. l.* *Fig. 205. nnn.* *Fig. 205. mmm.*

A little below the *Heart* lies the *Liver*, which was about an *Inch* wide, in the largeſt place, and ſeem'd divided on one ſide by the *Vena Cava* into 2 *Lobes* of an Unequal Length; for that on the Left ſide was about Ten *Inches*, and that on the Right ſide about a *Foot* Long. Its Colour was a *Brown red*, and it's Uſe no doubt for the Separating the *Gall* that was contained in a *Bladder* ſeated at ſome diſtance below it. This *Gall-Bladder* was 2 *Inches* long; the Colour of the *Gall* contained in it a *Graſs-Green*, which ſweating through its Coats had deeply *Tinged* all the adjacent Parts; the Taſt of it, in a *Viper*, which ſeems the ſame, for *I* did not taſte it here, was firſt *Salt*, then a *Sweet-Bitter*. The *Ductus* which brings it from the *Liver*, is Obſcure, and hard to be found: But the *Ductus Cyſticus* by which it empties its ſelf into the Inteſtine is evident enough. It ariſes from the Top of the *Bladder*; ſo gently Deſcending, paſſes through that part which *Charas* takes for the *Pancreas*, but which the Ancients call'd the *Spleen*; and ſo Enters the beginning of the *Large Inteſtine*. In *Vipers* indeed, the *Colour* of this Part, and Situation ſo near the *Inteſtine*, ſeems an Argument for *Charas* his Conjecture: but here it's *Colour*, which was *Deep-Red*, and ſuch hitherto I have obſerved the *Pancreas* to be in no other Animal, as likewiſe its *Figure*, not ſpreading but more Compact, ſeem to favour the Opinion of the *Antients*. I have only this to ſay of it, that it was about the Bigneſs of a Large *Bean*; that it adhered to the ſide of the *Inteſtine* at the Beginning of it; and that through the Middle of it, as is already obſerved, the *Ductus Bilarius* did paſs. *Fig. 205. oo.* *Fig. 205. p.* *Fig. 205. q.*

The *Fat* which was very Plentiful, is ſaid to be uſed by the Phyſitians of *Mexico* with good Succeſs, in the *Sciatica*, and all *Pains* of the *Limbs*, and for Diſcuſſing *Preternatural Tumors*. The *Membrane* it adhered to, I take for

the *Omentum*; which encompaſſed all Parts contained in this *Lower-Belly*; and was joined to Both ſides of the *Ribs*, ſo running to the *Rectum*, and forming a *Bag* that Inveloped the Parts here, but was Free and not Conjoined towards the *Belly*. The *Lower Belly* I call it, to Diſtinguiſh it from the reſt of the *Trunk*, for the Whole was but one continued *Cavity*; there being no Partition of it by any *Diaphragme*.

Fig. 206. The *Two Kidneys* which lay to the *Back* on each ſide of the *Spine*, but not very firmly conjoined, were about 7 *Inches* long; that on the Right ſide ſomething Longer than the Left, and about $\frac{1}{2}$ *Inch* Broad each: And tho' the *Subſtance* of it ſeems One Continued Body, yet it is plainly diſtinguiſhable into ſeveral Leſſer *Kidneys*; for they ought to be reckoned as many as there are diſtinct Syſtems and Orders of *Veſſels*; which, according to the Advantage of the Body of this *Animal*, are placed *at length*, not *Piled* on one another. As *I* remember in one of the *Kidneys I* numbred 15, all very curiouſly Contrived, and with an inexpreſſible Beauty. When they were firſt taken out of the Body, the Whole ſeemed a delicate *Compages* of *Veſſels*, and the Intermixture of thoſe of the *Blood* with thoſe other *White* ones, that are the *Secretory*, compoſed moſt Regularly-formed Bodies. In the *Figure*, that on the Left ſide repreſents the Upper Superficies of the *Kidney*, which appears firſt in the *Diſſection*; the other, the Lower ſide which lies to the *Back*; in both there are two large *Blood Veſſels* running down each ſide; one marked *nnn*, the other, where the *Vas deferens* runs, but is not here Repreſented; and from theſe ariſe ſeveral Leſſer *Branches*, *ooo* at ſet diſtances, which curiouſly ſpreading themſelves do Form, as it were *Ramifications* of *Trees*. As many as there were of theſe *Emulgent Veſſels* (for ſo I take them to be) ſo many *Kidneys* were in each; the Interſtices, *ppp* of theſe *Blood-Veſſels*, were filled up with other *White* ones; which *I* doubt not are for the *Secretion* of the *Urine*, and on this ſide did appear more numerous, than on the other. But 'tis Impoſſible to Repreſent the Curious interweavings of both; but here in the Under-ſide of the *Right Kidney*, in ſome places, they appeared more diſtinct; for *QQ* ſhews the Large *Blood Veſſel*, whence ariſes the *Emulgents*, *rrr* which ſpreading themſelves very thick into the Bodies, *sss* make them appear all *Bloody*; between which for a little ſpace, there appears a ſmall Body of the *white Secretory Veſſels*, *ttt*. The Uſe of this Part, in all *Animals*, is for carrying off the *Lixivial* and ſuperfluous *Serum* of the *Blood*: which is of ſo great Conſequence, that even thoſe *Animals* that *Drink not* at all, or but very little, yet by Nature are furniſhed with them; as the *Rattle-Snake* may be thought. When the *Separation* of this *Humour* is made in the *Kidneys*, 'tis Conveyed thence by the *Ureters* into a *Bladder*, if the two frequent Excluſion of it might be Inconvenient to the *Animal*; or, if it be made in Leſſer Quantity, into a *Cloaca*, juſt at the *Anus*, and ſo to be Ejected.

The *Ureters* did run almoſt the Length of the *Kidneys*: being a *Fig.* 206. *uu.* common Trunk that received the Leſſer Branches that went to each ſingle *Gland*, and did Terminate near each other in the *Cloaca*, making a *Kiſing*

there

there; for our *Rattle-Snake*, like *Birds*, had a *Cloaca*, which in the *Female Viper*, receives the Orifices of the *Ureters*, and the Two *Uteri*; and in part may be ſaid that of the *Rectum* too, which had a *Connivent Valve* that Covered it.

Near the Verge of the *Cloaca*, we obſerved two other *Orifices*, which ſeemed Covered by the Folding of the Skin; and theſe led into thoſe *two Bags* which *I* have taken the Liberty to call the *Scent-Bags*: One of them was about an *Inch* Long, and as big as a Gooſe-Quill, but Taper towards the End, and from the Colour of the *Liquor* it contained, appeared *Darkiſh*: The other *Bag* was ſomething leſs, and its Colour as in the *Viper*; this Difference, *I* ſuppoſe, may be Accidental. The *Liquor* included in them was ſomething Craſs, and of a ſtrong and very Unpleaſant *Smell*; ſuch, but in a more Intenſe Degree, as the *Animal* did Emit before *Diſſection*. *Fig. 205 mm.*

I ſhall here add, that our *Common Snakes* have a far greater *Fætor* (which lies in the ſame *Bags*) than our *Adders* or *Vipers*: And *I* have been told by Travellers, that ſome *Crocodiles* will leave a ſtrong, but Grateful *Smell* behind them; which, if ſo, *I* doubt not but it may be upon the ſame Cauſe.

But uſually, tho' this *Liquor* when new, and in great Quantity, be Offenſive, and of an *Ill Smell*, (and ſuch is *Civet* likewiſe, which is nothing elſe) yet when Dry, and in Leſſer Proportions, it may prove more grateful.

Thus the *Liquor* in the *Scent-Bags* of a *Weaſel* being Dryed on a Paper, and kept ſome time, did not ſeem Unpleaſant to me; but rather the contrary: And I ſee no Reaſon why *Pole-Cats* may not be *Civet-Cats*, though they may not turn to that Account. But in a *Lyon I Diſſected*, the Liquor contained in the *Scent-Bags* was, in the Opinion of all that *Smelt* it, much like that of *Oyl* of *Aniſe*, or *Fennel-Seed*; which was almoſt the Only Difference I could find between the *Lyon* and a *Cat*; for in a *Cat* this *Liquor* is *Ill ſcented*.

The *Teſtes* are very Unproportionate in Length, the Right being $2\frac{1}{4}$ *Inches* Long, the Left $1\frac{1}{4}$ *Inch* long, ſcarce ſo big in Compaſs as a Gooſe Quil. The Unequal Length of this Part *Charas* takes notice of in *Vipers*; and *I* ſhall add, that the *Ovarium* of the *Female Viper* is the ſame; for that of one ſide was as big again as the other. The Colour of the *Teſtes* was White, as is uſual, and ſo was their Subſtance. The *Vaſa Præparantia* had nothing Uncommon: But the *Deferentia* were Remarkable; for though they did run in a ſtraight Line almoſt from the *Teſtes* to the *Penis*, and did form no large Body, yet this *Ductus* was ſo often Involuted, that were it Unravelled and Extended its whole length, 'twould be twice as long; which made me think that it was only the Extenſion of the *Epididymis*; for the whole *Teſtis* is but a *Congeries* of curiouſly *Convoluted Veſſels* which terminate in the *Epididymis*, whoſe Continuation makes the *Deferens*. And where its *Convolutions* are many upon the Body of the *Teſtis* it ſelf, there the *Deferens* is an even *Ductus*: But as in our Subject it making *Fig. 206. hh.* *Fig. 206. ii.*

making no ſuch Body there or but a very ſmall one, in its Paſſage downwards it
Fig. 207. *a.* was every where Crimpled, and about the middle of the *Kidneys* often *Convoluted*. Upon the *Diſſection* of a *Viper*, *I* have ſince found that they were Continued along the *Penis*, *Single* where the *Penis* was ſo, and afterwards *Divided*, and did run to the End of Each: Nor, were there any *Veſiculæ Seminales* or *Proſtrates* here to Receive them.

Fig. 206. *kk.* There were 4. *Penes*, two on each ſide, which lay *Sheathed* in the Body: ſo that upon firſt Opening it they were not perceived, but only the large *Orifices* where they were drawn in as a Finger of a Glove may be by a Thread faſtened to the end. But having Protruded them by a *Probe*, they appeared as is repreſented in the *Figure*. And *I* did obſerve that towards the *Baſis*, or Root, they were *ſingle* of each ſide, and that here they were thick beſet with Prickles, whoſe Points looked Backwards, and were very ſharp, and ſeem'd, eſpecially when Dry, like the Subſtance of the Briſtles of a *Hedge-Hog*: but hence they were Divided, and did Form two Round Bodies of the bigneſs of a ſmall Gooſe Quill, about $\frac{3}{4}$. of an *Inch* Long, of a *Red* Colour, but the whole, as Protruded, was above an *Inch* Long. When protruded *I* found they could eaſily be Retracted, and Drawn in by the help of Large *Muſcles*, that were faſtened to them and did run along under, and were at laſt Inſerted at the End of the *Tail* at the ſetting on of the *firſt Rattle*; which upon the Trial was ſo plain that we needed not doubt of the Uſe of them, and *I* ſhall therefore call them *Retractores Penum*. There are ſeveral *Animals* that have no *Penis* at all, but *Vaſa Deferentia*; as moſt *fiſhes*. All *Quadrupeds* that *I* know of have but a *Single* one. Some *Birds* have but *One*. Moſt others, if they may be ſaid to have any, have *two*, but very ſhort. *In Crabs, Lobſters, &c.* there are *two* long ones, one on each ſide: but *Earth-worms*, *Leeches*, *Shell-ſnails*, *&c.* are *Hermaphrodites*, and have the perfect *Organs* of *Both ſexes*. But where the *Sex* is *ſingle*, the *Rattle-ſnake* and that *family* have theſe *Organs* of *Generation* the moſt Numerous of any *I* have hitherto met with. But why the *Male Rattle Snake*, or the *Male-Viper*, ſhould have 4. *Penes*, when the *Female* has but 2. *Uteri* for receiving them, ſeems a Difficulty to me. Amongſt many Conjectures *I* have had about it, what ſeems the moſt to ſatisfy me, is this; That they have the *Penis* here on each ſide *double*, or *Forked*, that ſo being entered the *Uteri*, by ſpreading themſelves like the *Pythagorean* Y. they may the better and more firmly be Retained there till they have performed their Duty. And this too ſeems one Uſe of the *Aculei*, or *Briſtles*, towards the *Root* of them: for having their points looking Backwards when once they have entered the *Pudendum*, they muſt needs Lock them in, and retain them there, till ſuch time as the parts being tired, and Subſiding, have leave to Retreat. For in *Animals* that have no *Veſiculæ Seminales* 'tis requiſite that the *Coitus* be *Long*, that ſo the *ſeed* which cannot Quickly, may Leiſurely, be Tranſmitted from the *Teſtes*: but where tis before hand Stored up in the *Veſiculæ*, there the *Coitus* is ſoon over; but when they muſt Expect the Generation, or at leaſt a Sluggiſh Deſcent of it, Nature makes Proviſion for the more convenient performing it. So in *dogs*, which have no

Veſiculæ

Veſiculæ Seminales, near the *Root* of the *Bony Penis* there is a Large Body made up of an abundance of Cells and Veſſels: which upon the Kuſhing in of the *Blood* and *Spirits*, is ſo mightily Extended and Swelled, that it forceably keeps him in, till ſuch time as the *Impetus* be over, and the part Subſides. So the *Lump fiſh* on it's *Breaſt* has a Large Round Body Curiouſly contrived, like the *Tail* of a *Leech*, or the *Acetabulum* of the *Polypus* by which it can firmly adhere to the *Females*, and ſo by this Means, tho' its *Penis* be very ſhort, yet be able to perform a *Coitus*. *Cats*, *Lyons*, *&c.* which have likewiſe very ſhort *Penes*, that they may the better Cling, are forced to make Uſe of their Teeth and Claws, and from the Pain of theſe, not from the Scalding of the Seed, come thoſe fierce *Scrieks*, and Hideous *Youlings*. Therefore in our *Rattle Snake*, (where, as we have obſerved, there are no *Veſiculæ*, and where the *Vas Deferens* is all along Crimpled and Winding: and ſo upon both Accounts muſt be thought to be long in *Coition*) the Contrivance and Structure of theſe Parts ſeem very Requiſite. For altho' in this Action they Twiſt their Body, which may be ſome Advantage too, yet not Sufficient alone: for otherwiſe upon a little Occaſion the Parts would be apt to Slip out, which now they cannot, being *Forked*, and *Hooked in* too by the *Aculei*, or *Briſtles*. But the *Deferentia* being Continued to the End of the *Penis* do likewiſe ſhew this muſt be the *Uſe* of them. But that the *Female* may receive no Injury by theſe *Spines*, Nature has made that Part of the *Uteri* which they Enter, Strong and Griſtly; as we obſerved in a *Viper*: and that the *Male* too might not be Harmed by an over Extention of theſe Parts, thoſe ſtrong *Muſcles*, which ſerve for *Retracting* and Drawing them in, do likewiſe ſecure them in this reſpect too. It may be likewiſe conſidered, ſince they are Naturally ſo *Cold* and *Frigid*, whether theſe *Aculei* may not ſerve to Incite them, and ſtir them up.

The *Head* was but ſmall, yet the *Rictus* was very Large. The *Tongue* in all reſpects like that of a *Viper*, was compoſed of 2. Long Round Bodies, Contiguous and joyned together from the *Root* $\frac{2}{3}$ of its Length, with great Agility they could Dart them out, and Retract them again; and that part which appeared out was of a *Black* Colour, whereas that which lay *Sheathed* within was *Red*; for 'twas faſtened below the *Throat*, and thence was Covered with a *Vagina*, or Sheath to the place where it Iſſues out, which was near to the End of the *Larynx*; and for the better Ejaculation of it, the under *Jaw* too was here Divided, leaving a conſiderable Space. *Fig.* 209. *g.*

For if it were conjoyned as in other *Animals* and beſet with *Teeth*, they would be apt to injure the *Tongue*; or at leaſt it might prove incommodious to the Uſe 'tis deſigned for, which in part *I* ſuſpect with *Charas* to be for Catching *Flies*, and ſuch ſmall Creatures, they have a mind to Devour. *Fig.* 209. *i.*

Over the *Tongue* did lye the *Larynx*; not formed with that Variety of *Cartilages* as is Uſual in other *Animals*, but ſo as to make a *Rime*, or *Slit*, *Fig.* 209. *f.*

for

for Receiving or Conveying out the *Air*. Nor was there any *Epiglottis* for preventing other Bodies from Slipping in; this being sufficiently provided for, by the Strict Closure of them: And the *Air* passing only through such a *Slit*, without the Contrivance of other Parts for Modulating it, can only make such a *Sound* as we observe in their *Hissing*.

Fig. 209. *cc. h.* *Fig.* 209. *dd.* *Fig.* 210. *h.* *Fig.* 211. The *Teeth* are of Two sorts. 1. The Lesser which are seated in each *Jaw*, and serve for the Catching and Retaining the *Food*. 2. The *Poysonous Fangs* which Kill it, and are Placed without the *Upper-Jaw*. They are all *Canini*, or *Apprehensores*: for since they do not *Chew* or Bruise their *Food*, but Swallow all Whole as they meet with it, there is no need of *Molares*. Of the first sort of *Teeth*, in the *Lower Jaw* there are 2. Rows on each side; 5 in a Row, the Inward Lesser than the Outward: so that there are here 20 in all. In the *Upper Jaw* there are but 16. 5 on each side Placed Backwards, and 6. before: These do no Harm. The *Fangs* are placed without the *Upper Jaws*, towards the Fore part of the *Mouth*, not fastened to the *Maxilla*, as the other *Teeth*: but the two Outmost and Largest *Fangs* were Fixt to that *Bone*, which, if any, may be thought to be the *Ear-Bone*. The other *Fangs I* could not perceive were fastened to any *Bone*, but to *Muscles* or *Tendons* there. These *Fangs*, or Larger *Teeth*, were not to be perceived upon First Opening the *Mouth*, they lying *Couched* under a strong *Membrane* or sheath; but so as did make a large Rising there on the Outside of the *Lesser Teeth* of the *Maxilla*: but at pleasure when *Alive* they could Raise them to do Execution with; not unlike as a *Lyon* or a *Cat* does it's *Claws*. These *Teeth* were Hooked and Bent like the *Teeth* of a *Barbarossa*: but some of the *Smaller* of them were Bent at *Right-Angles*. On each side we met with about 6. or 7. but not placed altogether so exactly as in the *Scheme*. In all these *Teeth*, especially the *Larger*, we took notice of a pretty large *Foramen*, or Hole, towards the *Root* of it, and towards the *Point* there was a plain Visible and Large *Slit*, like the Cut of a Pen Sloping; and that part from the *Slit* to the *Root* was perfectly *Hollow*: which first of all was Discovered to us, by pressing gently with our Finger the side of the *Gumme*; for then we did perceive that the *Poyson* did readily Arise through the *Hollow* of the *Teeth*, and Issued out of the *Slit*.

Fig. 210. *g.* *Fig.* 210. *f.*

This *Poysonous Liquor* I observed to be of a *Water* Colour, lightly Tinged *Yellow*. What the *Poyson* of *Serpents* is, and how it produces its Dire Effects, has been of Late Contested between S. *Redi* & M. *Charas*. 'Tis *Redi*'s Opinion, that the *Yellow Liquor* contained in the *Vesicles* of the *Gummes* of *Vipers*, is the Only and True Seat of the *Poyson*; That this Juice is not *Venemous*, when taken in at the Mouth; but that it is so when let into *Wounds*, whether it be used when *Liquid*, or after it is Dryed. But M. *Charas* wholly Opposes this, and Asserts, that the *Poyson* is no where but in her *Inraged Spirits*; and that this *Yellow Juice* is nothing but a meer *Innocent Saliva*.

But

But the Fabrick of the *Teeth*, (they being thus *Hollow*, and having that Large *Slit* towards the End, and this *Juice* ſo readily and naturally iſſuing through them) ſeems to me to Argue, that Nature Deſigns it for other Uſes than *Nouriſhment*; ſo if ſo, by giving them ſo Large a Vent ſhe would be fruſtrated of her end. But they being ſo Sharp and ſtrong at the Ends, and the *Slit* too placed towards the Back, not inſide of the *Tooth*; what can be more conveniently Contrived both for making the *Wound* and infunding the *Poyſon*? For if the *Slit* was inwards, by the ſtrug ing and Withdrawing of the *Animal* Aſſaulted, the *Slit* would be apt to be ſtopt, and Occluded; and the Deſcent of the *Poyſon* prevented: But being thus formed, it gives a greater Advantage for its *Infuſion*. Thus the *Scorpion*, the *Bee*, the *Emmet*, nay the *Sting* of a *Nettle*, at the ſame time they make a *Wound*, they leave behind them a Drop of *Liquor*, which excites thoſe Dreadful *Symptoms*: Whereas the *Wound* without it, would be inconſiderable. And what has ſome Weight with me, (contrary to the Sentiments of M. *Charas* of the *Innocence* of this *Liquor*) is a Relation *I* had from an intelligent and Knowing Perſon; who informed me that being in the *Indies*, there came to him and his Company an *Indian* with ſeveral ſorts of *Serpents*, and offered to ſhew them ſome Experiments about the Force of their *Poyſon*, and the Difference of them; and that his Practice is Common with them. Having therefore pull'd out a Large One, the *Indian* told him that this would do no Harm; therefore making a *Ligature* on his Arm, as they do in *Letting Blood*, he Expoſed it Naked to the *Serpent*, having firſt Whipt and Irritated him to make him Bite it. The Blood that came out of the *Wounds*, made by his *Teeth*, he gather'ed with his Finger, and laid it on his Naked Thigh till he had got near a *Spoonful*. After this he takes out another call'd *Cobras de Cabelo*, which was Leſſer, and inlarges much upon the Greatneſs of its *Poyſon*; and to ſhew them in part an inſtance of it, Graſping it about the Neck, he Expreſſes out ſome of the Liquor in the *Baggs* of the *Gummes* about the Quantity, as he thought, of $\frac{1}{2}$ a *Grain*, and this he puts to the *Coagulated Blood* on his Thigh, which as ſoon as mixt with it ſtraight put it into a great *Fermentation*, and *Working* like *Barme* Changed it into a *Yellowiſh Liquor*. The ſame has been likewiſe obſerved by others, and does ſeem to give us ſome Light, how 'tis that this *Poyſon* Acts, and confirms the known Obſervation, that the *Biting* of a *Viper* will Cauſe the *Yellow Jaundiſe*. A preſent Antidote for this *Poyſon* is ſaid to be the *Snake-Stone*; *Pierre de Cobras de Cabelo* 'tis call'd by the *Portugueſes*, and is Famous all over the *Indies*: 'tis Deſcribed by *Gracias ab Horto*, by *Kircher* and others; particularly by Senior *Redi* who renders very much ſuſpected the Relations that are commonly had of its great Force and Virtue: But that it does not always Fail ſome Accounts I have had of Perſons Relieved by it here in *England*, have Convinc'd me. One inſtance is Remarkable that was told me by an Eminent Phyſitian in *London*, of a Perſon near the Town that was *Bit* by a *Viper*; his Hand and Arm ſoon *Swelled* with great Extremity of *Pain*: But upon the Application of this *Stone* for one Night both were Aſſwaged, and he thought himſelf well, and took off the *Stone*, which did ſtill firmly Adhere. But not long after his

Vid. Inf. §. XLVIII.

former

former *Symptomes* violently returning, he had recourſe to his *Antidote*, and then ſuffered it to continue there till it Fell off it ſelf, and ſo was *Cured*. One Tryal I formerly made my ſelf, in a Patient troubled with the *Gout* in her *Stomach*; having removed it thence, it ſeiz'd her *Toe:* but ſhe being impatient of the *Pain*, that I might ſeem to do ſomething, and to hinder her uſing abundance of Medicines, which every Body was like to adviſe her to, and might be apt to ſtrike it to her *Stomach* again, *I* thought of this; holding the *Stone* therefore in my Hand, and without acquainting her, *I* put it near the *Joynt* where her *Pain* was moſt; and being very near it, *I* perceived it move out of my Hand, and readily Adhere to the Part. Soon after ſhe acquainted me, that ſhe very ſenſibly perceived a great Drawing and Trickling all down her *Leg* and *Thigh*, and afterwards owned an *Abatement* of her *Pain*. In *Peſtilential Swellings* very Probably it may be of *Uſe*.

Amongſt the *Bones* of the *Head*, *I* obſerved that the *Cranium* here was Entire, and without *Sutures*: only where ſome other *Bones* were joyned to them; as forwards over the *Noſtrils* were 2 *Small Bones*, to which were faſtened the *Cartilages*, or rather *Bones* which Divide the *Noſe*. The other *Bones* ſeemed admirably Contrived for the great Extenſion, and Widening of the *Maxillæ:* Which ſeems a great Proviſion of Nature; for ſince it muſt *Swallow* all things *Whole*, and its *Head* is but ſmall, without this moſt *Mechanical* Contrivance it were impoſſible to do it. The *Upper Jaw* Forward was joyned to the *Bone* that receives the *Poyſonous Fangs*; and which had a Large *Cavity* in it, which Opened *Outward*, and was thought to be the *Foramen* of the *Ear*: but *Inwards* we obſerved No *Perforation* for a *Nerve*, unleſs there might be one that comes to it under that *Bone* which conjoyns it to the *Cranium*. This *Articulation* ſeems Advantagious, both for the *Motion* of the *Fangs*; which Lye ſometimes *Couched*, ſometimes *Erected*; as of the *Jaw* too: but its Principal and moſt Remarkable Advantage for *Swallowing* Large Bodies, is the Curious *Articulation* of the *Maxillæ* Backwards to the *Cranium*. by 2 *Bones*, which from their Uſe (ſince we know no Name to Diſtinguiſh them by) we ſhall call *Maxillarum Dilatores*. Their Shape, Bigneſs, and Aptneſs for this *Motion* will readily enough be conceived by the *Eye* in obſerving the *Figure*. For the *Lower Jaw* being not Conjoyned at the *Mentum*, as is uſual in other *Animals*, but *Parted* at a good Diſtance; upon the receiving a Large Body, as the *Membrane* here to which they are Faſtened eaſily Extends, ſo by Lifting up, as alſo by Bringing theſe 2 *Bones* more to a ſtraight Line, it muſt needs conſiderably widen the *Rictus* of the *Mouth:* and for this Cauſe too they are made *two*, not *one*, for performing this *Motion* more eaſily. This *Articulation* of the *Dilatores* (which is very Curious) with the *Upper* and *Lower Jaw*, makes thoſe *Protuberances* of the *Head*, which we likened to that of a *Bearded Arrow*. The *Lower Jaw* of each ſide was Compoſed of *two Bones*, as appears in the *Figure*, but firmly conjoyned. The *Fore Bone* was for receiving the *Small Teeth*, the *Hinder* towards the *Articulation* grew Broad; as likewiſe did the *Bone* of the *Upper Jaw* anſwerable to this place in the *Lower*. But this *Upper Jaw*, towards the *Poyſonous Fang* Divided into *two Bones*; one was faſtened to the *Bone* of the

Fig. 210. *a.*
Fig. 210. *cc. d.*
Fig. 209. *b.*
Fig. 210. *ee.*
Fig. 210. *n. o.*
Fig. 210. *m.*
Fig. 210. *kk.*
Fig. 210. *ii.*

Poyſonous

Poysonous Fang Outwards; the other, which received the *Small Teeth*, was inserted into the same *Bone* more inwards.

The *Vertebræ*, according to the whole Figure of the Body, were smallest towards both Extreams, and Largest in the Middle. From the *Neck* to the *Anus* there were as many observed as *Scales* on the *Belly*. *viz.* 168. but from the *Anus* to the setting on of the *Rattle*, 29 more in Number than the *Scales*.

The former *Vertebræ* had a Flat Upright *Spine* towards the *Back*; and a Slender Round oblique Descending one inwards to the *Belly*. To each *Vertebra*, besides those *Spines* just mentioned, there were other *Processus*'s for the Advantage of Setting on of the *Ribs*, and the *Articulation* with one another: But what was most remarkable the *Round Ball* in the Lower part of the *Upper Vertebra*, which enters a *Socket* of the Upper part of the *Lower Vertebra*, like as the *Head* of the *Os Femoris* does the *Acetabulum* of the *Os Ischii*; by which Contrivance, as also the *Articulation* with one another, they have that Free Motion of *Winding* their Bodies Any Ways. The *Ribbs* in the *Neck* were small, but Larger towards the Middle of the Body, where they were about 2 *Inches* long: but towards the Tail they grew Lesser and Shorter again; and did all Terminate at the Beginning of the *Scales* of the *Belly*. In the *Vertebræ* of the *Tail* inwards there were 2 *Spines*: Whereas in the other *Vertebræ* there was but *one*; as likewise there were here Transverse slender *Processus*'s something Analogous to *Ribs*.

Fig. 212. *a. b.*

Fig. 212. *c. d.*

Fig. 212. *e.*

Fig. 213. *bb.*

To the *Last Vertebra* of the *Tail* was fastened the *Rattle*; in our Subject there was but 5. but some others seemed to be Broken off. That next the *Tail* was of a *Lead-Colour*; the others, of a *Cinericious*. 'Tis well Described by Dr. *Grew*, in his *Musæum Reg. Soc.* This *Rattle*, (according to *Gulielm. Piso* (and *I* know no other use of it) was given by Nature to this Pernicious Animal, *ut illius* Sonitu *admonitus quilibet Homo non solum, sed & qualecunque Pecus, vel Jumentum, tempestive sibi Caveat à vicino Hoste.* Some Authors assert, that every *Year* there is an Addition of a *New Rattle*; which Dr. *Grew* suspects, for then he must Live 16 *Years*; for so many *Joynts* there are observed in some in our *Repository*; *I* have been told, in some there have been above 20. These *Rattles* are placed with their Broadest part *Perpendicular* to the Body, not *Horizontal*. And the *First* is fastened to the *Last Vertebra* of the *Tail* by means of a thick *Muscle* under it; and by the *Membranes* that Conjoyn it to the *Skin*.

Fig. 11, 12.

Mus. R. S. pag. 51.

Explication of the Figures, Designed *by Mr.* Rich. Waller. *ib. p.* 55.

Fig. 205. Represents the *Upper* part of the Body Opened, *aaa*. The *Aspera Arteria*. *B*. The *Upper* part of the *Lungs*, which is *Vesiculous*. *ccccc*. The *Lower* pars of the *Lungs*, which makes a Large *Bladder*. *d*. The *First Swelling* of the *Oesophagus*, or *False Stomach*. *eee*. The *Oesophagus*, *or Gullet*, and that part of it where 'tis Streighter. *f*. The *Second Swelling* of the *Oesophagus*, or *Second False Stomach*. *g*. The *True Stomach*. *h*. A short streightning of the *Gut*, a little below the *Pylorus*. *i*. The *Intestines*. *k*. The *Heart*. *l*. The *Auricle*. *mmm*. Three *Arteries*, whereof there are 2. *Ascending*, and one *Descending*. *nnn*. Three Large *Veins*, whereof 2 are *Descending*, and

the 3*d. Aſcending*; which laſt does ſeem to Divide the *Liver* into two *Lobes*. *oo*. The *Liver*. *p* The *Gall-Bladder*. *q*. The *Spleen*, as 'tis call'd by the *Antients*; but by *Charas*, the *Pancreas*: *rrr*. A large *Blood-Veſſel* that runs in the midſt of the *Scales* of the *Belly*. *ss*. The *Muſcles* belonging to the *Scales* of the *Belly*.

Fig. 206. The *Parts* Contained in the *Lower* part of the Body. *aaa*. The *Inteſtines*. *b*. The *Gall-Bladder*. *c*. the *Ductus Bilarius*, that paſſes through the Middle of the *Spleen*, or as call'd by *Charas*, the *Pancreas*, and Enters the large *Gut*. *d*. The *Spleen*, or *Pancreas*. *ee*. The *Inteſtines*, which was very large and *Winding*, but Short. *ff*. The *Rectum*. *g*. The *Anus*. *hh*. The *Teſtes*. *ii*, *ii*. the *Vaſa Deferentia*. *kk*. the *Penes* on each ſide, which Firſt at the Root are *Conjoyned*, and are thick beſet with *Briſtles*. *l*, *l*. The *Muſcles* that ſerve for the drawing in the *Penes*. *m m*. The *Scent Baggs* *n n*. A Large *Blood Veſſel* that runs on one ſide of the *Left Kidney*. *oo*. The *Emulgents* that ariſe from the ſame, *ppp*. The *Secretory Veſſels*. *QQ*. The Large *Blood Veſſels* of the *Right Kidney*. *rrr*. The *Emulgents* ariſing from it. *sss*. A Round Body of *Blood Veſſels* *ttt*. *Secretory-Veſſels*. *uu*. The *Ureters*.

Fig. 207. The *Penes* of one ſide of a *Viper*, *a*. The *Vas Differens*, which afterwards *Divides*, and runs to the End of the *Penes*. *b*. The *Penes* *c*. The *Muſcle* which *Retracts* the *Penes* in.

Fig. 208. The *Lungs* Open'd by the *Trachea*. *aaaa*. The *Arteria Aſpera*, Divided in the middle. *bbb*. ſome Larger Branches of *Blood-Veſſels*. *ccc*. The *Veſiculæ*, or *Cells*, of the *Lungs*.

Fig. 209. The *Head*, with its *Mouth* Open'd. *a*. the Hole of the *Noſtril*. *b*. the *Foramen* which Leads to a large *Cavity*, which has no *Perforation* for any *Nerve* inwards: but yet 'tis thought to be for Hearing *cc*. the *ſmall Teeth* in the *Upper-Jaw*. *dd*. the Large *Fangs*, or *Poyſonous Teeth*. *eee*. the Place where the *Bladders* of *Poyſon* lye, *f*. the *Larynx*. *g*. the *Forked Tongue* *h*. the *Teeth* in the *Lower-Jaw*. *i*. the place where the *Lower Jaw* is Divided at the *Mentum*.

Fig. 210 The *Scul*. *a*. the *Cranium*, without any *Sutures*. *bb*. the *Orbits* of the *Eyes*. *cc*. two ſmall *Bones* over the *Noſe*. *d*. the *Griſtly*, or rather *Bony Sepimentum* of the *Noſe*. *ee*. A ſmall *Bone*, that lyes between the *Cranium* and that *Bone* in which is fixed the *Poyſonous Fangs*. *ff*. A *Cavity* in that *Bone*, to which is faſtened the *Poyſonous Fang*, whoſe Outward Orifice is repreſented in Fig. 209. by the Letter. *b*. and is thought to be the *Ear*. *g*. the Large *Poyſonous Fang*, which is faſtened to the *Ear Bone*. *h*. the other *Poyſonous Teeth*, which are not *Fixt* in the *Bone* but to *Muſcles*. *ii*. the *Upper Maxilla*, which contains the *Small Teeth*. *k k*. One ſide of the *Lower Maxilla*, with its Double Row of *Teeth*, which in the Middle ſeems to be joyned by a *Suture*. *l*. the Diſtance at the *Mentum*, between the two ſides of the *Lower Maxilla*, or *Jaw*. *mm*. Where the two *Maxillæ* are joyned together Backwards, and by a *Tendon* are faſtened to another *Bone*, which from its Uſe, and for Diſtinctions ſake, we call *Dilatores Maxillarum*

illarum. nn. the *Dilatores* of the *Jaws. oo.* A ſhort *Bone* which Joyns the *Dilator's* to the *Scull*, or *Cranium. p.* the *Vertebræ* of the *Neck.*

Fig. 211. The *Poyſonous Teeth.*

Fig 212. One of the *Vertebræ* of the *Back. a.* the *Outward Spine*, of the *Vertebræ*, which is Flat Longways. *b.* the *Inward Spine* of the *Vertebræ*, which is Round. *c.* A large Flat *Proceſſus*, for the *Articulation* of the *Vertebræ. d.* Small *Tranſverſe Proceſſus*'s for the ſetting on the *Ribbs. e.* A *Round Ball*, like the *Head* of the *Os Femoris*, which enters a *Socket* of the *Lower Vertebra*, as that does the *Acetabulum* of the *Os Iſchii.*

Fig 213. One of the *Vertebræ* of the *Tail*, *a.* the *Spine* towards the *Back. bb.* the two *Inward Spines. cc.* the *Tranſverſe Spines*, Analogous to *Ribbs.*

Fig. 214. The *Vertebræ* of the *Tail*, and the *Muſculous Fleſh* which faſtens the *Firſt Rattle. a.* the *Vertebræ. b.* the *Muſcle* on which is faſtened the *Rattle.*

Fig. 215. A *Single Rattle*, which has 3 *Joynts:* the Firſt and Largeſt appears when Conjoyned with others; the two other ſerve for the Faſtening on the Succeeding *Rattles*, and are Covered by them.

Fig. 216. The *Five Rattles* as joyned together.

XLIV. The *Wild-Penny-Royal* or *Dittany* of *Virginia*, groweth ſtraight up about one *Foot* high, with the *Leaves* like *Penny-Royal*, with little *Blew* Tufts at the joyning of the *Branches* to the *Plant*, the Colour of the *Leaves* being a *Reddiſh-Green*; but the *Water Diſtill'd*, of the Colour of *Brandy*, of a *Fair Yellow:* The *Leaves* of it Bruiſed are very Hot and Biting upon the Tongue. Of theſe *Leaves* ſo Bruiſed we took ſome and having tyed them in the Cleft of a long Stick, we held them to the *Noſe* of the *Rattle-Snake*, who by Turning and Wriggling laboured as much as ſhe could to Avoid it: But ſhe was *Kill'd* with it, in leſs than *half* an *Hour's* time; and, as was ſuppoſed, by the *Scent* thereof. This was done *A.* 1657 in *July*, at which Seaſon thoſe Creatures are reputed to be in the greateſt Vigour for their *Poiſon.* It is alſo remarkable that in thoſe Places where the *Wild Penny-Royal* or *Dittany* grows, no *Rattle-Snakes* are Obſerved to come.

A Way of Killing Rattle Snakes; *by Capt.* Silas Taylor. n. 3. p. 43.

n. 4. p. 76.

XLV. There is this Difference between the *Brooding* of *Snakes* and *Vipers*; the *Snakes* lay their *Eggs* in Dung-hills, by whoſe Warmth they are *Hatched:* but the *Vipers Brood* their *Eggs* within their Bellies, and Bring forth *Live Vipers.* To which may be added, that ſome Affirm to have ſeen *Snakes* lye upon their *Eggs*, as *Hens* ſit upon theirs.

The Brooding *of* Snakes *and* Vipers, *by* ..... n. 8. p. 138.

XLVI. In order to examine the Opinions, of M. *de la Chambre*, S. *Redi*, and others, concerning the *Poiſon* of *Vipers*, Dr. *Francini* came to the Houſe of S. *Magalotti* 2 *Jun.* 1672. and ſent for a Box in which were a great many *Heads*, cut off that Morning, of *Vipers* lately come from *Naples*; S. *Magalotti* alſo ſent to the Publique Market for a couple of *Pigeons*, to be ſure of having ſome that

Experiments made with Vipers; *by Mr.* Tho. Platt. n. 87. p. 5060.

were not Prevented by any *Antidote*. The *Pigeons* being come, the *firſt* was wounded with the *Teeth* of a *Viper*'s *Head* that had been cut off about 7 or 8 a Clock the ſame Morning. The way of making the *Wound*, was by thruſting twice the *Maſter-Teeth* into the fleſhy part of the *Pigeon*'s Breaſt, till ſuch time as preſſing the Upper part of the *Jaw*, the two little *Bladders*, that ſerves as *Gums* to the *Teeth*, did empty out upon the *Wound* ſome of that *Yellow Liquor* which here is ſuppoſed to be the True and Only *Poiſon* of the *Viper*. This *Pigeon* being thus *Bit*, and ſet upon the Ground, began to ſtagger immediately, and Dyed in leſs than 3 or 4 *Minutes*. The *ſecond Pigeon* was Wounded in the ſame Manner; but at the firſt *Wound* there only Entred one of the *Teeth*, which brought forth a great deal of *Blood*; the ſecond time they both Entered, and this had the ſame Fate, with this difference only, that he Languiſht *half a quarter* of an *Hour*.

The next Morning 6 *Pigeons* and a *Cock* having been brought, Dr. *Francini* at firſt, thruſt ſeveral Thorns of *Roſe Shrubs* into the Breaſt of one of thoſe *Pigeons*, to manifeſt, that ſuch Accidents as might befal thoſe that ſhould be *Wounded* by the *Teeth* of the *Dead Vipers*, were not meerly cauſed by the *Wound*; and afterwards for the further ſatisfaction of the Company, he took a *Pin*, which was none of the leaſt, and gave another *Pigeon* a very Deep *Wound* in the Breaſt, which was no ſooner got Free, but began to leap and friſk about the Room, as if it had not been concerned in the leaſt. Then a *third Pigeon* was bit in the Breaſt by both the *Maſter Teeth* of a *Viper*'s *Head*, that had been cut off the Morning before; the Effect was, that the *Pigeon* had the ſame *ſhaking Fits*; after which, falling upon his *Belly*, in 5 or 6 *Minutes* after the *Wound*, he *Died*; giving Signs a little before of a Painful Agony, by his often Gaping. Another having been ſerved after the ſame manner with another *Head*, had the like Accidents, and *Died* within a *Quarter* of an *Hour*. It was alſo obſerved that the *Wound* of this *laſt Pigeon* let out a great deal of *Blood*; whereas not ſo much as one *Drop* was ſeen to come out of any of the others.

After the Experiments the Dr. took 3 *Stalks* out of a *Broom*, and having ſmooth'd them, and ſharpened them at the ends after the manner of a *Lancet*, he drew from the *Gums* of ſeveral *Heads* enough of that *Yellow Juice* to dawb two of thoſe *Stalks*; which being thus moiſtened with that *Liquor*, were both put into the *Breaſts* of 2 *Pigeons*, and there left; the like having been done to another with the *third Stalk* not covered with that *Juice*, which was at leaſt one third part Bigger, and longer than the other Two. In a word, the *Two firſt Dyed* within 4 or 5 *Minutes*, and the *Laſt* was in *Auguſt* following in S. *Magalotti*'s *Pigeon-Houſe*, as Brisk and fat as ever, tho' the *Stalk* was not drawn out till after ſome *Days*.

Upon a Relation, that ſome had Aſſerted at *Paris*, that to *Swallow* a *Viper*'s *Head*, was a moſt certain Preſervative and Remedy againſt the *Biting* of a *Viper*, Dr. *Francini* made theſe two Experiments; he made the *Cock ſwallow* a *Viper*'s *Head*, and then cauſed him to be well Bitten in both Thighs by a *Live* one. The other Experiment was by Truſting the *Teeth* of a *Dead Viper*'s *Head* into another *Pigeon*, that had before got down one of theſe *Heads* into

Fig. 205.

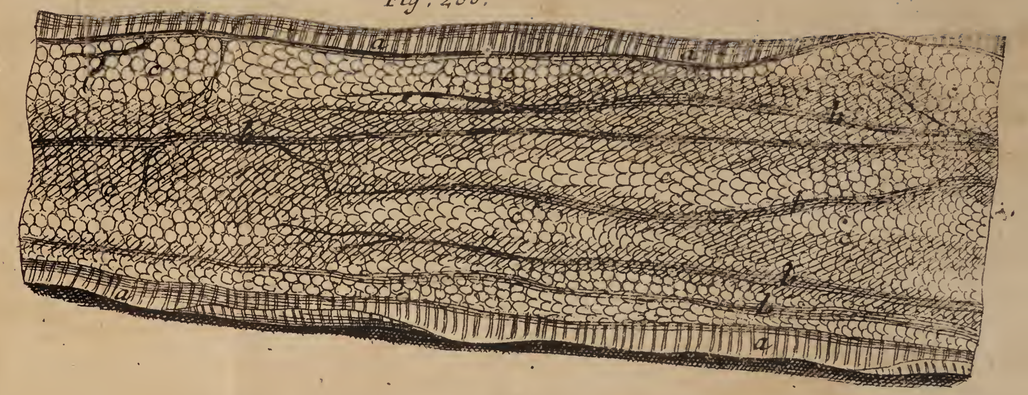


Fig. 208.

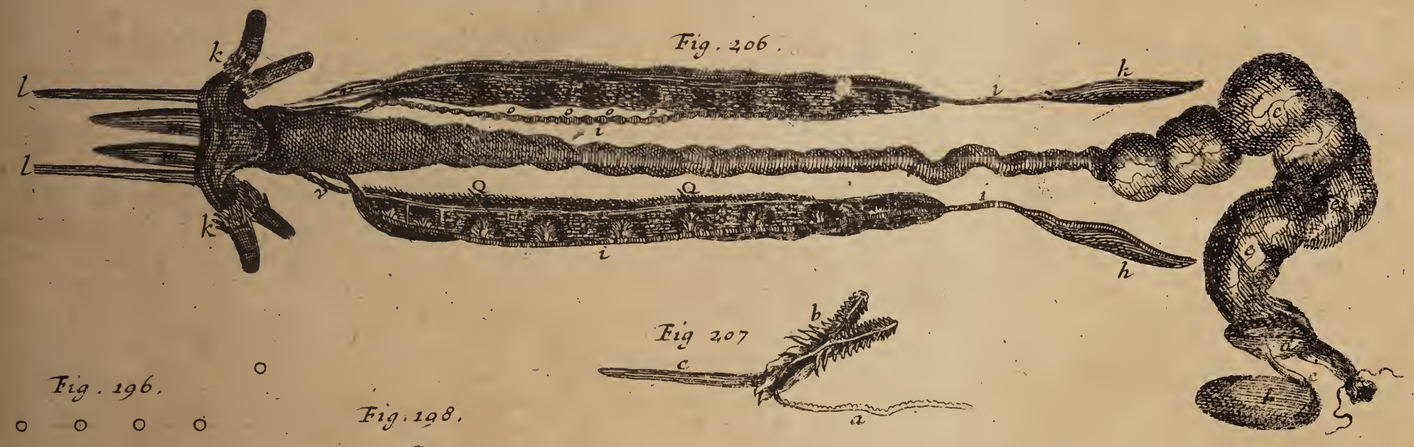


Fig. 206.

Fig 207

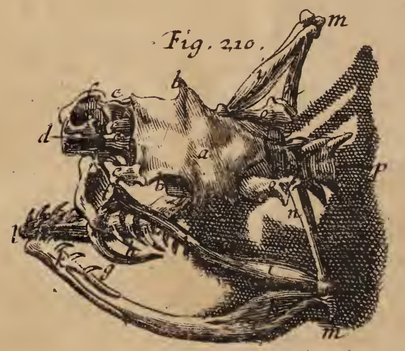


Fig. 210.

Fig. 209.

Fig. 196.

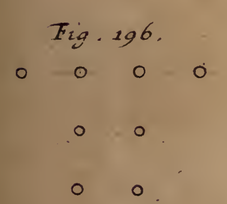


Fig. 198.

Fig. 199.

Fig. 202.

Fig. 200.

Fig. 190.

Fig. 197.

Fig. 201.

Fig. 191.

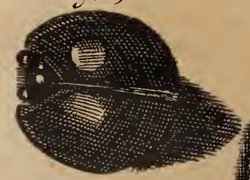


Fig. 192.

Fig. 193.

Fig. 195.

Fig. 212.

Fig. 211.

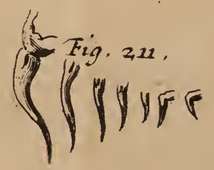


Fig. 216.

Fig. 215.

Fig. 214.

Fig. 213.

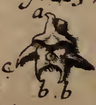


Fig. 194.

Fig. 204.

Fig. 203.

into his *Belly*. The Concluſion was, that both Died; the *Cock* within a *Quarter* of an *Hour*; and the *Pigeon* in leſs than 4 *Minutes*.

Some few Days after, Dr. *Francini* repeated the ſame Experiments, by cauſing 2 *Pigeons* to be *Bit* by a *Viper's Head* that had been Dead above 10 *Hours*, they both *Died*, one in 6 *Minutes*, and the other in 8. And with another *Viper's Head* he *Poiſoned* a *Chicken*, which Died in 10 *Minutes*. There appeared afterwards another *Pigeon*, that had been *Wounded*, many *Hours* before, by a *Dead Viper's Head*, but it had been *Dead* ſo long, that the *Liquor* quite dryed up in the *Gums*, was become ſo Hard, that for all the ſqueezing of it nothing would come to the *Teeth*, whence this *Pigeon* was very well: And Dr. *Francini* having cauſed the ſame Bird to be *Bit* again by the ſame *Dried Head*, it had, after a little fluttering with his Wings, whilſt the Pain of the *Biting* laſted, no other harm.

A *Live Viper* then being taken, 4 *Chickens* were bit by it one after another. The *Two firſt*, either becauſe the *Liquor* did not Penetrate into the *Wound*, or the *Blood* Expelled it, appeared not to have any Diſtemper; the 4*th* looked as if it would *Die* preſently, but a little after coming to himſelf, he got clear off for that time; but the 3*d*, who ſeemed at firſt to be very lively, *Died* within an *Hour* and an *half*.

There being afterwards a young *Bitch* brought in, of a pretty ſize, ſhe was *Bit* twice by a *Live Viper* in the Middle of the Hanging part of the *Ear*. Whereupon ſhe very ſoon began to give Mortal Signs, by Staggering, Vomiting and being Convulſed: after which, having a little Recovered her ſelf, the ſame Accidents Returned upon her, by which ſhe was Reduced to ſuch a grievous Condition, that 4 *hours* after her being *Bit*, ſhe could not ſtir any more, and ſeemed juſt as if ſhe had been *Dead*, holding out her Tongue, and looking very Gaſtly, without any other ſign of *Life* than that of a Painful *Breathing*; to which ſhe added ſometimes a Faint *Barking*, and a Languiſhing Howling. In this Condition ſhe was ſtill found next Morning; only her *Reſpiration* was yet weaker, and ſhe appear'd juſt a drawing to her End. It was obſerved that no Part of her Body was *Swelled*, nor had any *Spot* upon it. She had voided backward ſome Matter of a very *Black* Colour, of which her Hind Parts being very foul, a ſwarm of *Gnats* and *Waſps* were devouring her alive: Which Moved one of the Servants of the Houſe, to knock her on the Head.

After this, there were *Bit* two *Capons* and a *Pullet* by a Freſh *Viper*, vexed on purpoſe; and becauſe they gave not then any Signs of being Ill, they were ſent back to their *Coops*, and there having continued well till Evening, they were ſurprized at Night by a Diſtemper, which in all likelyhood proceeded from the *Poyſon*; for next Morning one of the *Capons* and *Pullet* were found *dead*.

The Symptoms attending the Bite *of a* Serpent; *by Mr.* Aar. Goodyear, n. 245. p. 351.]

XLVII. Mr. *Rob. Burdet*, an *Engliſh Merchant* at *Aleppo*, on the 4 *Oct.* 1678 was *Bit* by a *Serpent* on the Left *Wriſt*, near the *Pulſe* towards his *Hand*. It ſeemed at firſt like two Pricks of a Pin; he immediately *vomited*, and his *Wriſt* and *Hand* begun to *ſwell* preſently; he had ſome few Days before a *Looſeneſs*, which perhaps this increaſed. He rode eaſily, after he was *Bit*, about 2 *Miles* Home, and

as

as ſoon as he got to his Chamber, he ſaid he was *Bit* by a *Rat*, (and would not own it was a *Serpent*) though a *Turk* accidentally paſſing by, ſaid he ſaw the *Serpent* Hang at his *Wriſt*, as he pull'd his Hand out of the Refuge, hoping to have taken a *Hare* that he had Cours'd in there. He ſaid he felt no *Pain*, but a great Deſire to *Sleep*; his *Arm* continued *Swelling* Upwards, and grew *Black*. Some little Remedies were uſed till the reſt of the *Factory* Return'd, and then they begun to *Cup* and *Scarify* his Arm; he having ſtill no *Pain*, but a great *Drowſineſs*: but was kept *Waking*, to uſe that little Time he had left, to Prepare himſelf for *Death*; which he Performed exceedingly well. At laſt the *Swelling* came up to his *Shoulder*, and then he Complained much; and within a *Quarter* of an *Hour* Died. He was *Bit* about 10 in the *Forenoon*, and *Died* about 3. in the *Afternoon*. His Body *Swell'd* much after *death*, and Purged. The *Snake* was like a *Common Snake*, for Length; his Colour *dark Sandy*, with *Black* ſpots; his 2. *Teeth*, or *Fangs*, are like thoſe of a *Rattle Snake* on the *Upper Jaw*; the *Poyſon* lyes in the *Gums*; and vvherever they Fetch *Blood* of any Creature they certainly *Kill*, though in ſome parts ſooner than in others. The people of the Country ſay, that if as ſoon as one is *Bit* by a *Serpent* they ſhall *Suck* immediately the *Wound*, they may be ſaved: but they muſt rub firſt their *Gums* and *Teeth* with *Oyl*, that none of the *Poyſon* may Touch any place where the *Skin* is broken, and Spit out immediately what they ſuck; every time Waſhing the Mouth, and taking more *Oyl*. This *Serpent* Kill'd a Dog, in about 8. *Minutes* time, biting him at the End of his *Ear*; and 2. Young *Turkys* afterwards in 3. or 4. *Minutes* each, *Biting* them at the End of a *Claw*; and then we *Poyſoned* him with the *Oyl* of *Tobacco* out of a *Reed Pipe* (that had been much Uſed, and not Cleanſed for a *Week* or two) and he died in about 2. or 3. *Minutes*, trembling as ſoon as the *Oyl* was Dropt into his *Mouth*.

A Stone *Healing the* Biting *of a* Serpent; *by Sr.* Phi. Vernatti, n. 6; p. 102.

XLVIII. Sr. *Philiberto Vernatti* ſome time ago ſent from *Java Major* (where he Reſided) a certain *Stone* affirmed by him to be found in the *Head* of a *Snake*, which laid upon any *Wound* made by any *Venomous* Creature is ſaid to *Stick* to it, and to Draw away all *Poyſon*: and then, being put in *Milk*, to Void it's *Poyſon* therein, to make the *Milk* turn *Blew*; in which manner it muſt be Uſed, till the *Wound* be Cleanſed. The like Account of ſuch a *Stone* is given by M *Thevenot* in the Relations of his *Voyages* and *Travails*.

Obſervations on ſeveral Poyſons; *by Sr.* Theodore de Mayerne, n. 211. p. 162.

XLIX. The *Venome* of a *Viper* in it ſelf is not *Mortal* to a Robuſt and ſound Body: and tho' very Unhappy and Miſchievous Accidents attend it; as a great *Tumour*, *Tenſion* and *Weight* of the Part, *Humidity* and Variety of *Colour*, *Phrenſies*, *Convulſions* and *Vomitings*; yet in 8. or 10. *Days* at moſt theſe Accidents are over: and although the Patient may be very Ill, yet he recovers again; whilſt the *Poyſon*, having run through Divers Parts of the Body, at laſt always throws it ſelf into the *Scrotum*, and *Swelling* it extreamly cauſes a great *Heat* and *Quantity* or *Urine*, very Hot and Sharp, by which it is Diſcharged; this *Evacuation* being the Ordinary and moſt certain *Criſis* of the *Diſeaſe*.

It

It is Obſervable that the *Perſpiration* being Obſtructed by the *Poyſon*, a Man *Bit* by a *Viper*, and *Swelled* up, in 3. or 4 Days ſhall Weigh almoſt as much more than he did before A Sickly Perſon, under an ill habit of Body, or Fearful, Dies Infallibly, and in ſhort time by this *Venom* without ſpeedy Help. In the Extream *Nervous Parts*, near the *Pulſe* and *Tongue*, the *Bites* are dangerous, and Accidents very Painful. Freſh *Vipers* that have not *Bit*, but have the *Bladders* of the *Gums* full of *Venom*, are the moſt Miſchievous: Wherefore *Mountebanks*, to impoſe upon the People, either make their *Vipers Bite* before they bring them out; or with a *Needle* Scratch the *Gums*, and Preſs out the *Poyſon*.

The Remedy for theſe Great and Painful *Swellings* is, to Drink the *Decoction* of *Marrubium*, or the Powder taken inwardly, and a *Fomentation* with the *Decoction*, applying a *Cataplaſm*, made with *Marrubium Tapſus Barbatus* and *Agrimony*, on the place. *Ariſtolochia* is alſo a ſtrong and powerful *Antidote* againſt the *Viper*: ſo that if one be *Bit* on the *Tongue*, he need only take a ſlice of this *Root*, Heat it and Apply it, and it goes away.

Pontæus, a Chymical *Mountebank* (from whom *I* had the above mentioned Obſervations) compoſed his *Antidote* of *Extract* of *Juniper Berries* drawn with a *Decoction* of *Roots* of Round *Ariſtolochia*, of *Succiſa*, *Marrubium Album*, *Flower of Brimſtone* and of *White Vitriol*. For *Poyſon* not *Corroſive*, ſuch as thoſe of *Animals* and *Vegetables*, and even for the *Plague* it ſelf, (which he believes he can *Cure* by the ſame Remedy) he makes uſe of no *Vitriol*: But if the *Poyſon* be *Sublimate*, which of it ſelf excites *Vomiting*, he Adds *Vitriol*; not in a proportion to *Vomit*, as a *Drachm*, but only a *Scruple* or *half* a *Drachm*, the *Vomiting* being aſſiſted by the *Corroſive Poyſon* it ſelf.

To Encreaſe the Value of this *Antidote* with the people, when the Experiment is made on *Dogs*, to that *Dog* which they would have *Dye* of the *Bite* of the *Viper*, he gives with the *Antidote* a Quarter of a *Nux Vomica* not powdered but only cut in Bits, and the next Day the *Dog Dies*. If it were powdered the *Dog* would *Dy* in *half* an *Hour*. He ſays *Nux Vomica* never *Vomits* but ſhuts up the *Stomach*, and Contracts the *Nerves* by its *Poyſon*. To preſerve the *Dogs Alive*, you muſt give them with the *Antidote* or any thing elſe, 3. or 4. *Grains* of *Sublimate*, which immediately ſets them a *Vomiting*, and ſo ſaves them *Alive*.

He offers to take all ſorts of *Poyſons*, even *Corroſives*, after an ordinary *Meal*, and for a Tryal of Skill he refuſes them not on an *Empty Stomach*. He much Eſteems *Morſus Diaboli*, *Succiſa* or *Devil's Bit*, againſt all ſorts of *Poyſons*. He Laughs at the *Poyſon* of a *Toad*, which he ſays has none at all, no more than a *Frog*.

The manner of the *Acting* of the *Vipers Poyſon* is thus; In about $\frac{3}{4}$ of an *hour*, a *Syncope*, or *Swooning*, ſeizes them with *Trembling*, and *Convulſions*, *Tingling* of the *Ears*, and frequently *deafneſs* for a Moment: next as it were a White Sail comes before their *Eyes*, which ſoon Vaniſhes: On the place of the *Bite* a *Swelling* Riſes, at firſt of the Bigneſs of a *Pea* which grows as big

as

as a *Bean* or a *Nut*, and Increasing inlarges it self over the Neigbouring Parts, to a very considerable *Tumour* and stretching of the Flesh, which grows *œdematous*, and by little and little falls into the *Scrotum*, and Leaves the Part *Black*, *Blew* and *Yellow*. It makes as it were Bags in the *Skin*, which feel Heavie when you walk, as if fill'd with *Quick-Silver*. Do what you will the *Poyson* will have its Course: and it is usually 3. *Days* before it comes to the Heighth, and as long Abating.

He says the *Gall* of the *Viper* is no ways *Venomous*: all the *Poyson* is in a *Liquor* in the *Gums*, which is *Yellow* like *Oyl*; of which you may easily Disarm the *Viper*. The *Viper* is the Most *Venomous* of *Serpents*; the *Asp* is but a *Species* of the *Viper*. The *Napellus* is a very Dangerous *Poyson*, Acting by its *Acrimony*: but you must take a great Quantity of it. It burns the Throat extreamly as does *Alum*: but it is Cured by the *Antidote*. *Crude-Antimony* does Nothing if attaqued by the *Antidote*.

The most mischievous of all *Poysons* is *Opium*: of which having given an Excessive Quantity to a Servant, at first he he had *Convulsions*; then strange *Vomitings*, not able to let any thing go Down into his *Stomach*; a *Sleepiness* followed; all which time they kept him *Awake* as much as possible At last all of a Sudden, he Grew well, and called for *Victuals*.

A Salamander by S. Steno, n. 21. p. 377.

L. M. *Steno* writes from *Rome*, that a Knight called *Corvini* had assured Him, that having cast a *Salamander*, brought him out of the *Indies*, into the *Fire*, the Animal thereupon *Swell'd* presently, and then *Vomited* store of Thick *Slimy Matter*, which did *Put Out* the neighbouring *Coals*, to which the *Salamander* retired Immediately, *Putting them out* again in the same Manner, as soon as they *Rekindled*; and by this means saving himself from the Force of the *Fire* for the space of *two Hours*; That afterwards it Lived 9. *Months*; that he had kept it 11 *Months*, without any other *Food*, but what it took by *Licking* the *Earth*, on which it Moved, and on which it had been Brought out of the *Indies*, which at First was Covered with a *Thick Moisture*, but being dryed Afterwards, the *Urine* of the *Animal* served to *Moisten* the same; but being put upon *Italian Earth* it *Dyed* 3 *Days* after.

Observations on a Cameleon; by Dr. Jonath. Goddard. n. 137. p. 910.

LI. This *Cameleon* was a *Female*; The *Skin* appeared mixt of *Several Colours* like a Medley Cloth: *Lighter* towards the *Belly*; otherwise near upon it, *Equally Mixed*. The Colours discernable are *Green*, a *Sandy-Yellow*, a *Deeper Yellow* towards a *Liver Colour*; and indeed one may easily fancy some *Mixture* of all or most *Colours* in the *Skin*; whereof some are more Predominant at sometimes. There are some Permanent *black Spots* on the Ridge of the *Back*, and on the *Head*. Upon Excitation, or Warming, she becomes suddenly Full of *Black Spots* of the bigness of a Great pins Head Equally dispersed on the *Sides*, with small *Black Streaks* on the *Eye-Lids*; all which afterward do Vanish. The *Skin* is *Grained* with Globular Inequalities, like the Leather called *Shagreen*. The Grossest *Grain* is about the *Head*, next on the Ridge of the *Back*, next on the *Legs*; on the *Sides* and *Belly* Finest; Which perhaps in several Postures, may shew several *Colours*, and when the Creature

is

is in Full Vigour, may alſo have in ſome ſort *Rationem Speculi*, and *Reflect* the Colours of Bodies adjacent: Which, together with the *Mixture* of *Colours* in the *Skin*, may have given Occaſion to the Old Tradition of *Changing* into *All Colours*.

The *Eyes* reſemble a *Lens*, or *Convex-Glaſs*, ſet in a Verſatile Globular *Socket*; which ſhe turned *Backward*, or any way, without moving her *Head*. And ordinarily the one a Contrary or Quite Different way from the other. The *Tongue*, (which ſhe was never ſeen to put forth of late, though ſhe often opened her *Mouth* Wide) was eaſily drawn out, when ſhe was Dead, to half the Length of her Body, being Round and Full toward the End, like a *Peſtil*, with ſome Cavity at the Extremity: Having a *Bone*, about half the Length of it, toward the *Root*; over which alſo the Fore-part would Slip Backward. The *Bone*, where connected to the Body, is Bifurcated. She hath *Teeth* plainly to be Felt and ſeen above and Below, on the whole Circumference of the *Jaw*.

The *Trunk* of the Body, for the Structure of it, is all *Thorax*, or *Breaſt*, having *Ribbs* from the *Neck* to the ſetting on of the *Tail*. The *Ribbs* are of *two* ſorts; the *Larger* above tending Backward from the *Spine*, or *Back-Bone*; the *other*, from the Extremities of the *former*, tending Forward, as in the *Breaſts* of *Fowls*. There is a kind of *Diaphragm*, a Thin Tranſparent *Membrane*, as in *Birds*, ſeparating a ſmall Portion, about the 4*th* part of the *Cavity* next the *Belly*, from the reſt: Wherein is Contained a ſmall *Ventricle* connexed to the *Gula*; to which is Continued an *Inteſtine*, having ſome little *Convolution* in the Conveyance of it; which Extended might be about the length of the whole Body, with *Head* and *Tail*. The *Excrements* therein *Black* or of a *Sad French Green*. She had a ſmall Thin *Liver* Contiguous to the Upper part of the *Diaphragm*: In part Divided into 2 *Lobes*, of a *Blackiſh*, or very *Sad-Colour*. The *Lungs* ſeemed to be made of *Membranous-Cells*, or *Diviſions*, very thin and Tranſparent, reſembling a little Light *Froth*. The *Heart* was Firm and Fleſhy, but very ſmall; and at the very Fore End of all the *Breaſt*, or Body. At the Hinder End of the Body was a Double *Ovary*, conſiſting of 5 or 6 *Eggs* (of the bigneſs of the Greateſt Pins Heads, and ſticking to the Back) on each *Side*: of the ſame *Colour* and *Conſiſtence* with thoſe of the *Yolk* of an *Egg*.

Obſervations about the Lungs *of* Frogs; *by* S. Malpighi. n. 71. p. 2149.

LII. Miratus ſum valde, D. *Thruſtono* in *Teſtudinum*, *Lacertarum* & *Ranarum* Sectionibus non occurriſſe Commercium inter *Bronchia* & *Pulmones*, quos *Veſiculas*, à laxitate Exterioris *Pulmonum Membranæ* obortas, vocat; cum ſane immiſſa in *Trachæam* Fiſtula, & ſimul inſufflato Aere, *Pulmones* eidem *Tracheæ* appenſi hinc inde circa *Cor* turgeant; quod & ad Libitum Animalis frequenter accidit: Hi etiam, dum Aere turgent, ſi filo innodentur ut Sicceſcant, ſecti patenter oculis *Cellulas* & *Veſiculas*, evidenter *Membraneas*, exhibent. Et licet in *Ranis* brevis ſit *Bronchiorum* proceſſus, à *Larynge* tamen Bini Ductus, Semicircularibus aliquot Annulis conflati, in *Membraneas Veſiculas* hiant; atque ita ſuccedit *Inſpiratio* & *Expiratio*. At in *Teſtudine*, *Lacertis*

Diatriba de Reſpir. Uſu Primario.

& ſimilibus, oblonga *Trachea* in binos ſubdiviſa Ramos, Aerem *Pulmonaribus Veſiculis* ſubminiſtrat. Scio in *Ranis*, prope *Os*, hinc inde binas interdum turgentes erumpere *Veſiculas*, (procul tamen à *Pulmonibus*) quæ *Buccæ* ſunt Appendices, & Aere interdum, à *Pulmonibus* in *Oris* Cavitatem *Expiratione* propulſo, foras exilire.

Circa exaratos *Pulmones* Reticularem *Muſculum* locari ſcias, cujus *Carneos* Plexus, Sinus, & *Veſiculas* ambientes, alias ruditer delineavi Hujus Mirabilis Contextus patet in *Ranis*, & *Lacertis* præcipue; nam Multiplices *Carnei* Lacerti per Longum producuntur, & Tranſverſaliter elongatis Fibris invicem continuantur; intermediæ vero areæ Reticularibus *Carneis* Plexibus ulterius occupantur, non abſimili ritu ac in *Arborum* Foliis accidit: *Retis* autem enarrata hæc Minora Spatia rectis poſtremo Fibris, quaſi brevibus Tendinibus, pervaduntur. Mirabilis hic *Muſculus* non Exteriorem tantum *Pulmonum* ambit Regionem, ſed interiores quaſcunque *Veſiculas* & Sinus circundat, ita ut ſuo Motu ſingulas *Pulmonis* partes comprimendo, *Expirationem Sonumque* promoveat. Hæc eadem Structura in *Pulmonibus* Perfectorum Animalium proportionaliter obſervatur, & in *Agnorum* extremis præcipue *Lobulis*, Aere turgidis, & adhuc Mollibus, patet.

The Production of Todpoles; *by Mr.* Rich. Waller. n. 193. p. 523.

LIII. *Mar.* 12 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 appear'd *Fig.* 217. as Fig. 217. being a Round Black Globule Encompaſt 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 2*d. Day* *Fig.* 218. they appear'd as Fig. 218. The 3*d. Day* as Fig. 218. The 4*th. Day* as Fig. 219. *Fig.* 219. About the 6*th Day*, ſeveral of them were Looſed from their *Eggs*, and on the *Fig.* 220. 7*th.* and 8*th.* more of them: When they appear'd of the Shape of Fig. 220. *Fig.* 221. which in Fig. 221. is Repreſented bigger than the Life, that the Poſture they lay in may be ſeen the better. On the 7*th* and 8*th Days*, upon pricking of them with the point of a Needle they would Contract themſelves; ſome of them on the 8*th Day* would of themſelves bend their Bodies, but not Move out of their Place. 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 to the Bottom of the Water, and could not Riſe again. On the 9*th Day* they were not Viſibly increaſed in Bulk, only they Moved themſelves more Freely at the Bottom of the Veſſel.

Fig. 222. At about 14 *Days* End they appeared as Fig. 222. at which time they *Fig.* 223. *Swam* about in the Water by Moving their *Tails*, as Fig. 223. and ſome Rudiments of their *Fore-Legs* were Viſible, which looked Forked and like the Sprig of a *Plant.* At 3. *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

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 3 *Eggs* leaving a little ſpace, which being fill'd with *Air*, made them *Specifically Lighter* than Common *Water*.

LIV. The *Ductus Alimentalis* in *Animals* from its Uſes may ordinarily be Divided into 4. parts. 1. That which conveys the *Food*, as the *Oeſophagus*. 2. That which *Digeſts* or Corrodes it, the *Stomach*. 3. That which *Diſtributes* the *Chyle*, the *Inteſtines*. 4. That which Empties the *Fæces*, the *Rectum*: But a *Leech* is all *Stomach*, from one end to the other, and does devour at a Meal ſeveral times the Weight of its whole Body. The *Stomach* when ſwelled and ſtretcht with *Blood* is far bigger than the *Leech* it ſelf; nay ſeveral times Exceeds it. But I miſtook the Number, it was not *One*, but *Many Stomachs*; for the Cavity is Divided by ſeveral Tranſverſe *Membranes*, into *Divers* Diſtinct *Camera's*; but theſe *Membranes* in the Middle have a Hole that leads from One into the Other: But by the Pouching out of each ſide, each of theſe may be Reckon'd alſo *Two*; in all we may number, (there being 10 or 12 of theſe *Camera's* beſides theſe 2 long ones which at laſt run to the *Tail*) at leaſt 22 if not 24 *Stomachs*. But the *Rectum* which lies between the Forking of the 2 Laſt long *Sacculi*, or *Stomachs*, is but Small, and ſhort in reſpect of the Whole.

The Stomach of a Leech; by Dr. Edw. Tyſon. n. 144. p. 33.

LV. The *Upper Lip* of a *Leech* is ſtretched out into a Point, and falls upon the *Under*, which is Round like a *Crecent*, and Shorter. Its *Throat* on the inſide is covered with a great many White *Muſcles*, about 5 or 6 *Lines* long, as big as a ſmall Thread, and lying Parallel one to another, along its Body. When it applyes the *Mouth* to the Fleſh of any Animal, all theſe *Muſcles* Contracting themſelves, ſhe *Sucks* it with ſo great Violence and Greedineſs, that ſhe makes it enter in Form of a little *Pap* into its *Throat*. So that all the Effect of *Suction* terminating in a very little ſpace, of neceſſity the Fleſh muſt Break in that place.

The Anatomy of a Leech; by Mr. Fran. Poupart. n. 233, p. 722.

There is ſeen at the End of its *Tail*, a little Flat thing, exactly Round, the Border of which is elevated far above the *Tail*, and all round it, which it applies ſo Uniformly upon the Bodies to which it Faſtens it ſelf, that it Touches them in all their Parts; and then drawing up a little the Middle of this Flat part, without taking off the Edges, ſhe makes of it, as it were a little *Balm* which leaves a Cavity in its Middle. This excellent *Glue* faſtens ſo ſtrongly to the *Tail* of the *Leech*, that 'tis a hard matter to pull it away without making ſome Rent, eſpecially if you draw it perpendicularly from the Surface on which the Animal is Faſtened. It has always recourſe to this little inſtrument for Faſtening its Body, to the end it may not be ſuſpended in the Air, while

it Draws its *Nouriſhment* by *Suction*, or elſe that it be not Carried away with the Current of the Water, while it carries its *Head* here and there for Seeking its *Nouriſhment*.

Its *Gut* goes in a ſtraight Line from the *Mouth* to the *Anus*, as big as a Gooſes Quill, all along ſet with a great Number of little *Valves*: Some of which make a perfect *Circle* with a Hole in the middle, and others a *Half Moon*; ſome are ſhap't *Spiral* ways, and there is a Great one of this ſort near the *Tail*, faſhioned like a *Heart*, which leaves only a very little Hole, near which is found much *Yellow Fat*, which fills all the Cavity of the *Inteſtine* to *half* an *Inch*. Two little *Inteſtines*, or *Appendixes*, each *half* an *Inch* long, and of the bigneſs of the Feather of a little Birds Wing, pierce the *Great Gut*, in which they are Open at one end and ſhut at the other. All this ſtructure makes it Evident why the *Inteſtine*, which makes no *Convolutions*, and yet reſerves ordinarily but *Liquid Aliments*, does yet retain them to a Perfect *Concoction*.

A *Nerve* the Bigneſs of a Horſe Hair, all Black, Hard to Break, having *Knots* at a Diſtance one from the other, beginning at the *Mouth* of the Animal, paſſes over the Parts that ſerve for *Generation* in the *Male*: 'tis Faſtened in a ſtraight Line all along the *Gut* above, Ends at the little *Circle* in the End of the *Tail*, and in the Way ſends out *Branches* to the Right and Left Side, which go from every *Knot*. 'Tis very probable that by this *Canal*, the *Animal Spirits* run abundantly, which gives ſo great *Briskneſs* to this *Reptile*, which make it Ply into ſo many Faſhions, Swim ſo ſwiftly, ſo Properly, and Suck with ſuch Greedineſs.

The *Leech* is *Hermaphrodite*; the Parts of the *Male* Deſtinated to *Generation*, are placed where the *Neck* ought to be. The *Yard* which is about 2 *Inches* long, is *White*, Round, Hollow, and Griſtly: a part of the *Yard*, which is always in the Body, is a *Sheath*, about 15 *Lines* of an *Inch* long, as Big as a Little Birds Quill, covered with a fine *Membrane*, which Faſtens it ſtrongly to the *Belly*, round about a little *Hole* given the *Leech* for putting Out and In his *Yard* when he Pleaſes, and not for *Breathing* as the Antients ſaid. The other part of the *Yard*, which comes out 9 or 10 *Lines* of an *Inch*, is the Bigneſs of a Sowing Thread, and the End of it, for the length of 2 *Lines*, is Bigger than the Reſt. All the *Yard* is Hollow; and has in its Cavity a White *Muſcle* as big as a Hair, Faſtened only to the *Root* and *Head*, all the reſt being at Liberty. 'Tis with this *Muſcle* that the Animal Draws the *Yard* into its *Sheath*; which any one may Try by Cutting it at the *Root*, to Draw out this *Muſcle* with his Nails. On every ſide of the *Root* of the *Yard*, is a little White *Webb*, Flat, Oval, about 2 or 3 *Lines* long, reſembling *Small Guts* twiſted about, with a *Cartilaginous* Body, as big as a Double Thred, and 2 *Lines* long, which Faſtens to the *Root* of the *Yard*: in which 'tis probable it carries the *Prolifick* Matter. A little above the *Root* of the *Yard* between theſe 2 *Webbs*, there is a little *Griſtly Globule*, 2 *Lines* long, White, Hard, Hollow, Round, Oval, Sharp, inwardly covered with a *Membrane*, Wrinkled and full of a Milky Liquor. There is at the Head of this *Globule* a ſmall *Web*, like to an *Epidydymis*, whoſe little *Canal*, of the ſame piece with it,

creeps

creeps over the *Globule* and is Faſtned at the Point of it, and above the *Epididymus* are 2 *Glandes* exactly Round, each as big as a Grain of *Millet*. I take this little *Globule* to be a *Teſticle*. All along every ſide of the *Inteſtine* is a White Canal, or *Ovarium*, of the Bigneſs of a ſmall Twiſted Thread, and folded in a thouſand Manners, to which are faſtened with a *Tail*, as it were the Grain of a *Raiſin* to their *Grape*, many little *Globules* exactly Round, as big as a little Pea, full of a *Milky* Juice, and ſome little White *Eggs*, Griſtly, perfectly Round, as big as a Grain of *Millet*, Hard, which are hardly Broken, making a Noiſe, and full of a *White* Matter. There is in the *Inteſtine*, towards the end, a great *Valve* faſhioned like a *Heart*, with two little *Bags*, where begin 1000 ſmall Channels made of fine *Yellow Fat*, which fill the Cavity of the *Inteſtine* for *half* an *Inch*. It's probable that theſe Paſſages of *Fat* receive the *Prolifick* Liquor, to Conduct it into the *Ovarium*.

An Extraordinary Leech, *which torments the* Sword-Fiſh; *by S.* Paulo Boccone. n. 99. p. 6159.

LVI. There is an Extraordinary *Sanguiſuga*, or *Leech*, found ſometimes ſticking faſt in the Fiſh call'd *Xiphias*, or *Sword Fiſh*: *S. Boccone* gives it the Name of *Hirudo*, or *Acus Cauda utrinque pennata*, becauſe of its Working it ſelf into the Fleſh, and *Sucking* the *Blood* of the ſaid *Fiſh*. He deſcribes it to be of about 4 *Inches* long; the *Belly* of it White, *Cartilaginous*, and Tranſparent; without *Eyes* or *Head*, (that he could obſerve) but inſtead of a *Head*, it had a Hollow *Snout*, encompaſſed with a very Hard *Membrane*, differing in *Colour* and *Subſtance* from the *Belly*; which *Snout* it thruſts whole into the *Body* of the *Fiſh*, (as ſtrongly as an *Auger* is wound into a piece of *Wood*,) and fills it full of *Blood* unto the very Orifice. It hath a *Tail* ſhaped like a *Feather*, ſerving for its Motion, and under it two *Filaments*, or ſlender *Fibres*, longer than the Whole *Inſect*, whereby, it ſeems, it clings about *Stones* or *Herbs*, and ſticks the Cloſer in the Body of the *Sword-Fiſh*; of which it attacks thoſe Parts only where the *Fins* of the Fiſh cannot touch or Trouble it; the Obſerver affirming, that he hath often found it Sticking in the *Back* and in the *Belly*, and ſometimes Cloſe to the *Head*, ſometimes Cloſe to the *Tail* of that Fiſh, but always far enough from the *Fins*. Within its *Belly* he noted ſome *Veſſels*, like *Small Guts*, reaching from One End of it to the Other, which by the Preſſure of his *Nail*, he made reach to the Orifice of the *Snout* whence they retired back of themſelves to their Natural Scituation; they ſeeming to be the Inſtruments for *Sucking* the *Blood*, becauſe the *Snout* is, in it ſelf an Empty Part, deſtitute of *Fibres* and *Valves* to Draw and Suck with; whereas theſe *Veſſels* having a Motion reſembling that of a *Pump*, in which the *Snout* of this Animal ſerves for a *Sucker*, Drawing the *Blood* from One End to the Other: And the *Belly* of this *Inſect* being fram'd Ring-wiſe, the Structure ſerves to Thruſt the ſaid Inner Veſſels unto the Orifice of the *Trunk*, and to draw them back again.

This Creature as it *Torments* the *Sword-Fiſh*, ſo it is, by our Obſerver's Relation, *Vexed* it ſelf by another *Inſect*, which he calls a *Louſe*, of an *Aſh-Colour*, faſtened toward the *Tail* of this *Leech* as Firmly as a *Sea Snail* is to a *Rock*. 'Tis of the Bigneſs of a *Pea*, and hath an *Opening*, whence come out

many

many ſmall Winding and Hairy *Threads*. It hath not been Obſerv'd, (as far as our Author could Learn,) to Trouble, or to be upon any other Animal than this *Leech*.

The Odd Turn of Some Shell Snails; *by Dr.* M. Liſter. n. 50. p. 1011. n. 72. p. 2171.

LVII. I have found Two ſorts of *Shell-Snails*, Eaſily Diſtinguiſht One from Another, and from all beſides, becauſe the *Turn* of the *Wreaths*, is from the *Right* Hand to the *Left*, contrary to what may be ſeen in *Common Snails*. They are very ſmall, and might therefore well Eſcape thus long, the more *Curious Naturaliſts*; neither of them much Exceeding, at Leaſt in Thickneſs, a Large *Oat-Corne*.

The *Firſt I* thus Deſcribe: The *Open* of the *Shell* is pretty Round, the Second *Turn*, or *Wreath*, is very large for the Proportion, and the Reſt of the *Wreaths*, about the Number of *Six*, are ſtill *Leſſened* to a *Point*. This *Turben*, or *Conical Figure* is well near a *Quarter* of an *Inch*; the Colour of the *Shell* is *Duskiſh*, yet when the *Shrunk Animal* gives leave, you may ſee Day through it, and then it is of a *Yellowiſh* Colour. Theſe *Shells* are extreme *Brittle* and *Tender*.

The *Second* ſort ſeem to be much *Stronger* and Thicker *Shell'd*; they are well near *Half* as *long again* as the Other, and as *Slender*; they have the Exact *Figure* of *Oat-Corn*, being, as it were, *Pointed* at Both Ends, and the Middle a little *Swelled*. The *Open* of the *Shell* is not Exactly *Round*, there being a peculiar *Sinus* in the Lower Part thereof. I think you may number about 10 *Spires*; having their *Turn* from the *Right* Hand to the *Left*. The Colour of the *Shell* is of a *Dark* and *Reddiſh Brown*.

Both theſe ſorts of *Snails*, when they *Creep*, lift up the *Point* of their *Shells* towards a *Perpendicular*, and Exert, with Part of their Body, *two Pair* of *Horns*, as moſt of their Kind do.

Cat. Plant:

In *March* I have ſeen many of them *Pair'd*, and in the very *Act of Venery*: and therefore it is moſt Certain (contrary to the Opinion of *Ariſtotle*) that they *Engender*. But whether thoſe that are thus found *Coupled*, be *One* of them *Male*, and the other *Female*, or rather, as Mr. *Wray* hath Obſerved, that they are *Both Male and Female*, and do, in the *Act* of *Generation*, both *Receive* into Themſelves, and *Immit* a Like *Penis* (as it ſeems Probable to any Man that ſhall Part them) I ſhall not Determine.

Theſe *Snails* are to be Found, frequent enough under the *Looſe Bark* of *Trees*; as *Old Willows*, and in the Ragged *Clefts* of *Elms* and *Oak*, *&c.* and in No Other Place that *I* could Obſerve.

Some ſorts of Virginian Snails *by Mr.* J. Baniſter. n. 198. p. 671.

LVIII. 1. The Outſide of One Sort of *Land-Snails* in *Virginia* is of *Aſh-Colour*, inclining to a *Yellow*; the Inſide *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* it ſelf is *Tranſparent*; and you may plainly perceive by the *Opacity* there, that the *Body* of the *Animal* lyes 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

which by a kind of *Syſtole* and *Diaſtole*, Contracts and Dilates it ſelf; from this proceeds a *Limpid 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 Sailers Call it,) Exerts, may be *Analogous* to This.

2 This Deſcription of the *Heart* of a *Snail*, agrees well with the *Anatomy* thereof, made, and long ſince Publiſhed, by *Harder* and *Fr. Redi* — *By Dr.* Liſter. *ib.*

3. There is a *Small Snail* of the *Land Kind*, with a *Dented Aperture*, and an *Outward Coat*, on which it is *Hirſute*, or rather finely *Echinated*. I am apt to believe, that theſe (nor hardly any elſe) are not *Dented*, till they are at their *Full Growth*: For *I* find ſeveral *Small Ones* amongſt them, with an *Open Entrance*, that ſeem to belong to this *Kind*. — *By Mr.* Baniſter. *ib.* p. 672.

I have hitherto Obſerved very little Variety of *Naked Snails*; I know of but One Kind, which is a ſmall *Aſh Coloured* and *Spotted* One, and *Milky*, like Dr. *Liſter*'s, *Fig.* XVI.

LIX. In *Oct.* 1684. There were two Ladies at *Mynehead*, (where I then was) who told me that there was a certain Perſon living by the Sea-ſide in *Ireland*, who made conſiderable gain, by *Marking* with a Delicate Durable *Crimſon-Colour*, fine Linnen of Ladies, Gent. *&c.* Sent from many Parts of that Iſland, with their Names, or otherwiſe as they pleaſed, which was made with ſome Liquid Subſtance taken out of a *Shell-Fiſh*; and one of them thought it to be taken out of the *Shells* here *Figur'd* and Deſcrib'd. Hereupon *I* made many Experiments on all the *Shell Fiſhes I* had taken on that *Coaſt*; and at laſt Obtain'd that Delicate Colour they told me of. The whole Proceſs is as followeth. — *The* Purple-Fiſh, *by Mr.* Will. Cole. n. 178. p. 1278. — *Fig.* 224, 225, 226, 227, 228.

The *Shells* being Harder than moſt of other Kinds, are to be broken with a ſmart ſtroke of a Hammer, on a Plate of Iron, or firm piece of Timber, (with their *Mouths* downwards) ſo as not to Cruſh the *Body* of the *Fiſh* within: The Broken pieces being pickt off, there will appear a White *Vein*, lying Tranſverſly in a little Furrow or Cleft, next to the *Head* of the *Fiſh*, which muſt be digg'd out with the ſtiff Point of a *Horſe-Hair Pencil*, being made ſhort and Tapering. The *Letters*, *Figures*, or what elſe ſhall be made on the *Linnen* (and perhaps *Silk* too) will preſently appear of a pleaſant *Light Green* Colour; and if placed in the Sun, will Change into the following Colours; *i. e.* if in *Winter*, about *Noon*, if in the *Summer*, an *Hour* or two after *Sun Riſing*, and ſo much before *Setting*, (for in the *Heat* of the *Day*, in *Summer*, the *Colours* will come on ſo faſt, that the ſucceſſion of each Colour, will ſcarce be diſtinguiſht,) next to the firſt *Light Green*, it will appear of a *deep-Green*; and in few *Minutes* change into a *full Sea-Green*; after which in a few *Minutes* more, it will Alter into a *Watchet Blue*; from that, in a little time more, it will be of a *Purpliſh-Red*, after which, lying an *Hour* or

two

two, (ſuppoſing the Sun ſtill *Shining*) it will be of a very *Deep-Purple-Red*, beyond which the Sun can do no more. But then the *Laſt* and moſt *Beautiful Colour* (after Waſhing in ſcalding Water and Sope) will (the Matter being again put out into the Sun or Wind to Dry) be a fair Bright *Crimſon*, or near to the *Prince*'s *Colour*; which afterwards, (notwithſtanding there is no uſe of any *Stiptick* to *Bind* the Colour) will Continue the ſame, if well ordered; as *I* have found in Handkerchiefs, that have been Waſht more than 40 times; only it will be ſomewhat Allay'd, from what it was, after the *firſt Waſhing*. While the Cloth ſo writ upon, lies in the Sun, it will yield a very ſtrong *Fætid* ſmell, as if *Garlick* and *Aſſa-Fætida* were mix'd together.

The *Shells* are of *diverſe Colours*, but moſt part of them *White*; ſome are *Red*, ſome *Yellow*; others of both theſe Colours; ſome a *Blackiſh-Brown*; many of a *Sandy Colour*; and ſome few *Striped* with *White* and *Brown* Parallel Lines. It ſeems to be a kind of *Amphibious* Animal, alternately living in both Elements every *Tide*: For being out of their Native place, and in want of ſuch *Viciſſitudes*, they take this Courſe to find the Air; when any of them are put into a *Veſſel* of *Sea-Water*, [for in *Freſh* they ſoon Expire) after they have lain ſome time on the *Bottom* of the Veſſel, they Creeping to the *Superficies* of the Water, and by Extending a kind of *Lipp*, with their *Operculums*, cling to the ſide of the Veſſel or Pan, (which is moſt convenient for their Aſcent) with about *half* that Part above the Water; ſometimes creeping down under it, and Returning again to their Station, between Wind and Water.

Fig. 229.

I have found that ſometimes their *Veins* are Fuller and *Whiter*, and the Juice more *Viſcid*, at other times more *Flaccid* and *Watery*.

Theſe *Shells* are in great abandance on the *Sea-Coaſt* of *Somerſetſhire*: *I* have found them alſo on the Shores of *South-Wales*, oppoſite to it; and *I* doubt not but they may be found on the other *Coaſts* of *England*, eſpecially the *South* and *Weſtern* Parts, where *I* am almoſt aſſured *I* have formerly ſeen them, though then unknown to me. And *I* am of Opinion there may be found on our *Marine Coaſts*, ſome Bigger *Shells* which may have a *Colouring* Juice, though not the ſame with this, for that *I* know few Natural things, both of *Animals* and *Vegetables*, but what have diverſe ſorts of the ſame Kind, in the ſame Place.

I am aſſured by ſome who have Boyl'd, Dreſt and Eaten of this Fiſh, that they are wholeſome Food; as good at leaſt, and Taſte as well as *Lympots* or *Winkles*; only the *Fleſh* is ſomething Harder.

Perhaps this *Colouring Juice* may be the *Spermatick* and *Prolifick* Matter, by which they Propagate their Kind: Which *I* am inclinable to think, from its Conſiſtence, Virulent, and *Fætid Savor*. Or elſe it may be a Humour in this Animal, which by its *Vital Energy*, as the Spring of *Life* and *Motion*, ſupplies the want of *Heart*, *Liver*, *Blood*, *&c.* as in other *Exſanguineous Animals*.

There are many ſorts of this *Purple Fiſh*, differing in Bigneſs, Structure, Colour of the *Shell*, according to the Nature of the *Sea Grounds*, Depth or Shallow-

Shallowneſs of Water, Rocks, Gravel, Mud, as alſo the *Latitude*, where they are found; and ſo Differing alſo in the *Varieties* of *Colours* of the *Tinging Juice* in their *Veins*, as *Black*, *Livid*, *Violaceous*, *Deep Sea Green*, *Light* and *Deep Red*, *Amethyſtine*, *&c.* But the Beſt of all were found in the *Tyrian Seas*, near that Iſland on which the Renowned City of *Tyre* was built, (now an inconſiderable Town call'd *Sur*;) this was Celebrated, and Priz'd above all the reſt, for that it Excell'd them all in its illuſtrious Colour, call'd in former Ages by Divers Names; as *Oſtrum Sarranum*, *Pelagium*, *Venenum Tyrium*, *Purpuriſſum*, *Flores Tyriani*, *&c.* Almoſt all Authors agree, that it lies in a certain *Vein* in the *Fiſh*: And ſome of them mention it to be *White* and *Viſcous*, as this of ours is. This Excellent *Dye* ſeems to have arrived at its Higheſt Perfection in the Days of *Pliny* (being in the Reigns of the *Veſpaſians*) when the Artiſts of the Imperial City of the World, in Preparations of that *Tinging Succus* for *Dying* the *Robes* and other Veſtments of *Emperors*, *Senators*, *&c.* Strove to excel each other in new faſhion'd *Purples*, to Gratify the Luxuriant Exceſs of the Great ones of thoſe times, by Preparing and *Mixing* the Colour found in the ſeveral Sorts of theſe *Shells*. Theſe Colours ſold then at Great prices; that which was the Fine *Double Dyed Purple* of *Tyre*, call'd *Diabapha*, yielded 1000. *Roman Denarii* the *Pound*, which is Computed to be more than 30 *l. Sterling*: and this of *Ours*, being ſo Excellent a Colour, without other Preparation, or Addition of any thing to it, may now, or at leaſt hereafter, by farther improvement vie with the *Tyrian Purple*.

Johnſton, out of *Ariſtotle*, mentions a *Species* of theſe *Fiſhes*, under the Name of *Littorales quæ parvæ & Flore ſunt Rubro*; this agrees with *Ours*, which may be named *Purpura Littoralis (ſive Tenienſis) Parva Turbinata*.

Obſervations on a Tortoiſe; by Sir Geo. Ent: n. 194. p. 533.

LX. *Oct.* 7. 1651. *Teſtudinem* meam appendi, priuſquam *Latibulum* adiret, ibidem per totam Hyemem *Hybernatura*, pendebatque exacte 4 ℔. 3. Un. 7. *Dr*:

Oct. 8. 1652. Erutam è Terra *Teſtudinem* (nam ſe pridie *Humaverat*) appendi denuo, ponderabatque. 4 ℔. 6 *un.* 1. *dr.*

Mar. 16. $165\frac{2}{3}$. *Teſtudo* ſponte è *Latibulo* ſuo prodiit: Pendebatque 4 ℔. 4. *un.*

Oct. 4. 1653. *Teſtudo* poſtquam per aliquot dies *Jejunaſſet*, ſubtuſque Terram ſeſe *Abſcondiſſet*, inde educta atque appenſa Ponderabat 4 ℔. 5. *un.* *Oculi* (quos diu *Clauſos* habuerat) tum Aperti plurimum *Madeſcebant*.

Mar. 18. $165\frac{3}{4}$ *Teſtudo* è *Latebris* prodiens, & in *Lance* appenſa ponderabat 4 ℔. 4. *un.* 2. *dr.*

Oct. 6. 1654. *Teſtudo* ad *Hyberna* ituriens pendebat. 4 ℔. 9. *un.* 3. *dr.*

Die *Feb.* ultimo $165\frac{4}{5}$. *Teſtudo* ex *Hyemali* Crypta prorepens pependit 4 ℔. 7. *un.* 6. *dr.* Amiſit itaque Ponderis 1. *un.* 5. *dr.*

Oct. 2. 1655. *Teſtudo*, *Hyematum* itura, pependit 4 ℔. 9. *un.* prius autem aliquandiu *Jejunaverat*.

Mar. 25. 1656. *Teſtudinem* è *Latebris Hybernalibus* prodeuntem appendi, eratque 4 ℔. 7. *un.* 2 *dr.*

Sept. 30. 1656. *Teſtudo*, ſubtus Terram lturiens, pendebat 4 ℔. 12. *un.* 4. *dr.*

Mar. 5. $165\frac{6}{7}$. *Teſtudo*, de ſubtus Terram exiens, pondo erat 4 ℔. 11. *un.* 2. *dr. ſs.*

Unde ſatis liquet quam *Fixis.* Particulis hæc Animalia, quæ *ſub Terra* ſe muniunt adverſus *Frigus Hybernum*, conſtent: cum per tot *Menſes* tam Exigua pars Corporis in *Sudores* aut *Effluvia* abeat, ut an vivent necne, dum hunc in modum *Sepulta* jacent, merito ambigatur.

A Tortoiſe *living* 3 *days* ***without a*** Head; ***by M.....*** **n. 26. p. 480.**

LXI. S *Steno* writes from *Florence*, that a *Tortoiſe* had its *Head* Cut off, and yet it was found to *Move* its *Foot* 3 Days after.

A ſort of Oyſters *in* E. India; *by M.* Witzen. n. 203. p. 871. *Fig.* 230. *By Dr.* Liſter. *ib. p.* 872.

LXII. 1. In the River of *Goa* there is a *Shell* repreſented in Fig. 230 which holds a ſort of *Oyſter*: It is very ſcarce, and in the *Indies* as well as here in *Holland* the *Shell* Powdered is eſteem'd a good *Medicine.*

2. The like ſort of *Oyſter-Shells* is to be found in the *Weſt-Indies.* And conſidering the Hint given us by M. *Witzen*, of its being thought *Medicinal* at *Goa* where it is found; and alſo how that *Calcined Shells* are the moſt common Entertainments 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.

Shining Worms *in* Oyſters; *by* M. Auzaut. n. 12. p. 203.

LXIII. 1. M. *Auzout*, at the Intimation of M. *de la Voye*, Obſerved a *Shining* Clammy Moiſture in *Oyſters*, which ſtuck to the *Shell*, and being drawn out, *Shone* in the Air its whole Length (which was about 4 or 5 *Lines*,) and being put upon the Obſervers Hand, continued to *Shine* there for ſome Time. And afterwards cauſing more than 20 *Dozen* of *Oyſters* to be opened, in the Dark, he found this *Shining Subſtance* to be really *Worms* (as M. *de la Voye* had thought them before,) and thoſe of 3 ſorts; *One* ſort was *Whitiſh*, having 24 or 25 *Feet* on each ſide, forked, a Black ſpeck on one ſide of the *Head* (taken by him for a *Chryſtalline*) and the *Back* like an *Eele* ſtript off her *Skin*; the *Second* was *Red*, and reſembling the common *Glow Worms*, found at Land, with Folds upon their *Backs*, and *Feet* like the former, and with a *Noſe* like that of a *Dog*, and *one Eye* in the *Head*; The 3*d.* ſort was *Speckled*, having a *Head* like that of a *Sole*, with many Tufts of *Whitiſh Hair* on the ſides of it.

2. The Obſerver alſo ſaw ſome much Bigger, that were *Grayiſh*, with a Big *Head*, and 2. *Horns* on it, like thoſe of a *Snail*, and with 7 or 8 *Whitiſh Feet*: But theſe though kept by him in the Night, *Shined* not.

3. The

3. The 2 *first* ſorts are made of a matter eaſily Reſoluble, the leaſt ſhaking or Touch turning them into a *Viſcous* and *Aqueous* Matter; which falling from the *Shell*, ſtuck to the Obſervers Fingers, and *Shone* there for the ſpace of 20 *Seconds*: And if any little part of this matter, by ſtrongly ſhaking the *Shell*, did fall to the Ground, it appeared like a little piece of *Flaming Brimſtone*; and when ſhaken off nimbly, it became like a ſmall *Shining Line*, which was Diſſipated before it came to the Ground.

4. This *Shining* Matter was of Different *Colours*; ſome *Whitiſh*, ſome *Reddiſh*; but yet they both afforded a *Light*, which appeared a *Violet* to this Obſerver's Eye.

5. He Obſerved among them 2 more Firm than the reſt, which *Shone* all over; and when they fell from the *Oyſter*, *Twinkled* like a great *Star*, *ſhining* ſtrongly, and emitting Rays of a *Violet Light* by Turns, for the ſpace of 20 *Seconds*. Which *Scintillation* the Obſerver imputes to this, that thoſe *Worms* being *Alive*, and ſometimes Raiſing their *Head*, ſometimes their *Tail*, like a *Carpe*, the *Light* Increaſed and Leſſened accordingly; ſeeing that when they *ſhone* not, he did, viewing them by a Candle, find them *Dead*.

6. Forcibly ſhaking theſe *Oyſter-Shells* in the Dark, he ſometimes ſaw the whole *Shell* full of *Lights*, now and then as big as a Fingers End, and abundance of this *Clammy* Matter, both *Red* and *White*, which he judges to have been *Worms* Burſt in their *Holes*. And in the ſhaking he ſaw all the Communications of theſe little *Verminulous Holes* like to the *Holes* of *Worms* in *Wood*.

7. In more than 20 *Dozen* of *Oyſters*, he took no *Shell* (10 or 12 excepted) but it emitted *Light*: And he found ſome of this *Light* in 16 of the *Oyſters themſelves*.

8. This *Light* occurs more frequently in Big, than ſmall *Oyſters*; in thoſe that are Pierced by the *Worm*, oftner than in thoſe that are not; and rather upon the *Convex* ſide, than the other; and more in *Freſh* ones than in the *Stale*.

9. Having ſomewhat Scaled the *Convex*-ſide of the *Shell*, and diſcovered the Communication of the *Holes*, wherein the often mentioned *viſcous Moiſture* that has any form of *Inſects* is found, he ſmelt a Scent that was like the Water of a Squeezed *Oyſter*.

10. The *Worms* give no *Light* when Irritated, but if they do, the *Light* laſts but a very little Time: Whereas that which appears in thoſe that were not Angred before, continues a great while; the Obſerver affirming to have kept of it above 2 *Hours*.

LXIV. The *Pearl-Shells* in *Norway* and elſewhere do breed in *Sweet-Waters*. Their *Shells* are like to thoſe, which commonly are call'd *Muſcles*, but they are Larger. The *Fiſh* in them looks like an *Oyſter*, and it produceth a great Cluſter of *Eggs*, like thoſe of *Craw-Fiſhes*, ſome *White* ſome *Black*, *The Origine of* Pearl; *by M.* Chriſtophorus Sandius. n. 101. p. 11.

(which latter will yet become *White*, the Outer *Black-Coat* being taken off;) these *Eggs*, when Ripe, are Caſt out, and being caſt out they Grow, and become like thoſe that Caſt them. But ſometimes it happens, that one or two of thoſe *Eggs* Stick faſt to the ſide of the *Matrix*, and are not Voided with the reſt. Theſe are Fed by the *Oyſter* againſt her Will, and they do Grow, according to the Length of Time, into *Pearls* of Different Bigneſſes, and imprint a Mark both in the *Fiſh* and the *Shell*, by the Situation, conform to its Figure.

This Account I received from a *Dane*, call'd *Henricus Arnoldi*, an Ingenuous and Veracious Perſon, having by his own Experience found it ſo at *Chriſtiana* in *Norway*, and with great Seriouſneſs aſſured me of the Truth thereof.

Pearl Fiſhing *in* Ireland; *by Sir* Rob. Redding. n. 198. p. 659.

LXV. There are 4 *Rivers* in the County of *Tyrone* abounding with that ſort of *Muſcles* wherein *Pearls* are found, 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 call'd *Lough-Lean* in *Kerry*, which afford the like *Fiſh*; and no doubt there be many more that I do not know.

In the Warm Months before Harveſt is Ripe, whilſt the *Rivers* are Low and Clear, the Poor People go into the Water, and ſome with their Toes, ſome with Wooden Tongs, and ſome by putting a ſharpened 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 theſe *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. I my ſelf ſaw a *Pearl* bought for 50 *Shill.* that weighed 36 *Carrats*, and was Valued at 40 *l.* and had it been as *Clear* as ſome others produced therewith, it would certainly have been very Valuable. And a Miller took a *Pearl* which he ſold for 4. *l.* 10. *Shill.* to a Man that ſold it for 10 *l.* to another 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*. The *Young Muſcles* never have any *Pearl* in them.

The Natives, though very foul Feeders, will not Eat the *Fiſh*: Which ſeems to me to Cut like the *Oyſter*, *Blackiſh Green*. The *Shell* is faſtened with 2 *Tendons*, one at Each End, whereas the *Oyſter* and *Scallop* are with one only in the Middle. They ly in part opened, 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 Flouds from the Neighbouring Mountains, which are moſt Impetuous

after

after any little Rain. The *Insides* of the *Shells* are of an *Oriental* and *Pearly* Colour and Substance, like a flat *Pearle*, especially when first Opened; and I was told by an Ingenious Person, living upon the Place; that he had 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 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*, 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. 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. Yet sometimes 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, they found no *Pearl* at all in 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, Lest, 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*.

The Bottoms of these Rivers *I* observed to be part *Sandy*, part *Stony*, and part *Oazy*. Many of these *Muscles* ly in *Brackish* Water; being driven down the Rivers 4 or 5 *Miles* within the *Flowing* of the *Sea*. *I* have sometimes Observed the same *Pearl Clear* at one End, and *Dark* at the other.

LXVI. *Pectinem* nactus, ineunte *Januario*, ejus Dissectionem, qua potui accuratione, certe ex Uno Exemplari, instituí. Imprimis vidi *Cardinem* ex *Concava valva* leviter incurvari, & super injici alteri ac *Planæ Valvæ*, totoque illo Latere inter se *Cartilaginæ* quadam firmiter connecti: Item in ipso medio spatio *Cardinis* alteram Aterrimam Robustamque admodum *Cartilaginem* disponi. Hinc adeo mira illa Constrictionis vis, & fortasse *Planam Valvam*, Remi alicujus more, movendi, adque Pernicitatem & volatus quandam imaginem moliendam: de quo quidem non semel loquuti sunt veteres tanquam huic *Conchilio* peculiari.

The Anatomy of a Scallop; *by Dr.* M. Lister. *n.* 229. *p.* 567.

Apertis

Apertis autem *Valvis* hæc conſpicienda ſeſe exhibent. Ad Dextram & ſub *Cardine* Os Cucullatum, inſtar *Oſtreæ*. Velamina autem *Oris* conficiuntur ex Concurſu *Branchiarum* Exteriorum, quæ *Muſculoſæ* ſunt, totumque Animala *Capite* ad *Ani* exitum, ſcilicet ſiniſtram verſus è regione *Oris*, ubi inter ſe rurſus connectuntur, circumambiunt.

Ex iſto autem Pari *Branchiarum* Exteriorum ea quæ *Planæ Valvæ* incumbit, *Centro* ſuo adhæret ſuperiori Limbo ingentis cujuſdam *Muſculi* Rotundi, qui ex Rectis Angulis in Mediis *Valvis* inſeritur: Altera verò Exterior *Branchia* ſimiliter conjungitur, alteri Capiti ejuſdem *Muſculi Centralis*.

A *Muſculo* vero *Centrali* Ambæ iſtæ Exteriores ſive Spuriæ *Branchiæ* è Tenui *Membrana* & Pellucida admodum conſtant; Et ad Medias *Valvas* expanſæ, leviter iis adhærent, ut moveri inde non poſſint, tuenturque *Animalis Dorſum* ab Aquæ Injuria, intra *Valvas* receptæ; à loco vero iſtius Adheſionis, Craſſus quidem *Muſculus* Mirificus, tanquam Limbus, incipit. Is autem à me Depingitur tantum eo quo contrahitur modo; ſed in *Vivis* mirè Extenſilis eſt, etiam longè ultra *Margines Vulvarum*. Item Laciniis donatur, & ex *Rufo* variatur Lineolis Elegantiſſimis. Multis autem Diebus à Piſcatione noſtri *Pectinis* is Limbus haud obſcurè movebatur. *Uſum* autem ejus ſic intelligo, nempe ex Contractione Incurvata Introrſum, more Retis cujuſdam, cum ambo iſti *Branchiati Muſculi* extra *Conchas* emiſſi ſint, quicquid intra ſe complexi fuerint, ſibi mutuo adpliciti, ad ſe rapiunt in *victum Animalis*: Laciniis autem, extremis ſuis Marginibus tenuitur inciſis, Aqua *Marina* ſeparari videtur, retento *Cibo*. Si qui vero ſint alii ejuſdem Partis *Uſus*, me latent. Illud tamen addere lubet, hunc *Limbum* poſſe inſervire etiam *Mecationi* cujuſlibet *Animalis* Minuti aut *Piſciculi*, ex forti Compreſſione; itemque ex *Motu Undulatorio*, qui in eo valde Notabilis eſt, poſſe circumferri victum; eumque tandem, quacunque Parte *Circuli Retiarii* ſit, ipſi *Ori* exporigi, ita *Manus Locum* quodammodo ſupplet.

Ad Veras autem, certe quæ ita appellari ſolent, *Branchias* venio, hæ vero quatuor ſunt leviter *Flavicantes*, atque Pectinatim ſtriantur Eleganti quodam opere. Illæ autem *Branchiæ Muſculum* magnum *Centralem* circumambiunt, interque ſe comprehendunt ſive incumbunt *Utero*, ejuſque *Ovario*, certe *Partibus Generationi* dicatis. Harum autem Partium *Figuræ* rectè à me ante Delineatæ fuerunt, & jam *Vivo* quoque *Animali* video ejus partem inferiorem ex *Croco* reſplendere; Superiorem vero *Albicare*; juxta *Os* vero Proceſſus quidam, Duplici *Foramine* apertus, conſpiciendus eſt. Horum autem *Foraminum Unum*, *Vulvæ* Exitus Exiſtimandus eſt; & ſi *Androgyni* ſint *Pectines* (quod ſuſpicor ex perpetua ſimilitudine iſtius Partis in omnibus à me viſis, & vivo & Conditis) *Alterum*, ad *Maris* Genitale Membrum exerendum inſtituitur.

Ad *Caput* procedo; Huic *Os Labiis* circumſcriptum eſt *Rufeſcentibus*, more *Branchiarum* Internarum; & Brevibus admodum, & in noſtro Exemplari Criſpis, forte vitioſis & mutilatis. Sub ipſum vero *Cardinem* medium duo prægrandes veluti *Circuli* ſive Cavitates inſtar *Oculorum* (ut *Oculi* non ſunt) alicujus *Rhombi* Piſcis, oblique poſitorum.

Os

Os vero *Caputque* excipit Majuſculum *Meconium Subnigrum*, ad ſiniſtram vergens. Pone id *Cor* latitat, perque ipſum *Pericardium* Pellucidum conſpici poteſt; ex carneo leviter *Rufeſcit*. *Cordis Aorta* in *Branchias* diſpertitur. An vero id ſolum *Pericardium* ſit, quod ſcilicet proxime adjacet. *Nigro Meconio*, ſive totum etiam illud Figura *Rhomboide* comprehenſum, hæreo An pars ejus Inferior *Veſica Urinaria* ſit, quæro: Certe ex *Meconio* oritur *Inteſtinum Rectum*, ſuperque *Pericardium* equitans, ad Internas *Branchias* protenditur, & *Muſculo Centrali* adnectitur.

Muſculus autem *Centralis* Orbicularis eſt, *Albus* & Lævis. magna ſuperficiei ſuæ parte, quâ *Conchæ* adhæret; ex ſiniſtra vero parte, alio *Candidiori Muſculo* lacerato diſtinguitur, & *Conchæ* magis formatur.

Explication of the Figure.

Fig. 231.

aaa. Os, Caputque bb. Meconium Aterrimum c Cor, prout ſubter Membranam latitat. *dd. Pericardium*, an *Veſica Urinaria Rhomboides eeeee. Inteſtinum Rectum Pericardio* ſuper equitans. *fffff.* magnus *Muſculus Centralis*. *gg.* alius *Muſculus* laceratus *Teſtis* fortiter adhærens. *hhhh Branchiæ* Internæ. *ii. Uteri* prælongati Exitus, duobus *Foraminibus* diſtinctus tanquam in *Androgynis*. *kk. Uteri* pars ſuperior *Albida*. *lll. Uteri* pars Inferior *Crocea*. *mmmmm. Limbus Variegatus*, ſive *Muſculus Retiarius Secundus*.

LXVII. There are found on the Coaſts of *Malabar* and *Ceylon*, certain *Cockles* or *Shells*, in *Dutch* call'd *Kouk-horens*. Theſe *Shells* contain a *Fiſh* that lives in the Bottom of the Sea, fixt in 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*. This long Body which is Wrinkled like an *Andouille*, or *Sauſage*, is fill'd with a great Number of Round *Cells*, 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 faſtened 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*. It is obſervable that this *Matrix* has a kind of *Back-part* and *Belly*; the *Back* is ſomewhat like that of a *Sckelvis*, and of a *Grayiſh* Colour, the *Belly* is *Whiter*, and is that part which is fill'd with the *Cells* from one End to the other: The Skin which covers it is very like that of *Stock-Fiſh* or other Dryed *Fiſh*.

A ſort of Cockles *in* Eaſt India, *by M.* Witzen. n. 203. p. 870.

Fig. 232.

LXVIII. The *Stones* in the *Heads* of *Craw fiſh* are always on the *Outſide* of the *Stomach*, while the *Old Coat* ſticks on the *Back* of the *Fiſh*, and paſs *into* the *Stomach* as ſoon as they *Caſt* their *Coats*; *I* never ſaw them on the *Outſide*, when they have *Changed*, nor *within* before.

Stones *in the Heads of* Crawfiſh; *by Mr.* Ch. King. n. 266. p. 672.

I have Obſerved that the *Males* of *Crawfiſh* change their *Coats* a conſiderable time before the *Females*; for they always keep theirs till they have parted with their *Young* from their *Tails*.

LXIX. Thoſe

Cancelli, *or* Soldiers; *by Mr.* Will. Cole. n. 178. p. 1284.

Vid. Sup. §. LIX.

LXIX Thoſe who ſhall ſeek after the *Purple-fiſh* will find, as *I* have done, ſome of thoſe *Shells* in which are the *Cancelli*, or rather *Aſtaci*, unto which they are more like, and ſo may Miſtake: For thoſe little *Crabbs*, or *Craw-Fiſhes*, *I* have found in moſt of our *Engliſh ſhells*, excepting the *Bivalved*, and *Patella*'s. Of theſe Fiſhes in many parts, (eſpecially in the *Weſt Indies*,) there are many ſorts, and ſome very Large, which our Country-men there call the *Soldiers*; for that they ſay, they Enter by force, Kill and take Poſſeſſion of thoſe Houſes they have not built; and when they grow too big, forſake them, and enter into Larger. Whether that be True, *I* know not, but this *I* have found, when *I* have broken ſome of the *Shells* in which thoſe *Vagrants* are, ſo as not to Bruiſe their Bodies, and then put them *Naked* into the Water, *I* have beheld them with nimble ſpringing Motion, to Run to and fro till they find a Stone to hide themſelves under; which not finding, they bury themſelves in the looſe Sand. This Obſervation gave me full ſatisfaction, that they were not (*at* leaſt all the Kinds,) *Connate* and *Coaleſcent* with their *Shells*; and other *Teſtaceous* Animals of the Sea and Land are.

A Stellar-Fiſh; *by Mr.* Winthrop. n. 57. p. 1151. n. 74. p. 2221.

Fig. 233.

LXX. 1. *I* underſtand by the Fiſher man who brought me this *Fiſh*, that he *never ſaw*, nor Heard of any but 6 or 7 that were taken at ſeveral times by himſelf, not far from the *Shoals* of *Nantucket* (which is an Iſland upon the Coaſt of *New-England*) when he was Fiſhing for *Cod*. This *Stellar fiſh*, when it was alive, and firſt pulled out of the Water, was like a Basket, and had gathered it ſelf round like a Wicker-Basket, having taken faſt hold upon that *Bait* on the *Hook* which he had ſunk down to the Bottom to catch other Fiſh, and having held that within the ſurrounding *Brachia*, would not let it go, tho' drawn up into the Veſſel; until by lying a while on the Deck, it felt the want of its Natural Element, and then Voluntarily it Extended it ſelf into a *Flat Round* Form. The only Uſe that could be diſcerned of all that Curious Compoſure, wherewith Nature had Adorned it, ſeems to be, to make it as a *Purſe-Net* to Catch ſome other *Fiſh*, or any other thing, fit for its *Food*; and as a Basket of Store to keep ſome of it for future ſupply; or as a *Receptacle* to prepare and Defend the *Young Ones* of the ſame kind from Fiſh of *Prey*; if not to feed on them alſo (which appears probable the one or the other;) for that ſometimes there were found pieces of *Mackerel* within that *Concave*: And he told me, that once he caught one, which had within the Hollow of its Embracements a very ſmall *Fiſh* of the ſame Kind, together with ſome piece or pieces of another *Fiſh*, which was judged to be of a *Mackerel*.

He told me that every one of the *ſmalleſt Parts* had *Motion* when it was alive, and a Tenacious ſtrength; but after it was Dead and Extended to a flat Round, it was ſo Brittle that it could not be Handled without Breaking ſome Parts of it; but by carefully laying it to Dry, it was ſomewhat Hardned. I think (till a fitter *Engliſh* Name may be found for it) that it may be Call'd a *Basket-Fiſh* or a *Purſe-Net-Fiſh*.

2. This

2. This Elaborate Piece of Nature we may Call *Piscis Echino Stellaris Visciformis*, its *Body* (as was noted by Mr. *Hook*) resembling an *Echinus* or *Egg-fish*, the *Main Branches*, a *Star*, and the *Dividing* of the *Branches*, the Plant *Missel-toe*. This *Fish* spreads it self from a *Pentagonal Root*, which encompasseth the *Mouth* (being in the Middle, at *a.*) into 5 *Main Limbs* or *Branches*, each of which, just at the issuing out from the Body, subdivides it self into *two* (as at *i.*) and each of those 10 *Branches* does again (at 2.) Divide into *two* parts, making 20 *Lesser Branches*: Each of which again (at 3.) Divide into *two Smaller Branches*, making in all 40. These again (at 4.) into 80; and those (at 5.) into 160; and they (at 6.) into 320 They (at 7.) into 640; at 8, into 1280; at 9. into 2560; at 10. into 5120; at 17. into 10240; at 12. into 20480; at 13 into 40960; at 14. into 81920; beyond which, the farther Expanding of the *Fish* could not be certainly Traced, though possibly each of those 81920 small Sprouts or Threds, in which the *Branches* of this *Fish* seem'd to *Terminate*, might, if it could have been Examined when living, have been found to subdivide yet farther. The *Branches* between the Joints were not Equally of a Length, though for the most part pretty near; but those *Branches*, which were on that side of the Joint, on which the Preceding Joint was placed, were always about a *4th* or *5th* part Longer than those on the other side. Every of these *Branchings* seem'd to have, from the very *Mouth* to the smallest Twigs or Threds, in which it ended, a Double Chain or Rank of *Pores*, as appears by the *Figure*. The *Body* of the *Fish* was on the other side, and seemed to have been Protuberant, much like an *Echinus*, or *Egg-fish*, or *Button-Fish*, and, like that, Divided into 5 *Ribbs* or *Ridges*, and each of these seem'd to be kept out by two small *Bony Ribs*. *NS.* In the *Figure* is represented Fully and at Length, but One of the *Main Branches*, whence 'tis easie to Imagine the Rest, cut off at the *4th. Subdividing Branch*; which was done to avoid *Confusion*.

By ---- n. 37. p. 1153.

Fig. 233.

3. This *Star-Fish* is the *Stella Arboreſcens Rondeletii*; First Described by Him, and since by other Naturalists.

By Mr. Fran. Willoughby. n. 58. p. 1200.

LXXI. 1. *In Dec.* 1696. Two Remarkable *Marine Animals* were found in the *Stomach* of a Common *Cod-Fish* sold in the *Fish-Market* in *Dublin*. One of them by lying long in the *Stomach* was much Mangled and in part Digested: But the other was Compleat in all its Parts, and had received no manner of Alteration, save 'twas Dead. It was Bigger at one End, and went Taper or Gradually Lessening towards the other. It was $4\frac{6}{10}$ *Inches* Long; and where Largest, as it was $1\frac{6}{10}$ Broad, so it was about $3\frac{1}{2}$ *Inches* in Circumference: At the Smaller End, not above $\frac{4}{10}$. of an *Inch* Broad. It had neither *Shell*, *Crust*, *Scales*, or *Bone*, for its Covering, but was *soft*: Yet not Flabby, or Fleshy, as the μαλάκια, or *Mollia*, but rather *Membranous*.

A Scolopendra Marina; *by Dr.* Tho. Molineux. n. 225. p. 405.

Fig. 234, 235.

The *Back* or *Upperside*, was shaped Roundish, especially towards the sides; in the Middle it was something Flattened; the *Belly* was perfectly Plain. Along the middle of the *Back* ran a large *Stripe* from one extream to the other,

Fig. 234.

about $\frac{2}{10}$ of an *Inch* broad, towards the Upper-End, but ſtill narrower as it came towards the *Tail.* This *Stripe* was all covered with a ſhort ſoft ſort of *Down*, not unlike in Texture, Colour, and Subſtance, to that which grows on the *Back* of the *Leaf* of *Tuſſilago* or *Colts-foot.* Joining to the Edge of this *Stripe*, ran from one End to t'other, a *Liſt* about $\frac{2}{10}$ of an *Inch* broad, that covered both ſides of the Animal, and part of his *Back.* This *Liſt* or Verge, was thickly ſhagged, with a fine Soft *Hair* that grew very Thick, and about $\frac{1}{4}$ of an *Inch* long; of a moſt delicate *Changeable Red* and *Green* Colour, and of ſo ſparkling a vivid *Luſtre*, that nothing of this kind could ſhew more Beautiful. Among this ſoft *Hair* were thickly interſperſed, without order, an abundance (ſome *Hundreds*, I believe) of Black ſharp, Hard *Prickles*, about the ſame Length of the *Hair*, and the Thickneſs of a Hog's Briſtle, but much Harder, and very ſharp at the Points. The *Tail*, or ſmaller End, Terminated in the *Back*, with 2 Triangular Pellucid ſoft *Scales*, that covered the Orifice of the *Anus*, at which its Excrement was diſcharged; as *I* found when *I* opened it, for the Extremity of the *Inteſtine* was cloſely inſerted into this Paſſage.

Fig. 235. The Bigger End, tho' it had not any *Horns*, *Eyes*, *Ears*, *Noſe*, or *Gills*, yet becauſe 'twas oppoſite to the *Tail*, and here was the *Mouth*, we may properly enough call the *Head.* The *Mouth* was a very large Patulous Opening, for the Bulk of the Animal; not placed at the End, but ſomewhat Underneath, as part of the *Belly*, and could not be ſeen when the *Back* was turned Uppermoſt. The *Belly* was flat, and no ways Protuberant, Covered with a ſmooth Naked Skin, of a much lighter Colour than the *Back*, irregularly *Spotted*, with little dark *Browniſh Spots*, ſome larger ſome ſmaller: 'Twas Broader towards the *Head*, and grew narrower ſtill towards the *Tail*; where for about the ſpace of an *Inch*, it was curiouſly Pinched with little *Indentures*, reſembling the ſmall *Joints* in the *Tails* of ſome *Inſects.* Theſe *Diviſions*, or *Joints*, were ſtill ſhorter and cloſer to one another, the nigher they were to the Extremity of the *Tail.* Beginning cloſe at each Corner of the *Mouth*, and ſo along both ſides of the *Belly*, was Ranged a Row of *Feet*, in a cloſe continued Series down to the Utmoſt Tip of the *Tail.* The Largeſt were placed towards the *Mouth*, and Upper part of the Body, where they were about a *Quarter* of an *Inch* long, but downwards they grew Leſs and Shorter, ſtill gradually diminiſhing, the nearer they approached the End of the *Tail*; where they were ſo Minute, that they were inſenſibly loſt, and not eaſily to be Diſtinguiſhed by the *Eye.* *I* diſtinctly Counted, from the *Mouth* to the *Tail*, on one ſide 36, and *I* could not be poſitive but there might be ſtill more. From within the Body, through the middle of each *Foot*, paſt 4, 5, or 6 of the ſame ſort of ſharp hard *Prickles*, that were interſpers'd amongſt the ſoft *Hair.* Theſe were larger or ſmaller, and more or leſs in Number, according to the Size of the *Foot*, and gave it ſtrength and firmneſs inſtead of *Bones*: And likewiſe iſſuing forth beyond the End of the *Foot*, ſerved in lieu of *Toes*, or *Claws.* Joining to this Row of *Feet*, towards the *Back*, was Ranged along each ſide in a direct Line, a Series of ſmall, thin, ſoft,

flat

flat *Fins*, Face to Face in ſuch an Order, that each *Foot* was exactly anſwered by its Correſpondent *Fin*; ſo that their Number was preciſely the ſame with that of the *Feet*, and they kept the ſame Rule of Proportion in their Size, ſtill gradually diminiſhing, the nearer they approached towards the *Tail*. *I* diſtinctly counted of theſe, as of the Feet, 36 of a ſide; each *Fin* was curiouſly Fringed at the Edge, with the ſame *Beautifully Coloured Hair*, *I* before mentioned to have covered the Sides and part of the *Back*. By help of theſe *Fins* it performed *Progreſſive* Motion through the *Water* as a *Fiſh*; and by means of the *Feet* could *Creep* along the bottom of the Sea, as a *Reptile*.

When *I* Open'd it, *I* found a Thin *Membranous Gullet*, that led from the *Mouth* to the *Stomach*, about an *Inch* long. From this was continued ſtraight downwards the *Stomach*, of a *Whitiſh* Colour, and of a Tough Thick Texture, conſiſting of an Outward and Inward *Membrane*, with a ſort of *Carneous* Subſtance between; reſembling ſomewhat in Make, tho' not in Figure, the *Gizard* in ſome *Fowl*; 'twas as large as the upper Joint of a Man's little Finger. To this was annext the *Inteſtine*, of a very differing Colour and Subſtance from the *Stomach*; for 'twas *Reddiſh*, Soft and Tender, and of a much ſmaller Cavity; 'twas continued almoſt directly, or with little Circumvolution, to the *Anus*. The *Brain*, *Heart*, *Gills*, *Liver*, or *Parts* for *Generation*, (if they have any) were hardly, if at all, to be diſtinguiſhed.

The *Muſcular Parts* were very Curious, Large and Diſtinct. One long continued *Stripe* of *Red Fleſhy Fibres*, about the *Sixth* part of an *Inch* Broad, ran directly along the middle of the *Back*, from the *Head* down to the *Tail*. This *Fleſhy ſtripe* ſent out from each ſide, like ſo many *Rays*, 36 ſeveral *Pair* of ſmaller Lateral *Muſcles*, which by the conſiderable Interſtice between, *I* could eaſily diſtinguiſh from each other; making ſo Regular a *Figure* all together, that they might very aptly be Reſembled to the *Spine*, or *Back-bone*, of the *Paſſer Marinus*, or common *Plais-Fiſh*, when it is entire with all its *Ribs*, or *Tranſverſe Proceſſes*, iſſuing by *Pairs* from both ſides of each *Vertebra*, from the *Head* down to the *Tail*. In this manner every particular *Foot* and *Fin* were ſupplied with their Correſpondent *Muſcles*, to give them *Motion*, either together or apart, as the Neceſſity or Deſign of the Animal required. And moreover, conſidering this ſort of *Muſcular Mechaniſm*, with the Taper ſhape of the Body, and likewiſe the Poſture and Uſe of the many *Prickles* interſperſed among the *Hairy Shag* that covered the ſides; it ſeems very evident to me, that beſides its *Progreſſive* Motion, it had alſo the Power, (as have moſt of the *Many-footed Land-Reptiles*, and ſome *Water Inſects I* have obſerved) of Contracting its Body in ſuch a way, that Bending its Head Inwards, it Roll'd the reſt of the Body Round it as a Center, making a Figure like a Rope *Coil'd* into a *Helix*; and in this Poſture, beſet almoſt quite round with *Sharp Prickles* ſtarting out directly forward, it Guarded it ſelf from Violences that might Annoy it.

This Animal, on many Accounts, I think may properly be Ranged with the *Scolopendræ Marinæ* deſcribed by *Rondeletius:* but it may be diſtinguiſht from them by Calling it *Scolopendra Marina à Capite Latiori verſus Caudam ſenſim gracileſcens, Limbo Pulcherime Hirſuto Spinuliſque crebris interſtincto è Mari Hibernico.*

Explication of the Figures. *n.* 234, *and* 235.

a a a a a. The *Downy Liſt* that Runs along the *Back*; *b b.* The two *Triangular Scales* that Cover the *Anus*; *c c c c c c c c.* The *Verge* of Fine *Changeable Green and Red Hair* that covered the ſides, and part of the *Back*; *d d d d d d d.* The Hard ſharp *Prickles* interſperſed among the *Hair*; *eeeee.* The *Skin* of the *Belly*; *f f f f.* ſeveral *Inciſures* reſembling *Joynts* towards the *Tail*; *g g g g g.* *Darker Spots* in the *Skin* of the *Belly*; *h h h h h.* The *Feet* of Each ſide the *Belly*; *I I I I I.* The *Fins* with their *Hairy Fringe* behind the *Feet*; *k k.* The Large *Mouth* Opened Wide.

By Mr. Dale. *n.* 249. *p.* 51.

2. I Obſerved at *Harwich* in 1698. divers of theſe *Marine Animals* brought up by the Fiſhermen, which they call *Sea-Mice.* They are Deſcribed by *Rondeletius*, (and by *Mouſett* and *Johnſon*) Figured under the Title of *Phyſalus*, but Badly.

By Dr. Molyneux. *n.* 251. *p.* 127. De Piſcibus. *L.* 15. *p.* 429.

3. I think if we'l ſuppoſe that *Rondeletius* ſaw what he Deſcribes under the Title of *Phyſalus*, we can't imagine that he and I had the ſame Object before us. This will appear Evident by comparing his Words with Mine; For he ſays of His Animal *Ore caret*, whereas I ſay, the *Mouth* of mine was a *Very Large Patulous Opening for the Bulk of the Animal*; He ſays, *in Medio Latior eſt & Extrema Gracileſcunt, Pudendi Muliebris ſpeciem referens*, whereas I ſay, *'twas Bigger at One end, and went Taper, or gradually Leſſening, towards the other*; he ſays, *in Dorſo Tumores parvi eminent, Verrucas Piſcatores noſtri vocant*, I am ſure *I* could obſerve none ſuch but ſay, *the Back was covered with a Short ſoft ſort of Down, in Colour, Texture and Subſtance like that which grows on the Leaf of Tuſſilago*; *Venenatum experti ſumus*, ſays He, whereas *I* found Two of the *Scolopendra*'s *I* deſcribed in the *Stomach* of an Animal that had Devoured them, and *Digeſted* one as its Natural *Food* and ſuſtenance, from whence we may conclude that they are not *Poyſonous*; and beſides *Rondeletius* his *Icon* agrees exactly with his own *Deſcription*, whereas it neither agrees with my *Deſcription* nor my *Figure*,

Vol. 3. *p.* 87.

But *I* have lately, in the *Acta Med. & Phil. Hafn.* of *Tho. Bartholine*, met with the *Figure* of a *Sea-Inſect* under the Name of *Vermis Aureus vel Species Erucæ Marinæ rurior*, which *I* am confident is the ſame with Mine; tho' *Bartholines Figure* is Faulty, and the *Deſcription* ſhort, Falſe, and Imperfect.

De Inſect. L. 5. *Cap.* 15.

And *I* am apt to think that *Ulyſſes Aldrovandus* Deſign'd Our *Scolopendra* by the *Scolopendra Marina Lato Corpore Subcaſtaneo velut Pedibus Innumeris longiuſculis Aurei Coloris*; tho his *Icon* be much worſe than *Bartholines*, and requires ſome ſtrength of Phanſy, to gueſs whether it be Really ſo or not.

LXXII. At

LXXII. At Sir *Juſt. Iſham's I* lately ſaw 4 very large *Carps* that a Boy took with his Hands in the *Heat of the Day*: His way was this, he Waded into the *Pond*, and then returning to the ſides he would Grope them out in the Sedge or Weeds, and *Tickling* them with his Fingers under the Belly, quickly removed his Fingers to the *Gills*, and threw them out upon the Land; and this he did not in a Narrow but Large *Pond*, of about an *Acre* of Ground. He knows when he is upon the *Carps Layer* (if *I* may uſe that Term) by the *Warmth* of the Water: and then he immediately repairs to the ſides to purſue his Game.

A way of Catching Carps; *by Mr.* J. Templer. n. 95. p. 6066.

I may here note, that *Carps* (and *I* ſuppoſe all other *Fiſh* that keep near the *Bottom*) keep always in a *Shoal* And when they move from one place to another, they Raiſe the *Mud* in the *Heat* of the *Day*: So that you may eaſily obſerve, what *Road* they travel, by *Muddy* Tincture near the bottom of the Water; and that ſo certainly as you cannot eaſily miſs of Covering the Greateſt part of them with a *Caſt-Net*.

LXXIII. From *Lamport* towards *Bridgewater*, *Eeles* are ſo cheap in the *Froſts* of Winter, that they Vend them for little. Their abundance is from hence, that as the People Walk, in the *Froſty Mornings*, on the Banks of the River, they diſcern towards the Edges of the Banks, ſome parts not *Hoar*, as the reſt, but *Green*: Where ſearching the *Holes* of the Banks, they find Heaps of *Eeles*.

Eeles *Diſcovered plentifully in Froſts in* Somerſetſhire; *by Dr.* J. Beale. n. 18. p. 323.

LXXIV. *I* have lately met with Relations of two *very Large Eels* caught upon the Coaſt of *Eſſex*: they both had all the *Characterizing Notes* of the *Eel*, and Wanted thoſe *Barbles* which the *Eel* ſometimes hath not, but the *Conger* is Never without. The *Firſt* was taken ſomewhere about *Crickſea*: Its *Length* from the Tip of off the Noſe to the Tail's End, was 5 *Foot* 8 *Inches*; and in *Circumference* it was 22 *Inches*. The *Other* was taken in *Maldon-Channel* about a *Mile* below the Town: the *Length* of which was 7 *Foot*; the *Circumference* 27 *Inches*; the *Weight* 36 *Pounds*; and out of its *Belly* was taken 5 *Pounds* of *Fat*; its *Skin* was *Black*, and being ſtuft, is ſtill preſerved at *Maldon*. This *Fiſh* was ſuppoſed to have been brought down thither by the great *Floods* at the Breaking of the Laſt *Froſt*: becauſe of a Hurt it had on its *Back*, which the Fiſherman who caught it told me, he did conjecture might be from ſome *Mill* it muſt paſs through.

Two very Large Eeles; *by Mr.* Dale. n. 238. p. 90.

LXXV. 1. The Reaſon of the Difficulty of Diſcovering the manner of the *Generation* of *Eels*, is the *Different Way* of *Generation*, and that they *Breed* in *February*, a time when Few are taken but what are Preſerved in *Trunks* or *Ponds*, where they *Breed* not. This *I* Examined 2 *Years* ſince, in ſome taken at a *Mill* in which Holes they *Breed*, eſpecially near Gravelly *Shallows*; and found *one* with *Egg*, *another* with 6 *Young ones* in the *Great Inteſtine*, which

The Generation *of* Eels; *by Mr.* Benj. Allen. n. 231. p. 664.

which *I* call the *Strait Bowel* that Deſcends immediately from the *Pylorus* until the *Winding* begins. They were faſtened to very ſmall *Placenta* each, which was Fixed to the *Inteſtine*; the *Meſeraicks* at that time were very Turgid. The *Eggs* were on the Outſide of the *Inteſtine*. It is certainly *Viviparous*, and *Feeds* not, at leaſt *Groſs*, in the *Winter*; during all which they lye ſtill, till they have Diſcharged their *Young*. The *Parts* Diſtinguiſhing the *Sex* are Diſcoverable; thoſe of the *Male* Affixt to the Extremity of the *Kidney*: the *Female* had a *Slender Gland* Tranſverſly lying near the Bowel; but of this *I* dare not ſay much.

In *Salt-Water Eels*, *I* have not found the like, though Searcht for; becauſe, *I* am of Opinion, they do not *Breed*, but are the ſame with the *Freſh-water* ones, ſince ſuch Multitudes of *Freſh Water-Eels* go down to the *Sea*, and cannot Return, yet are never taken at *Sea*, among the many brought hither; and there are *Veſtigia* of their *Beards* in the *Freſh-Water-ones*.

By Mr. Dale. n. 238. p. 92.

2. That the *Generation* of *Any Animal* cannot be *Equivocal* or *Spontaneous*, but from animal *Parents* hath been ſo well by many Undeniable Arguments Aſſerted, and by Multiply'd Experiments Confirmed, by thoſe Famous and Celebrated *Virtuoſi*, *Malpighius*, *Redi*, *Swammerdam*, *Leewenhoeck*, Mr. *Ray*, and Others, that *I* think there is no room to doubt but that *Eels* have the ſame Original: But it is much Diſputed amongſt Learned Naturaliſts, whether *Eels* have *Diſtinct Sex* or are *Hermaphrodites*. Mr. *Allen* Affirms the *Parts Diſtinguiſhing* the *Sex* to be Diſcoverable: But M. *Leewenhoeck* could never Find any ſuch thing; For *All* thoſe that he hath Diſſected, he Declares, were Provided with an *Uterus*: From whence he doth conjecture them to be *Hermaphrodites*, and beſides the *Uterus* to be provided with *Maſculine Seed*.

Another Controverſy about the *Generation* of *Eeles* is, whether they are *Oviparous* or *Viviparous*.

I find many ingenious Perſons who firmly Believe them to be *Oviparous*: But their Sentiments are Contrary to the Obſervations of *Walter Chartwynd* Eſquire who in the Month of *May*, found them to be *Viviparous*, by Cutting open the *Red Fundaments* of the *Females*, from whence the *Young Eeles* would iſſue forth *Alive*.

And although Mr. *Allen* Affirms them to be certainly *Viviparous* yet his Obſervations concerning the Place of their *Conception*, *I* cannot conceive to be Conſonant to that Care and induſtry of Nature, in providing convenient Receptacles for preſerving the *Fætus*; neither is it Agreeable to Reaſon to believe, that when Nature hath provided an *Uterus* in *All Animals*, not only the *Viviparous*, and ſuch as only Cheriſh the *Embryo in Utero*, but in the *Oviparous* alſo and *Inſects*, the *Eel* and *Xiphia*, or *Sword-Fiſh*, ſhould be the only Animals without it; much leſs that the *Guts*, appointed by Nature, for the *Secretion* of *Nouriſhment*, and the *Expulſion* of the *Fæces*, and are always

always in Motion, ſhould be the Place of *Generation* in any Animals though we may Allow *Eels* not to *Feed Groſs* in the *Winter*. On the contrary, that the *Eele* hath an *Uterus*, is aſſerted by M *Lewenhoeck*, who never found them without; which perhaps is that Part which Mr. *Allen* Names a *ſlender Gland, tranſverſely lying near the Bowel.*

Beſides, Nature having in all Animals, *Oviparous* as well as *Viviparous*, hitherto Diſſected, provided not only an *Uterus* but alſo *Tubes* (firſt obſerved by *Fallopius*) for the conveying the *Ovum* from the *Ovarium* to the *Uterus*, another great Difficulty and Objection lieth againſt Mr. *Allens* Obſervations; and in which indeed he ſeems to Contradict himſelf; for whereas he ſaith, that in one *Eel* he found *Eggs*, and thoſe on the *Outſide* of the *Inteſtine*, but in the other, 6. *Young Ones*, each faſtened to a ſmall *Placenta*, and thoſe *VVithin* the *Great Inteſtine*, How, and by what Paſſages, could thoſe Eggs come into the *Inteſtine*, to be formed and invigorated; unleſs we may ſuppoſe they do, like the *Embroy's* of ſome ſorts of *Inſects*, which for the conveniency of *Food*, Eat their own way into their *Heterogeneous*, or Aſſumed *Matrices*.

LXXVI. In *April* 1669. at *VVeſt-Cheſter*, *I* met with a *Young Porpeſs*, caught upon thoſe Sands. The Length was 3. *Feet* 7. *Inches*; A ſtring of 2. *Feet* and 2. *Inches* Girded him in the thickeſt place; The ſhape of his Body was not much unlike that of a *Tunny-Fiſh*, only his Snout Longer and Sharper; his *Skin* was Thin, Smooth, and without *Scales:* In an *Old* and well Grown Fiſh, it's like the *Skin* may be Thick and Tough, as *Rondeletius* repreſents it. His *Fins* are *Cartilaginous*, and Flexible, not ſharp or prickly, as the Antients report them. On his *Back* he hath only One, which was diſtant from the Tip of his *Snout* 1 *Foot* and 9. *Inches*, and the *Baſis* of it in Length $5\frac{1}{2}$. *Inches*; ſo that meaſuring from the Tip of his *Snout*, to the End of the *Tail*, it was Scituate ſomewhat below the Middle of the *Fiſhes* Length. On the *Belly* it had only one *pair* of *Fins*, $9\frac{1}{2}$. *Inches* diſtant from the Tip of the *Lower Mandible*, much about the Place, where the foremoſt pair of *Fins* in other *Fiſhes* uſually grow. The *Tail* is Forked, of the Figure of a Creſcent; the Breadth thereof from Angle to Angle 11 *Inches*; and the Plain of it lyes *Parallel* to the *Horizon*, as in all others (I ſuppoſe) of the *Cetaceous Kind:* The Reaſon whereof *I* conceive to be partly to ſupply the Uſe of the Hindmoſt Pair of *Fins* in other *Fiſhes*, which ſerve to Ballance the Body, and keep it up in the Water, and partly, to facilitate the Fiſh's Aſcent to the Top of the Water (to which he can immediately raiſe himſelf by a light Jerk of his *Tail* thus placed) for the uſe of *Reſpiration*, which is neceſſary for him.

Obſervations on the Anatomy of a Porpeſs; by Mr. J. Ray, n. 74. p. 2220. n. 76. p. 2274.

For, doubtleſs if violently Detained *Underwater*, he would in a ſhort time be *Suffocated* or *Drowned*. Immediately under the *Skin* lay the *Fat*, which as *I* remember our Seamen call the *Blubber:* It was firm, full of *Fibres*, and in this ſmall Fiſh, of an *Inch* Thickneſs, encompaſſing and encloſing the Whole Body *Back*, *Belly*, and *Sides*. The *Uſe* whereof *I* conceive to be, 1. To keep the *Cold water* at a Diſtance from the *Blood*, which is, *I* believe Actually and

to

to the Touch *Hot*; 2. To keep in the *Hot Steams* of the *Blood* from Evaporating, by that means alſo Preſerving and Maintaining its *Natural Heat*; 3. Perhaps alſo, to *Lighten* or Counterpoiſe the Body of the *Fiſh*, which would otherwiſe be too *Heavy* to Move and Swim in the Water. Under the *Blubber* lay the *Muſculous Fleſh* like to that of *Quadrupeds*, but of a Darker Colour.

The Body was Divided into 3. *Regions*, or *Ventres*, like a *Quadruped's*, *viz. Head*, *Breaſt*, and *Belly*. The *Veſſels* and *Viſcera* in each *Venter*, for the main the ſame as in *Quadrupeds*; The *Abdomen* was encompaſſed about with a ſtrong *Peritonæum*; The *Guts* Joyned to the *Meſentery*, and of a very great Length, by Meaſure 48. *Foot*, without any Difference or Diſtinction of *Great* and *Small*, neither was there any *Blind Gut*, or *Appendix*, that *I* could find; The *Stomach* was of a ſtrange Make, being Divided into 2. Large Bags, beſide other ſmaller Ones: *I* found nothing in it, but a good Number of thoſe little Long *Fiſhes*, which our Fiſhermen dig out of the *Sands* at *Low-water*, and therefore call'd in ſome places *Sand-Eels*, by ſome they are call'd *Launces* and by *Geſner*, *Ammodytæ*. The *Liver* was of a Moderate ſize, ſcituate in the Right ſide, and Divided into 2. *Lobes*, having no *Ciſtis Fellea*, or Receptable of *Gall*, annexed The *Pancreas* Large, ſticking cloſe to the 3*d*. *Bag* of the *Stomach*, into which alſo it's *Ductus* Enters, and Emptys it's ſelf. The *Spleen* was ſmall and roundiſh: The *Kidneys* Large, ſticking cloſe to the *Back*, and lying contiguous one to the other, made up of many little *Kernels*, like to, but much Leſſer, than thoſe of an *Ox*; of a Flat Figure, having no *Pelvis* in the Middle, but the *Ureters* going out at the Lower End. The *Urine Bladder* was Oblong, and Little for the Bulk of the Animal, having on each ſide a *Round Ligament*, made of the *Umbilical Arteries* degenerating: The *Penis* long, ſlender, having a ſmall ſharp *Glans*; it appears not Outwardly, but lies Hid in it's *Sheath* within the Body, Doubled up, or rather Reflected, in the Form of the Letter S. as is that of a *Bull*. The *Teſticles* ly within the Cavity of the *Abdomen* on each ſide, as they do in an *Hedg-Hog*, and ſome other *Quadrupeds*, of an Oblong Figure; for their *Internal* Subſtance, *Seminal Veſſels*, both *Præparantia* & *Deferentia*, *Epididymides*, *Vas Pyramidale*, *Corpus Varicoſum*, and *Glandulæ Proſtatæ*, exactly like to thoſe of *Quadrupeds*. The *Seminal Veſſels* Perforate the *Urethra* with many little Holes; whereof 4 are moſt Conſpicuous, ſomewhat above the *Neck* of the *Bladder*.

It had 6. *Short Ribs* that had no *Cartilages* and 7. that had *Cartilages* (on Each ſide I mean.) The *Breaſt-bone* was very ſmall. The *Diaphragm* was *Muſculous*, as in *Quadrupeds*. The *Heart* Large, included in a *Pericardium*, had it's 2. *Ventricles*, it's *Valvulæ Sigmoides Semilunares*, *Tricuſpides & Mitrales*, it's *Coronary Arteries* and *Veins*: and in a word, the whole Structure and Subſtance of the *Heart* and *Lungs* agreed exactly with that of *Quadrupeds*. The *Wind Pipe* was very ſhort, as it muſt needs be, the *Fiſh* having no *Neck*; the *Larynx* at Top was of a ſingular Figure, running out with a Long Neck, and a Nob at the End like an Old-Faſhioned *Ewer*.

The

The *Pipe* in the *Head* through which this *Kind* of *Fiſh* draw their *Breath*, and *Spout* out Water, lies before the *Brain*, and ends Outwardly in *one* common *Hole*, but Inwardly it's Divided by a *Bony Sceptum*, as it were into 2 *Noſtrils*; but below again it opens into the *Mouth* in *one Hole*. This lower Orifice is furniſhed with a ſtrong *Sphincter*, whereby it may be ſhut and Opened at pleaſure: and above this *Sphincter* the ſides of the *Pipe* are lined with a *Glandulous Fleſh*; which if you preſs, you will ſee ſtart out of many little Holes, or *Papillæ*, into the Cavity of the *Pipe*, a certain *Glutinous Liquor*. Above the *Noſtrils* is a ſtrong *Valve* or *Membrane* like an *Epiglottis*, which ſerves to ſtop the *Pipe*, that no Water get in there againſt the *Fiſh's* Will. Within the *Fiſtula* are 6 Blind Holes having no Outlet; *four* Tending toward the *Snout*, *two* above the *Valve* that ſtops the *Noſtrils*, and *two* Beneath it; and *two* Tending towards the *Brain* having a long but narrow Cavity for the *Uſe* of *Smelling*, as I conjecture, though Opening the *Brain I* could find neither *Olfactory Nerves* nor *Proceſſus Mammillares*.

The *Eyes* are ſmall conſidering the Bigneſs of the *Fiſh*, and Scituate at a good Diſtance from the *Baſis* of the *Brain*. The *Snout* is long, and Furniſhed with very large *Muſcles*, to *Root* or *Turn up* the Sand at the Bottom of the Sea for to find *Fiſhes*; as appears in that we found nothing in his *Stomach* but *Sand-Eels*, which, as was intimated before, lye Buried in the *Sand*. The *Brain* and *Cerebellum* are, for the ſubſtance and *Anfractus* of them, the ſame with thoſe of *Quadrupeds*, only differing in the *Figure*, as being ſhorter; But what they want in Length, they make up in Breadth. They have alſo the like *Teguments* called *Dura* and *Pia Mater*; *Six* or 7. *Pair* of *Nerves*, beſides the *Optick*; the ſame *Ventricles*: only in the *Medulla Oblongata* we obſerved not thoſe *Protuberances* call'd *Nates* and *Teſtes*. The *Skull* (*Cranium*) is not ſo ſtrong and thick, as in *Quadrupeds*: but *Articulated* after the ſame manner to the *Firſt Vertebra* of the *Back-bone*. This largeneſs of the *Brain*, and Correſpondence of it to that of *Man*, argue this Creature to be of more than ordinary *Wit*, and *Capacity*; and make to ſeem leſs Fabulous and Improbable thoſe Antient Stories related by *Herodotus*, *Pliny* the *Elder*, and *Pliny* the *Younger*.

In each *Jaw* it had 48. *Teeth*, ſtanding in a Row like to little Blunt Pegs. The *Tongue* was Flat above of an Equal Breadth to the very Tip, which was *Toothed* or *Pectinated* about the edges, *Tyed* firmly down to the Bottom of the *Mouth* all along the Middle, as *Ariſtotle* truly ſaith.

Whence *I* cannot but wonder, that *Rondeletius* ſhould herein Contradict *Ariſtotle*, and Affirm (contrary to Truth, as *I* believe) *quod Dolphinis Lingua eſt Mobilis, quæ modo Exeri modo Condi poteſt*; unleſs perchance in this particular the *Dolphin* Differs from the *Porpeſs*. For the *Porpeſs* is, as *I* take it, the *Phocæna* of the Antients, which is a leſſer ſort of *Dolphin*, and not the *Dolphinus*: at leaſt if the *Fiſh*, we are Deſcribing, were a *Porpeſs*; for the *Teeth* of this *Fiſh* were leſſer than, and of a Different Figure from, thoſe in the *Jaw* of the *Dolphin* we got beyond Seas; yet is the Difference not Great between the *Dolphin* and *Phocæna*. As for that *Fiſh*, which our Seamen now a days call the

the *Dolphin*, and which, as it is Deſcribed by Mr. *Terry* and *Ligon*, hath *Teeth* on it's *Tongue*, ſmall *Scales*, is *Finn'd* like a Rock, of a Pleaſant Smell and Taſt, what it is *I* know not: but *I* am ſure it is *Toto Genere* Different from the *Dolphin* of the *Antients*.

We Obſerved not in this *Fiſh* any *Noſtrils* beſide thoſe in the *Fiſtula*, nor any *Ear-holes* or *Meatus Auditorii* at all; wherein alſo *Ariſtotle* Agreeth with us: which yet *Rondeletius* found out near the *Eyes*. But we obſerved in the *Skull* a *Bone* anſwering to the *Os Petroſum*: which moſt certainly was the *Uſe* of *Hearing*.

As for the Name *Porpeſs*, *I* agree with *Geſner*, that it was ſo Call'd, *quaſi Porcus Piſcis*, moſt Nations calling this *Fiſh Porcus Marinus*, or the *Sea-Swine*: Indeed it Reſembles a *Swine* in many Particulars: as the *Fat*, the *Strength* of the *Snout*, *&c.*

A Venemous Scratch with the Tooth *of a* Porpeſs; *by Dr.* M. Liſter. n. 233. p. 726.

LXXVII. *Forte ex diſſectione Delphini*, ante Dies Tres minimum mortui, admodum leviter Digitum *Vulneravi* ab interna Parte; at citra Sanguinem, ſcilicet ſimplici *Dentis* Raſura. Nihil autem Mali inde ſenſi ad *Quartum* uſque *Diem*: quo tempore cum quodam *Livore* Digitus paululum Intumuit ad *Articulum*. Malum indies ſerpebat, adeo ut intra Alios *Quatuor dies* Digitos Duos Infeciſſet; Tertiuſque tandem Digitus male ſe habuit. Plurima ex Conſilio *Chirurgorum* adhibui, at parum profuerunt; jam *Manus* Correpta eſt, Dolorque *Carpum* invaſit; ex hoc autem Fomento primum ſtetit. (℞ *aq Spermatis Ranarum* ℥*vi. Boli Armen.* ℥*is. f. Vitrioli Albi* ℥ *iiii. m.*) Calide bis quotidie admotum eſt. Item interdum alio modo (℞ *Vitrioli Albi Combuſti, Boli Armeniac. an.* ℥ *iiii. Camph.* ℥*i. Aq. communis* ℔*viii. m. f. Collyrium.*) Deinde *Nutrito* impoſito, & ſuperinjecto *Emplaſtro* ex *dolo* & *diapalma*, convalui ex hoc Inuſitato ac Improviſo Malo, Præter *Livorem* autem, qui ſatis *Venenum* indicabat, Moleſtus ac Odioſus quidam *Pruritus*, an *Igniculus* dicam, me Dies Nocteſque vehementer Angebat, *Cuticulam* Partium Correptarum ex toto perdidi: *digiti* autem ad Vires ſuas non niſi poſt aliquot *Menſes* reſtituti ſunt.

Poiſonous Fiſh *about the* Bahama Iſlands; *by M.* J. L. n. 114. p. 312.

LXXVIII. The *Fiſh* that are here (at *New-Providence* one of the *Bahama-Iſlands*) are Many of them *Poiſonous*, bringing a great *Pain* on their *Joynts* who *Eat* them, which continues ſo for ſome ſhort time, and at laſt with two or three days *Itching* the *Pain* is Rubb'd off. Thoſe of the ſame *Species*, *Size*, *Shapes*, *Colour* and *Taſte*, are one of them *Poyſon*, the other not in the leaſt *Hurtful*; And thoſe that are, are ſo only to *Some* of the Company. The Diſtemper to *Men* never, that we hear of, proves Mortal: *Dogs* and *Cats* ſometimes Eat their *Laſt*. In *Men* that have once had that Diſeaſe, upon the firſt *Eating* of *Fiſh*, though it be thoſe that are Wholeſome, the *Poiſonous* Ferment in their Body is Revived thereby, and their *Pain* Increaſed.

Whales *and* Whale-Fiſhing *about* Bermudas; *by* . . . . n. 1. p. 11.

LXXIX. 1. An underſtanding and hardy Seamen gives this Account of the *Whale Fiſhing* about the *Bermudas*; that though many attempts of Maſtering

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the *Whales* of thoſe Seas had been Unſuccesful, by Reaſon of the Extraordinary *Fierceneſs* and *Swiftneſs* of theſe Monſtrous Animals, yet the Enterpriſe was lately Renewed: and Fit Perſons having been out at Sea 17. Times and Faſtened their Weapons a *Dozen* of times, they *Kill'd* in theſe Expeditions 2. *Old Female Whales*, and 3. *Cubs*; whereof one of the *Old* ones, from the *Head* to the Extremity of the *Tail*, was 88. *Foot* in Length, by Meaſure, it's *Tail* being 23. *Foot* Broad, the *Swimming Fin* 26 *Foot* Long, and the *Gills* 3. *foot* Long, having great Bends underneath from the *Noſe* to the *Navil*; upon her After Part, a *Fin* on the *Back*; being within Paved (this was the plain Seaman's Phraſe) with *Fat* like the *Cawl* of a *Hog*. The *other old* one, he ſaid, was ſome 60. *foot* long: Of the *Cubs*, one was 33. the other Two much about 25. or 26 *foot* long. The ſhape of the *Fiſh*, he ſaid, was very ſharp Behind, like the Ridge of a Houſe; the *Head* pretty Bluff, and full of Bumps on both ſides; the *Back* perfectly *Black*, and the *Belly White*.

Their *Celerity* and *Force* he Affirmed to be wonderful; in ſo much that one of theſe Creatures, which he *Struck* himſelf, towed the Boat wherein he was, after him, for the ſpace of 6. or 7. *Leagues*, in $\frac{3}{4}$ of an *Hour's* time. Being wounded, he ſaith, they make a Hideous *Roaring*, at which all of that Kind that are within Hearing, come towards that place, where the Animal is, yet without ſtriking or doing any Harm to the Wary. He is of Opinion, that this *Fiſh* comes neareſt to that ſort of *Whales*, which they call the *Jubartes*; they are without *Teeth*, and longer than the *Greenland-Whales*, but not ſo Thick. That they Fed upon much *Graſs*, growing at the Bottom of the Sea, was ſeen by Cutting up the *Great Bag* or *Maw*, wherein he had found in one of them about 2. or 3. *Hogsheads* of a *Greeniſh Graſſy* Matter.

The Largeſt ſort of theſe *Whales* might afford 7. or 8. *Tuns* of *Oyl* if well Husbanded: the *Cubbs* yield but little, and that is but a kind of *Jelly*. That which the *Old* ones Render, doth *Candy* like *Pork's Greaſe*, yet Burneth very well. He obſerved that the *Oyl* of the *Blubber* is as Clear and Fair as any *Whey*: but that which is Boyl'd out of the *Lean*, Interlarded, becomes as Hard as *Tallow*, ſpattering in the Burning; and that which is made of the *Cawl* reſembleth *Hog's Greaſe*. He affirms that though this *Greaſe* be *Boyling*, yet one may run ones Hand into it without *Scalding*. To which he adds, that it hath a very *Healing* Vertue for *Cuttings*, *Lameneſs*, *&c.* the part Affected being Anointed therewith.

The time of *Catching* theſe *Fiſhes* is from the Beginning of *March* to the End of *May*, after which time they appear no more in that Part of the Sea, but Retire (as it is Thought) into the *Weed-beds* of the *Gulf* of *Florida*; it having been Obſerved, that upon their *Fins* and *Tails* they have ſtore of *Clams* or *Barnacles*, (upon which he ſaid, *Rock weed* or *Sea-Tangle* did grow a Hand long;) many of them have been taken off them, of the Bigneſs of Great *Oyſter Shells*.

The ſame Perſon ſaith, that ſince his former account there hath been Taken, by order of the *Bermudas Company*, 16. of thoſe *Whales*: the *Oyl* whereof, to the quantity of 50. or 60. *Tuns* arrived in *Ireland* ſome Few *Months* ago. n. 8. p. 132.

He adds, That about 2 *Years* ſince, there Stranded upon the Coaſt of *New-England* a *dead Whale*, of that ſort, which they call *Trumpo*, having *Teeth* reſembling thoſe of a *Mill*, and its *Mouth* at a good Diſtance from, and under the *Noſe* or *Trunk*, and ſeveral Boxes or *Partitions* in the *Noſe*, like thoſe of the *Tails* in *Lobſters*; and that being opened, there run out of it a Thin *Oyly* Subſtance, which would Candy in time, after which the Remainder being a Thick *Fatty* Subſtance, was taken out of the ſame Part with a Scoop. And this Subſtance he Affirmed to be the *Sperma Ceti*; adding further, that the *Blubber*, as they call it, it ſelf, of the ſame ſort of *Whales*, when Stewed, yields on the Top a *Creamy* Subſtance, which taken off, and thrown upon *White Wine*, lets fall a *Dirty Heterogeneous Sediment*, but what remains aloft affords a *Sperma-Ceti-like* Matter.

He concludes his Relation with obſerving, that theſe *Whales* were to be met with, between the Coaſt of *New England* and *New Netherland*, where they might be *Caught* 8 or 9 *Months* in the Year; whereas thoſe about the *Bermudas*, are to be found there only in the Months of *February*, *March* and *April*.

By---ib.p.133. 2. Concerning the *Death* of the *Whale*, which hath been related to have ſtranded upon *New-England*, it is not very Improbable but that it may have been Killed by a certain *Horny Fiſh* which is ſaid by Mr. *Terry* (in his *Eaſt Indian Voyage*) to run his Horn into the *Whale's Belly*; and which is Known, ſometimes to Run his *Horn* into *Ships* (perhaps taking them for *Whales*) and there ſnapping it aſunder; as happened not long ſince to an *Engliſh Veſſel* in the *Weſt Indian* Seas.

By Mr. Rich. Norwood. n. 30. p. 566. 3. Within theſe 2 or 3 *Years*, in the Spring time and Fair Weather, they take ſometimes one 2 or 3 *Whales* in a Day. They are leſs, I hear, than thoſe in *Greenland*, but more Quick and Lively; ſo that if they be *Struck* in Deep Water, they preſently make into the Deep with ſuch violence, that the *Boat* is in Danger to be Haled down after them, if they cut not the Rope in time; therefore they uſually *Strike* them in *Shoal-Water*. They have here very good *Boats* for that Purpoſe, Mann'd with 6 *Oars*; ſuch as they can Row Forwards or Backwards, as occaſion requireth. They Row up gently to the *Whale*, and ſo he will ſcarcely ſhun them; and when the *Harpineer*, ſtanding ready fitted, ſees his Opportunity, he *ſtrikes* his *Harping-Iron* into the *Whale* about or before the *Fins*, rather than toward the *Tail*. Now the *Harping Irons* are like thoſe which are uſual in *England* in *ſtriking Porpoiſes*; but of ſingular good Metal, that will not break, but winde, as they ſay, about a Man's Hand. To the *Harping Iron* is made faſt a ſtrong Lythe Rope, and into the *Socket* of that *Iron* is put a Staff, which when the *Whale* is *ſtruck*, comes out of the Socket; and ſo when the *Whale* is ſomething Quiet, they Hale up to him by the Rope, and it may be, *Strike* into him another *Harping Iron*, or *Lance* him with *Lances* in Staves till they have *Kill'd* him. *I* do not hear that they have found any *Sperma Ceti* in any of theſe *Whales*; but *I* have Heard from Credible Perſons, that there is a *Kind* of ſuch as have the *Sperma* at *Elutheria*, and others of the *Ba-*

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bama Iſlands (where alſo they find often Quantities of *Amber Greece*;) and that thoſe have great *Teeth* (which *Ours* have not,) and are very *Sinewy*. One of this Iſland of *Bermudas* (*John Perinchief*) found one there *Dead*, driven upon an *Iſland*; and, though *I* think Ignorant in the Buſineſs, yet got a great Quantity of *Sperma Ceti* out of it. It ſeems they have not much *Oyl* as *Ours*; but the *Oyl*, *I* hear, is *at firſt*, like *Sperma Ceti*; but they *Clarifie* it, *I* think, by the Fire.

4. We have in theſe Seas about *Bermudas* great ſtore of *Whales*, which in *March*, *April* and *May*, uſe our Coaſt. *I* have my ſelf *Killed* many of them. Their *Females* have abundance of *Milk*, which their *Young* ones ſuck out of the *Teats*, that grow by their *Navel*. They have *No Teeth*, but *Feed* on *Moſs*, growing on the Rocks at the bottom during theſe 3 *Months*, and at no other Seaſon of the Year. When that is Conſumed and gone, the *Whales* go away alſo. Theſe we *Kill* for their *Oyl*: But there have been *Sperma-Ceti-Whales* driven upon the Shore, which *Sperma* (as they call it) lies *all over* the Body of thoſe *Whales*. Theſe have diverſe *Teeth*, which may be about as big as a Man's Wriſt. *By Mr.* Richard Stafford. n. 40. p. 793.

I have been at the *Bahama Iſlands*, and there have been found of the ſame ſort of *Whales Dead* on the Shore, with a *Sperma* all over their Bodies, but *I* could never hear of any of that ſort that were *Killed* by any Man; ſuch is their *Fierceneſs* and *Swiftneſs*. One ſuch *Whale* would be worth many *Hundred Pounds*. They are very ſtrong, and Inlaid with *Sinews* all over their Body, which may be drawn out *Thirty Fathom* long.

LXXX. 1. *I* conjecture that *Fiſhes*, by Reaſon of the *Bladder* of *Air* that is within them, can ſuſtain or keep themſelves in any *Depth* of Water; for the *Air* in that *Bladder* being more or leſs Compreſſed, according to the *Depth* the *Fiſh* ſwims at, takes up more or leſs ſpace; and conſequently the Body of the *Fiſh*, part of whoſe Bulk this *Bladder* is, is Greater or Leſs according to the ſeveral *Depths*, and yet retains the ſame Weight. Now the Rule *de Inſidentibus Humido*, is, that a Body that is *Heavier* than ſo much Water as is equal in Quantity to the Bulk of it, will *Sink*; a Body that is *Lighter*, will *Swim*; a Body of *equal Weight*, will reſt in any part of the Water. By this Rule if the *Fiſh* in the *Middle* Region of the Water, be of *Equal Weight* to the Water that is Commenſurate to the Bulk of it, the *Fiſh* will Reſt there without any Tendency Upwards or Downwards: And if the *Fiſh* be *Deeper* in the Water, the Bulk of the *Fiſh* becoming Leſs by the Compreſſion of the *Bladder*, and yet Retaining the ſame *Weight*, it will *Sink*, and Reſt at the bottom: And on the other ſide, if the *Fiſh* be *Higher* than the middle Region, the *Air* dilating it ſelf, and the Bulk of the *Fiſh* conſequently increaſing, but not the *Weight*, the *Fiſh* will riſe Upwards, and Reſt at the Top of the Water. *The Uſe of* Air Bladders *in* Fiſhes; *by*---- n. 114. p. 320.

Perhaps the *Fiſh* by ſome Action can *Emit Air* out of his *Bladder*, and afterwards out of its Body, and alſo, when there is not enough, *Take in Air* and Convey it to this *Bladder*; and then it will not be Wondred, that there

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ſhould be always a fit Proportion of *Air* in the Bodies of all *fiſhes*, to ſerve their Uſe, according to the *Depth* of Water they are Bred and Live in. Perhaps by ſome *Muſcle* the *Fiſh* can *Contract* this *Bladder* beyond the *Preſſure* of the Weight of Water. Perhaps the *Fiſh* can by its ſides, or ſome other Defence, keep off the *Preſſure* of the Water, and give the *Air* leave to dilate it ſelf. In theſe Caſes the *Fiſh* will be Helped in all intermediate Diſtances, and may *Riſe* or *Sink* from any Region of the Water without moving one *Fin*.

By *Mr.* Boyle. *ib.* p. 311.

2. To determine whether a *Fiſh* doth *Riſe* or *Sink* in Water by *Conſtricting* or *Expanding* himſelf, Take a *Bolt-Head* with a Wide *Neck*, and having filled it almoſt full with Water, put into it ſome *Live Fiſh* of a convenient ſize; that is, the biggeſt that can be got in, as a *Roche*, *Perch*, or the like, and then dtaw out the *Neck* of the *Bolt-Head* as ſlender as you can, and fill that alſo with Water. Then Obſerve the Motion of the *Fiſh*, and if upon his *Sinking*, you perceive the Water at the Slender Top does *Subſide*, you may Infer, he *Contracts* himſelf, and if upon his *Riſing*, the Water be alſo *Raiſed*, you may Conclude, he *Dilates* himſelf.

By *Mr.* Ray. n. 115. p. 349.

3. I think that —— hath Hit upon the True *Uſe* of the *Swimming Bladders* of *Fiſhes*. For 1. It hath been obſerved, that if the *Swimming Bladder* of any *Fiſh* be Pricked or Broken, ſuch a *Fiſh ſinks* preſently to the Bottom, and can neither ſupport nor Raiſe up it ſelf in the Water. 2. *Flat-fiſhes*, as *Soles*, *Plaiſe*, *&c.* which lie always Groveling at the Bottom, have *No Swimming Bladders* that *I* could ever find. 3. In moſt *Fiſhes* there is a manifeſt *Channel* leading from the *Gullet*, or Upper Orifice of the *Stomach*, to the ſaid *Bladder*, which without doubt, ſerves for Conveying Air thereunto: But there is a *Valve* or ſome other Contrivance to hinder the *Egreſs* of it, ſo that you ſhall ſooner Break the *Bladder* than force any *Air out* by this *Channel*. Yet in *Sturgeons*, Mr. *Willoughby* hath obſerved, that Preſſing the *Bladder*, the *Stomach* preſently ſwell'd: So that it ſeems in that *Fiſh* the *Air* paſſes freely Both ways.

I verily think there is in the *Coat* of this *Bladder* a *Muſculous Power* to Contract it when the *Fiſh* Liſts: For, in many *Fiſhes* it is very Thick and *Opake*, like the *Coat* of an *Artery* (which hath as Dr. *Willis* obſerves, ſuch a *Muſcular* Faculty) as for Example in all the *Cod-kind*; in ſome, *v. g.* the *Hake*, call'd in Latin *Merlucius*, it is inwardly covered with a *Red Carneous* ſubſtance, which *I* take to be *Muſculous Fleſh*; in others it is Forked at the Top, and to each Horn hath a *Muſcle* affixed. Now the *Muſculous* Force need not be great, being ſtill aſſiſted by the Water, as the *Fiſh* Deſcends; the *Preſſure* of the Water being much Greater at the Bottom than at the Top.

The Power alſo of *Dilating* the *Abdomen* by the *Muſcles* aſſiſts thoſe *Fiſhes* to *Riſe*, whoſe Natural Place is towards the Bottom: And the *Air* Compreſſed in the *Bladder Dilating* it ſelf as the *Fiſh* Aſcends, Facilitates that Action of the *Muſcles*. But thoſe *Fiſhes* that deſcend by *Contracting* the *Bladder*, letting the *Contracting Muſcle* ceaſe to Act, will *Riſe* again of their Own Accord, the *Air* within *Dilating* it ſelf; as we ſee in Glaſs Bubbles by *Compreſſion* of the *Air* in them Deſcending, which as ſoon as the Force is removed, Aſcend without more ado.

Beſides

Beſides the *Flat Fiſhes*, *I* before mentioned, all the *Cartilagineous* Kind, as well *Flat* as *Long*, want *Swimming Bladders:* What Courſe they uſe to *Aſcend* and *Deſcend* in the Water, *I* know not. Many of the *Eel kind* (not All) have *Swimming Bladders*, yet can they hardly *Raiſe* themſelves in the Water, by reaſon of the Length and Weight of their *Tails: I* ſuppoſe, the *Air Bladder* being near their *Heads* Helps them to lift up their *Head* and *Fore-part.*

LXXXI. *I* have obſerved in the *Eyes* of *Fiſh* that the *Proceſſus Ciliaris* is not Faſten'd to the joyning of the *Cornea* and *Sclerotis*, as in all Other Animals that *I* Diſſected, ſo as to Hinder the *Watery Humor* to go any further *Backward.* For *I* conſtantly obſerved that the *Humor Aqueous* may move a good way *Backward* in ſome, and in others almoſt as far as the *Optick Nerve.* And in as many *Fiſh* as *I* could conveniently examine carefully, *I* have found a *Membrane* which Covered 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 faſtened. This is Tranſparent, and pretty Thin; and ſo is all the *Cornea*, if compared to that of *Quadrupeds.*

The Eyes *of* Fiſh; *by Dr.* Allen Moulen. n. 199. p. 716.

I have alſo Obſerved that the *Eyes* of *Fiſh*, as well as thoſe of *Fowl*, are more or leſs *Cartilaginous:* For the *Sclerotis* is a *Cartilago ſui Generis*, eſpecially near the *Cornea*; and in the Larger ſorts of them, *I* have found the whole *Sclerotis* ſuch a kind of a *Cartilage.*

LXXXII. *Fiſh* are Remarkably Different from all other Animals in many particulars. The moſt conſiderable Difference is their want of *Lungs*, and their not *Breathing:* And yet it is Neceſſary that ſomething ſhould ſupply this in *Fiſhes*, which may have the ſame Effect upon their *Blood*, as the *Air* has upon Ours, by entering into our *Lungs*, that is to ſay, to Divide and Diſſolve it, and render it Fit for *Circulation.* Now we find no part in *Fiſh* more Proper to produce this Effect than the *Bronchiæ* that lye like ſo many Leaves upon each other under their *Gills*: For they receive the Water in by the *Mouth*, and Return it by the *Gills*, or Receiving it in by the *Gills* they Throw it out by the *Mouth.* Hence it is agreed upon by all that the Water contains ſomething that Produces this Effect, and this ſeems moſt probably to be *Air.*

The Structure of the Internal Parts *of* Fiſh, *by Dr.* Char. Preſton. n. 225. p. 419.

That there is *Air* in all Water cannot be Doubted after this Experiment of M. *Marolle.* He ſet a Veſſel of Water over the Fire, ſo to Drive out the *Air* from it. This *Water* he put into the *Air Pump*, to Draw out the *Air* from it; and after that Fill'd a Viol with it, within 2 or 3 Fingers of the Top, which ſpace he left only Full of *Air*, and ſtopt the Viol well; and by ſhaking it the Water Imbibed the *Air*, ſo as to Riſe up and quite Fill the Viol.

But we need not wonder that *Fiſh* cannot alſo Live in the *Open Air.* Their *Blood* is Naturally leſs *Hot* than ours, ſo that the natural *Heat* of ours would be a *Fever* in them, and *Mortal:* For the *Nitre* of the Pure *Air* is in too great

a Quantity, and too ſubtile, ſo that it Diſſolves their *Blood* too much, and makes it too *Fluid*, whereas the *Nitre* in the *Water* is more Groſs and in Leſſer Proportion; whence it gives their *Blood* only a *Fluidity* requiſite to keep it in its Natural State. To prove that it is in the *Bronchiæ* that this Diviſion is performed, we need but Obſerve their Extraordinary *Redneſs* above any other part of the Body; a Proof that the *Blood* is there more Divided. *Fiſh* are alſo found to *Dye* in Water *frozen over*, which happens plainly from their Communication with the *Outward Air* being Hindred by the *Ice*.

The *Heart* of *Fiſh* is Different from that of Other *Animals* in its having but *One Ventricle*: For it has only the *Vena Cava* and the *Aorta* that open into it, having *No Lungs*. So that by the *Aorta* the *Blood* comes out of the *Heart*, which is Branched into a Thouſand *Capillaries* over the *Bronchiæ*, and is after Reunited; which Re-union is made under the *Baſis* of the *Cranium*; and becauſe the *Blood*, when once there, has no need of being forced Higher Upwards, they have no occaſion for a Second *Ventricle* for that purpoſe, as *Terreſtrial Animals* have. The Reunion of theſe *Capillaries* of the *Bronchiæ* being made, they Form two large *Trunks*, of which one proceeds towards the *Head*, and the other towards the *Lower Parts*.

Fiſh have a *Diaphragm*; but not for the ſame Purpoſe as in Other Animals that Breath. It is always ſtrait and Tenſe, and Perpendicular on the *Vertebræ*; it Hinders the *Terminating Salts* that Exhale from the *Inteſtines* from coming to the *Heart*, which might cauſe ſome Alteration there.

Their *Stomach* is *Membranous*; for *Fiſh* Swallow down other Smaller Fiſh Whole, and ſometimes Earth. Wherefore 'tis needful to have a Power of Contracting and Straitning it ſelf, forceably to Break to pieces the Hard Matters contained therein. Their *Inteſtines* make ſeveral great *Windings* about; a Sign the *Fermentation* is but Slow therein; which is made up by the Length of the *Inteſtines*. The *Liver* has much the ſame Situation as in Other Animals; as alſo the *Spleen* has. They are provided of a *Gall-Bladder*, a *Ductus Choledochus* and *Pancreas*, or rather Two little Baggs faſtened to the *Ventricle* for the ſame uſe. *Fiſh* have uſually many *Pancreas*'s, ſo that in ſome there have been told 44 They have *Kidneys*, *Bladder*, *&c.*

They have the *Ovary* near the *Vertebres* of the *Loins*. The *Eggs* come forth at a Paſſage below the *Anus*: And the *Male* has a like *Ductus*, or *Hole*, by which they Eject their *Seed* upon that of the *Female* to impregnate the *Eggs*; which the *Male* ſometimes Changes the Colour of, as he paſſes over them, when he Caſts his *Seed* upon them after they are *Laid*.

Fiſh have on the *Vertebræ* of the *Loins* a *Bladder*, very large in Proportion to their Bulk; which ſerves, by *Compreſſing* or *Dilating* it ſelf, to render the *Fiſh* more or leſs *Heavy*, as Occaſion requires. The *Fins* and *Tail* aſſiſt them in their Paſſage through the Water whither they will: But 'tis this *Dilatation* that makes them capable of *Swimming* in it; and if this *Bladder* be by any

means

means Burſt, ſo that it cannot be *Extended*, the *Fiſh* can no more *Raiſe* it ſelf in the Water, but keeps continually at the Bottom. *Flat-fiſh*, ſuch as *Soles*, have none of this *Bladder*: For they are able, by Reaſon of their *Breadth*, to keep themſelves up in the Water. *Cray fiſh*, and other *Shell-fiſh* want it likewiſe, for the moſt part: for they *Creep* only at the Bottom of the Water. There are many *Fiſh* that have them *Double*.

LXXXIII. *Anſerum Ferorum Quinque* Genera vulgo numerantur in *Agro Eboracenſi* ſatis frequentium; *viz.* 1. *The little Spaniſh Gooſe*; *Sc.* æque Parvus ac *Brenta*; ſed Figura & Colore quodammodo ad *Anſerem Domeſticum* accedens; ab *Hiſpania* denominatur. 2. *The Barnicle* ſatis cognitus. 3. *The Scotch Gooſe*, *Sc* Vulgatiſſimus Ferus, à *Scotia* ad nos, exeunte *Auguſto* adveniens, è quibus fere conſtant innumeri illi Greges qui in Planis Campis (*the Wolds* dictis) & alibi paſſim inveniuntur. 4. *The Whilk*, *Anſer Maximus Niger*, ineunte Bruma primum adveniens; raro alibi quam in Pratis, Paſcuiſque Herba paſcitur. 5. *Anſer Paluſtris* Noſter, *Grey Lagg* dictus; huic Magnitudo *Anſeri Domeſtico* ſubpar. *The* Wild-Gooſe; *by Dr.* M. Liſter. n. 175. p. 1160.

Caput ex *Fuſco Nigricat*, & ad Medium Collum *Infuſcatur*; Dorſum ex *Cinereo Liveſcit*; ipſæ autem Alæ, & earum Remiges *Nigricant*; Uropygium *Albeſcit*, ejuſque Pennæ Externæ *Albidæ* ſunt; Venter *Cinereus*, is vero Imus ſenſim fit *Niveus*; Roſtrum a Capite ad Mediam fere partem *Nigrum*, deinde *Subpurpureum*, ipſo ejus Apice *Nigro*; in Superiore Mandibula non niſi unus *Denticulorum* Ordo, atque idem Simplex Ordo in inferiore; item huic Lingua utrinque Uno *Denticulorum* ordine Armatur. Pedes *Subpurpurei*, ſive *Carnei Coloris*; Ungues fere *Albidi*, excepto medii Digiti, qui ex majore parte *Nigricat*. Pendet *Libris* 7. & fere *Dimidium*. In Paludibus *Agri Eboracenſis* Nidificant; ipſi & eorum Pulli Menſe *Maio* pingueſcunt, & in Deliciis habentur.

But I will not Affirm the *Grey Lagg* to be Different from the *Common Wild Gooſe*; Mr. *Ray's* Deſcription and mine ſo well agree, ſave in the *Colour* of the *Bill* and *Leggs*. *Ib.* p. 1161.

LXXXIV. In the *Weſtern Iſlands* of *Scotland*, the Weſt Ocean throws upon their Shores great Quantities of very Large Weather-beaten Timber; The moſt Ordinary Trees are *Firr* and *Aſh*. Being in the Iſland of *Eaſt*, I ſaw lying upon the Shore a Cut of a large *Firr-Tree* of about $2\frac{1}{2}$ Foot Diameter, and 9 or 10 Foot long; which had lain ſo long out of the Water, that it was very Dry; and moſt of the *Shells* that had formerly covered it, were Worn or Rubbed off. Only on the Parts that lay next the Ground, there ſtill Hung Multitudes of little *Shells*: They were of the *Colour* and Conſiſtence of *Muſcle Shells*. This *Barnacle-Shell* is Thin about the Edges, and about half as Thick as Broad. Every one of the *Shells* hath ſome Croſs Seams, or *Sutures*, which as *I* remember divide it into 5 parts, near about the manner as in the *Figure*. *The* Barnacle; *by Sir* Rob. Murray. n. 137. p. 925. *Fig.* 236.

These Parts are fastened one to another, with such a Film as *Muscle Shells* are.

These *Shells* hung at the Tree by a *Neck* longer than the *Shell*, of a kind of a *Filmy* Substance, Round and Hollow, and Creased, not unlike the *Wind-Pipe* of a *Chicken*, spreading out Broadest where it is fastened to the Tree; from which it seems to draw and convey the matter which serves for the *Growth* and *Vegetation* of the *Shell* and the Little *Bird* within it.

In every *Shell* that *I* open'd *I* found a Perfect *Sea-Fowl*: The Little *Bill* like that of a *Goose*; the *Eyes* marked; the *Head*, *Neck*, *Breast*, *Wings*, *Tail*, and *Feet*, Formed; the *Feathers* every where perfectly Shaped, and *Blackish* Coloured; and the *Feet* like those of other *Water-Fowl*, to my best Remembrance. The Biggest *I* found upon the Tree, was but about the Size of the *Figure*; Nor did *I* ever see any of the little *Birds* Alive, nor met with any Body that did; only some Credible Persons have assured me that they have seen some as Big as their Fist.

The Scotch Barnacle *and* French Macreuse; *by Dr.* Tancred Robinson. n. 172. p. 1036.

LXXXV. 1. The Bird which at *Paris* is called *Macreuse*, and in other parts of *France*, *Macroul*, the *French* Eat upon *Fish-Days*, and all *Lent*, thinking it to be a sort of *Fish*, or a *Marine* Animal with *Cold Blood*; or else a *Barnacle* Generated either out of *Rotten* or *Corrupted Wood* floating upon the *Sea*; or out of certain *Fruits* falling into the Water, and there Metamorphosed into a *Bird*; or else from a kind of *Sea Shells*, adhering to Old Planks and Ship Bottoms, called *Conchæ Anatiferæ*. But in Truth these *Shells* contain a *Testaceous* Animal of their own *Species*; as the *Oyster*, *Cockle*, and *Muscle* doth. Whereas the *Barnacle* is of the *Goose*, and the *Macreuse* of the Duck kind, and both *Oviparous*; The Truth of which is Evident by the Anatomy of their *Parts* serving for *Generation*, and by their *Laying Eggs* and sometimes *Breeding* among us.

The *Macreuse* is the *Scoter*, or *Anas Niger Minor* described by Mr. *Ray*. It is Frequently taken in Nets placed *under Water* upon the Coasts of *Normandy* (most plentifully at the Mouth of the *Sein*,) *Languedock*, and *Provence*; and *I* am confident, *I* have seen it upon the *Laguna* of *Venice*, at the Mouths of the *Brenta*, *Addesis*, and the *Po*. A *Duck* very like unto this (if not the same,) I also saw upon the *Mare Mortuum*, and the *Lake Avernus*.

The Macreuse; *by Mr.* Ray. *ib. p.* 1041.

2. *I* had no sooner seen the Cases of the *Male* and *Female Macreuse* which Dr. *Robinson* sent me, but instantly *I* found it was no Stranger to me. There is a particular Description of the *Cock* in Mr. *Willoughby's Ornithology* among the *Sea Ducks*, to which this Bird belongs, and not to the *Divers* or *Duckers*. M. *Graindorge's* Description *I* find upon attent reading to be very Faithful: But notwithstanding what he saith of the *Debility* of its *Feet*, unfit for Walking on Land, *I* see not but that it may March as well as the rest of its Kind, all which have but *Short* and *Weak Legs* in Proportion to the Bulk of their Bodies, and those also situate very backwards.

What

What he ſaith of the *Smallneſs* and *Weakneſs* of the *Wings*, and *Shortneſs* of their *Feathers*, is common to many *Sea-fowl*, *viz.* the *Triadactylæ* and *Mergi* which yet by the *Nimble* Agitation of them, Fly very Swiftly and ſtrongly.

Why they of the *Church* of *Rome* ſhould allow this *Bird* to be *Eaten* in *Lent*, and upon other *Faſting Days*, more than others of this *Kind*, but eſpecially the *Tridactylæ*, I ſee no Reaſon; the *Fleſh* of theſe laſt, which Live only or chiefly by Preying upon *Fiſh properly ſo called*, taſting ſtronger of *Fiſh* then the *Duck-Kind*; which all Feed, partly at leaſt, upon *Shell fiſh* (as M. *Graindorge* found the *Macreuſe* alſo to do) and have a Delicate and well taſted *Fleſh*.

I Obſerved in this *Bird*, and in ſome others of the *Sea-Ducks* that are much *Under water*, that they Want that *Veſſel*, or *Ampulla*, ſituate in the very Angle of the *Divarication* of the *Wind-Pipe*, which for want of a better and Fitter Name we are wont to call the *Labyrinth* of the *Trachea*. We may very probably from hence Conclude, that the *Labyrinth* doth not rve them for a *Reſervatory* of *Air*, to enable them to continue the longer ſender Water; as *I* ſometimes conjectured; but for the intending and Mouulating of the *Voice*, ſeeing in the *Plaſh Duck* the *Females* want it: But *I* dam ſomewhat to ſeek about the *Uſe* of this *Veſſel*. I Obſerved it in the *Mergus Cirratus longiroſter major* or the *Dun-Diver*, and that very large, and extended by very ſtrong Bones, and yet *I* thought my ſelf to have ſufficient reaſon to Judge that *Bird* to be the *Female* of the *Merganſer*: But *I* dare not be confident that it is the *Female* becauſe of this *Labyrinth*.

LXXXVI. In the Houſes built for this *Uſe* there is a *Long Entrance a b.* on each ſide of which are 14 *Ovens* (ſome places have more, ſome leſs) The Bottoms and ſides of theſe *Ovens* which are on the Ground, are all made of Sun-Dried Bricks; upon which they put *Matts*, and on the *Matts*, *Eggs*. *The manner of* Hatching Chicken *at* Cairo, *by Mr.* Jo. Graves. n. 137. p. 923.

The Top of theſe *Ovens* are Flat, and Covered with Sticks, except 2 long ſpaces which are made of Sun-Dried Bricks; and are the *Hearths*, in which the *Fires* are made, to Heat the *Eggs* lying Under them in the Lower *Ovens*. *Fig.* 237

Above theſe Lower *Ovens* are ſo many other, made of Sun-Dried Bricks, and Arched at the Top: Where alſo there are ſome *Holes*, which are ſtop'd with *Tow*, *&c*, or left Open, as they pleaſe, to govern the *Heat* in the *Ovens* Below. Theſe Upper *Ovens* are made after this manner.

a. The *Mouth* of the *Oven*, opening upon the *Long Entrance* above mentioned. *b.* and *c.* *Entrances* into the *Ovens* Adjoyning. *d e.* two *Hearths* 3 or 4 *Inches* Deep, in which they make the *Fire*, to Heat this and the *Oven* Below. The Depth of the *Lower-Oven* is about $2\frac{1}{2}$ *Foot Engliſh*: the *Second*, above 4. *Fig.* 238

They begin in the Midſt of *January* to Heat the *Ovens*: Spending every Morning an 100. *Kintars* (or an 100. *pound* Weight) of *Camels*, or of *Buffulo's Dung*, and the like Proportion at Night, till the midſt of *Febr.* about

which time the *Ovens* are ſo Hot, that one cannot well endure to lay his Hand upon the Walls.

After this, they put the *Eggs* into the *Ovens* to *Hatch* the *Chicken*; which they continue Succeſſively till the End of *May*.

The *Eggs* are firſt put upon *Mats* in the *Lower Ovens*, which are upon the Ground; 7. or 8000. *Eggs* in Number; and laid only Double one upon another.

In the *Ovens* Above theſe *Lower*, the *fire* is made in the Long or Little Channels, from whence the Heat is conveyed into the *Lower Ovens* before mentioned. The *Eggs* which are directly Under theſe *Hearths*, lie Treble one upon another; the reſt, as was ſaid, only Double.

At night, when they new-make the *Fires* in the *Hearths* above mentioned, they then remove the *Eggs* that were directly Undermoſt (lying three one upon another) in the place of thoſe which lay on the Sides only Double: and theſe being now removed, they lye Treble under the *Hearth*, becauſe the *Heat* is Greater there than on the ſides.

Theſe *Eggs* continue in the *Lower Ovens* 14. Days and Nights: Afterwards they Remove them into the *Upper Ovens*; which are juſt over the Lower. In theſe (there being now no more *fire* Uſed) they turn all the *Eggs* four times every 24. *Hours*.

The 21. or 22. Day the *Chicken* are *Hatched*; which the *firſt* Day Eat not; the *Second*, they are fetched away by Women, who give them *Corn*, *&c.*

The Maſter of the *Ovens* hath a 3*d*. part of the *Eggs* for his Coſt and Pains; out of which, he is to make ſuch good unto the Owners (who have *two Thirds* in *Chicken* for their *Eggs*) if any happen to be Spoiled or Miſcarry.

The *fire* in the *Upper Ovens*, when the *Eggs* are Placed in the *Lower*, is thus proportioned.

The firſt Day the greateſt Fire; The *Second*, Leſs than the *firſt*; The *fourth* more than the *third*; The *fifth* Leſs; the *ſixth* more than the *fifth*; The *ſeventh*, Leſs; the *Eighth*, more; The *Ninth* without Fire; The *Tenth* a Little Fire in the Morning; The *Eleventh*, they ſhut all the *Holes* with *flax*, *&c.* making no more Fire; for if they ſhould the *Eggs* would Break.

They take care, that the *Eggs* be no *Hotter* than the *Eye* of a *Man*, when they are laid upon it, can well Endure.

When the *Chicken* are Hatched, they put them into the *Lower-Ovens*, which are Covered with *Mats*. Under the *Mats* is Bran to Dry the *Chicken*: and upon the *Mats*, Straw, for the *Chicken* to ſtand upon.

To Breed up Pheaſants *and* Partridges; *by Sir* Edm. King. n. 23. p. 428.

LXXXVII. *Ants* are the Principal Food of very young *Partridges* and *Pheaſants*, both Wild and Tamed, for ſeveral *Weeks*: And a chief Reaſon, why many find it ſo Nice a thing to *Breed* up the ſaid *Birds* is, that either they give them too Sparingly of this Food, or let them faſt too long; not knowing, that as ſoon as 'tis Day-Light, they will Seek it for their Breakfaſt, and if they Want

Want it, will in a few hours be Faint and Weak, and ſome grow ſo Chill for want of that ſupply of *Nouriſhment*, that it is no eaſy matter to Recover them. But afterwards, when they are grown bigger, if by *Ill Ordering* of thoſe who ſhould keep them Sweet and Often Shift their Water, or by *Ill Dyet*, as *Muſty Corn*, *&c.* they become *Sick*, then *Ants* will not always Recover them, tho you give them never ſo many; and *I* have been forced to make uſe of Other *Inſects* to Cure them, as *Millepedes* and *Earwiggs*; either of which will do Good, but both together Better, given in a good Quantity, and at leaſt 2 or 3 times a Day. But then thoſe other things muſt be Obſerved too, of Keeping their houſe *Clean*, and giving them *Sweet Corn* and ſhifting their Water twice a Day, Keeping them within till the *Dew* be from the Ground, Letting them Bask in the *Sand*, partly in the *Sun*, the Place being a little ſhaded, and putting them up in a Warm houſe before *Sunſet*.

LXXXVIII. 1. It is moſt certain that *Swallows Sink* themſelves towards Autumn into *Lakes*, no otherwiſe than *Frogs*; and many have aſſured me of it, who have ſeen them drawn out with a Net, together with *Fiſhes*, and put to the Fire, and thereby Revived.

Swallows *found in* Lakes *in* Winter; *by M. J. Schefferus.* n. 19. p. 350.

2. *I* have frequently heard *Fiſhermen* Affirm, that they have here, about *Dantzick*, often *Fiſhed* them out of the *Lakes*, in the Winter: but *I* never have ſeen it my ſelf.

By M. J. Hevelius. *ib. p.* 347.

LXXXIX. The *Ortygometra*, or *Rail*, is a ſort of Fowl very Numerous in all Parts of *Ireland* in its Seaſon; but that's but ſhort, and laſts not above 3 or 4 *Months* in the *Summer*: During all the remaining parts of the Year, it lies Buried and aſleep *Under Ground*.

The Rail; *by Dr.* Tho. Molineux, n. 234. p. 747.

XC. That ſort of *Bird*, mentioned by Dr. *Plot* to be often heard in *Wood ſtock-Park* (from the *Noiſe* it makes commonly call'd the *Wood-Cracker*,) is perhaps the Leſſer ſort of *Picus Martius Varius*: For ſince the Publiſhing of Mr, *Willoughby's Ornithology*, *I* have Obſerved that Bird ſitting on the Top of an *Oaken* Tree, making with her *Bill* ſuch a *Cracking* or *Snapping Noiſe*, as we Heard a long way off; the ſeveral *Snaps* or *Cracks* Succeeding one another with that Extraordinary Swiftneſs, that we could not but wonder at it. But how ſhe made the Noiſe, whether by the Nimble Agitation of her *Bill* to and fro in a Rift of the Bough, or by the Swift ſtriking of the *Mandibles* one againſt another, as the *Stork* doth, *I* could not clearly diſcern: but an intelligent Gentleman, who was very Diligent in obſerving the ſame *Bird*, ſaid it was the Former way.

The Wood-Cracker; *by Mr.* Ray. n. 172. p. 1043.

XCI. Aviculam, quam à *Germanis Silk-Tail* vulgo appellari audio, unam aut alteram Sclopeti glande transfixam, *Eboraci*, exeunte *Januario* 1680. vidi. Sane perquam Elegans Avicula eſt; Magnitudine *Turdum* fere æquabat; huic in extremis alarum Pennis 4 aut 5 Apices Parvi *Coccinei* Nudi, Cornei, minime

The Silk-Tail; *by Dr.* M. Liſter. n. 175. p. 1161.

Fig. 239.

minime Plumis Veſtiti; item in Extrema Cauda Limbus Latus, *Luteus*, inſtar *Corticis Citri*; cætera maximam partem *Lanium* Colore refert.

But I have ſince view'd the *Bill* of this Kind of *Bird* at Mr. *Charlton's*, and find it to want the *Notches* in the Upper part of the *Bill* Proper to the *Lanius-kind*; It muſt therefore be put amongſt the *Jays*.

The Humming-Bird *by Mr.* Jo. Winthrop. n. 74. p. 2223.

XCII. 1. *I* have ſent you the Curiouſly contrived *Neſt* of a *Humming Bird*; ſo Called from the *Humming Noiſe* it maketh whilſt it Flies 'Tis an Exceeding *Little* Bird, and only ſeen in Summer, and moſtly in Gardens, flying from Flower to Flower, ſucking *Honey* out of the Flowers as a *Bee* doth; as it flyeth, not Lighting on the Flower, but Hovering over it, ſucking with its long Bill a ſweet Subſtance. There are in the *Neſt* 2 of that Bird's *Eggs*, whether they uſe to have More at once *I* know not.

By Mr. Oldenburg. *ibid.*

2. Theſe *Eggs* were ſo ſmall that being weighed by me, the one *Weighed* but about 5 *Grains*, the other $3\frac{1}{2}$: And the whole *Neſt* weighed no more than 24 *Grains*.

By Mr. Hamerſly. n. 200. p. 760. n. 202. p. 815.

3. There is in moſt parts of *America* a Bird call'd by the *Engliſh* the *Hum-Bird*, by the *Spaniard*, *Tomincius*. He is of a moſt Excellent Shining *Green* Colour, 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 killed, whoſe *Weight* was the *Tenth* part of an *Ounce Avoirdupois*; 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 Birds* 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 of a Man's Glove, with the Taper end ſet downwards, wherein were 2 *Eggs* of the bigneſs of a *Pea*, of Oval form. 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. 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: But *I* have been many times very near them, both when they *Hovered*, 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 *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 through 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*.

4. Per-

4: Perhaps the *Tomincius* does not feed on any *Juice* he *ſucks* off, or out of *Flowers*, but rather (like many other Birds) on ſmall *Inſects*, 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*.

By Dr. Neh. Grew. n. 202. p. 815.

XCIII. There is a very great variety of *Species* in the *Parrot-kind*, whether we conſider the *Country*, *Size*, or *Colour*; *Johnſton* ſays, the Curious have obſerved above an *Hundred* ſorts of them. The *ſixth Species* of *Paroquets*, by *Margravius*, comes very near our Subject.

Obſervations on the Diſſection of a Paroquet; *by Mr.* Rich. Waller. n. 211. p. 153. *Hiſt of Brazile.*

It's *ſize* is between a *Sparrow* and a *Black-bird*, with a ſhort Neck, Black Eyes, a Crooked *Scarlet* Bill, *Greyiſh* Legs and Feet, with Toes two Before, and two behind, like the *Parrot*; yet he never ſtands on One Foot to Eat with the other, as *Parrots* do. When he ſtands ſtill on the Perch, his Breaſt and Belly ſhew of a Curious *Light Green*, his Back, and the Feathers of his Wings are ſomewhat *Darker*; on his Pinions are ſome ſhort *Blew* Feathers, as likewiſe a pretty many on his Rump. His *Bill* is Encompaſſed up to the *Eyes* with a broad beautiful *Scarlet* Circle; reaching alſo down to his Throat. This Place in the *Hen* is of a Paler *Orange Colour*; wherein is the only obſervable Difference. The Feathers of the *Tail* (which in all ſmall *Paroquets* is no Longer than the *Wings*) are not to be ſeen but when he flutters or ſpreads it. They are about two *Inches* long; near the Quill of a *Lemmon-Colour*, enclining to a *Green*; next that a *Scarlet* for a pretty breadth; then a Narrow Thread of *Green* on ſome of them; after that a *Black*; and laſt of all ending in a *Light Green*.

Having opened the *Thorax* and *Abdomen* (if I may ſo call them,) by blowing into the *Aſpera Arteria*, a large Cavity or Bladder was Raiſed up all along the *Abdomen* to the Edges of the *Os Iſchion*, and faſtened to the *Gizzard*, containing in it all the *Guts* and *Gizzard*; but excluding the *Heart* and *Liver*. A Conformation like this is obſerved in all *Birds*, and peculiar to them, and mentioned by M. *Perault*; the *Air* received by the *Lungs*, Refreſhing and carrying off the Noxious Steams from the *Entrails*, is not Confined, as in *Men*, and *Quadrupedes* to the *Thorax* only, by a *Mediaſtinum*.

Mech. des Animaux.

The *Aſpera arteria* differs from that of moſt other Animals; having not only a *Larynx* at the Top thereof, as is uſual, but another alſo at its Entrance into the *Breaſt*, where it is divided, and Branches it ſelf into *Two*. From this Structure, as I have been told, common to all *Parrots*, poſſibly it may be, that they can ſo readily imitate *Humane Voices*; but this Creature we Diſſected, never attempts an *Imitation* of *Words*, making only a ſhrill Chirping Noiſe, doubling the Tone, or making it 8 Notes Lower, as a *Stopt Organ-Pipe* is an *Eighth* to the ſame *Open*. This *Lower Larynx* may aſſiſt the Weak Fabrick of ſo ſmall a Creature as a *Parrot* to Counterfeit ſo *Baſs* a *Voice* as a *Man*'s; it being obſerved by ſome Ingenious Perſons, that *Parrots* are *Ventriloqui*; and that it may be Queried whether all *Ventriloquous* Cheats may not by Nature be framed for ſuch an Impoſture.

The

The *Heart*, in Proportion to the Animal, was Large, and the *Liver* ſmall.

The *Tongue* was Broad and thick, at the End ſomewhat like a *Man's*; whence a *Parrot* has its Name ἀνθρωπόγλοτ∫ος: the Extremity of it was Armed with a Black *Horny* Cover.

It has, beſides the *Gizzard*, 2 *Craws*; the Uppermoſt *Craw* being only a Receptacle, or Sack, for the *Food* (which is *Canary-Seed*) to be again committed to the Mouth of this *Bird*, where it is again *Chewed*, having before been only Husked; this animal *Ruminating* as ſome *Quadrupedes* do; and I have obſerved this *Bird*, when upon the Perch, not only bring its Food again up into its Mouth, and there *Chew* it, but when the *Cock* and *Hen* ſit together on the Perch, he will put out of his into the *Hens* Mouth. Their manner of *Chewing* is thus; The *Under Bill* being much Shorter, ſhuts within the *Upper*, or againſt the *Roof* of the *Mouth*, which is fitted with ſeveral Rows of very ſmall and ſcarce to be ſeen *Croſs-Bars*, as the Mouths of *Horſes*, *Dogs*, and ſome other Animals are; theſe *Bars* are not ſoft, but *Horny*, as being part of the *Upper Bill*, ſo that the *Bird* by Carrying the Edge of the *Under Bill* and End of the *Tongue* againſt the *Ridges* in the *Upper*, Breaks and reduces to a Pap the *Seeds* that have been firſt Moiſtned in the *Craw*; to Expedite which Action the *Upper Bill* is *Joynted* juſt below the *Eyes*. The Food being thus Macerated, is by the *Gula* again committed to the *Second Craw*; but before its Entrance into it, it paſſes by an abundance of ſmall *Glands* placed in that Part of the *Gula*, that the Food may Squeeze out of them in its Paſſage a Juice; of what Neceſſity in *Digeſtion* may be Enquired. From hence the Food paſſes into the *Gizzard*, or Proper *Ventricle*, ſmall in Compariſon of the *Ingluvies* or *Crop*; where, by ſeveral ſmall *Stones* pickt out of the Sand given it, by the Motion of the *Gizzard*, it is Comminuted, and thence Tranſmitted to the *Inteſtines*, on the Sides of which within a ſmall Diſtance, is placed the *Pancreas*.

Explication of the Figures.

Fig. 240. *a.* The *Aſpera Arteria*. *b.* That part which forms as it were another *Larynx* *c.* Part of the *Gula*. *d.* The *Upper Craw*. *e.* The *Heart*. *ff.* The *Venæ Axiliares* *gg.* The *Juglars*. *h.* A ſmall *Gland* on one of them. *i, i.* The 2 *Auricles* of the *Heart*. *kk.* The *Liver*. *l.* The *Gizzard*,

Fig. 241. *a.* The *Trachea*. *bb.* The *Larynx*; by which *Parrots* are rendered *Ventriloqui*. *cc.* The 2 Branches of the *Trachea*.

Fig. 242. *aa.* The *Cornua* of the *Os Hyoides*. *bb.* Two *Muſcles* of the *Larynx*. *c.* The *Fiſſure*, or *Glottis*. *d.* the *Trachea*. *e.* the *Tongue*. *f.* the *Horny End* thereof.

Fig. 243. *aa.* The *Teſtes*. *bb.* the *Deferentia*. *cc.* the *Kidneys*. *dd.* the *Ureters*.

Fig. 244. *a.* The Upper part of the *Gula*. *b.* The *Firſt* or *Upper Craw*. *c.* That part of the *Gula*, whoſe inſide is *Glandulous*. *d.* The *Lower Craw*. *e.* The *Gizzard*, or *Ventricle*. *f.* The *Firſt Inteſtine*. *gg.* The *Pancreas*.

Fig. 245. *a.* The *Upper Bill*. *b.* The *Inſide* of it. *dd.* The *Upper Jaw*. *c.* the place where the *Upper Bill* is *Moveable*. *e.* A Paſſage to the *Noſtrils*. *f.* the *Lower*

Lower Bill. g. The *Upper Bill* in another Posture, to shew the small *Ridges* therein.

XCIV. The *Oestridge* is esteem'd the Largest and Tallest of Winged or Feathered Fowl, as being some times 8 *Foot* High: Which Bulk if we compare with the *Tominejo*, or *Humbird*, weighing about 12. *Grains*, we may readily discern within what Compass and Latitude the Creation of *Birds* was Ordained.

Observations on the Dissection of an Oestridge; *by Dr.* Edw. Brown. Ph. Coll. n. 5. p. 147.

The whole *Foot* of this Bird, *à Calcaneo ad extremum Digitum*, is $\frac{3}{4}$ of a *Yard*; upon which he sits when he Rests himself: But the *Foot* properly so Called, or *Longest Claw* is only $\frac{1}{4}$; the *Lesser Claw* $\frac{1}{8}$. and *half* a *Nail*. The *Nail* upon the *Longer Claw* is a *Nail* long; above which stand one above another 63 Large *Scales*, reaching up along his *Foot* Before, or before those *Bones* which answer to the *Metatarsus*. The *Lesser Claw* hath No *Nail*, and only 8 or 9 *Scales* one above another, which reach no Higher than the *Claw* it self. The *Grain* of the *Foot* is like the *Grain* of the Skin of an *Elephant*, but not so very Hard, and is Moveable, and gives way upon Pressure like the *Foot* of a *Camel*; there being Fat Under it, whereby he Treads Soft and without Noise: But Higher than the Two *Claws*, the Skin looks *Scaly*. Every small *Scale* constituting an irregular *Pentangle*, *Quadrangle*, and sometimes *Hexangle*.

From the *Heel* to the *Knee*, or that Part of the Leg which answers to the *Tibia* in *Man*, it is $\frac{5}{8}$. of a *Yard*. The *Thigh* above $\frac{1}{4}$. and very Thick.

Upon the *Breast* there is a Hard *Callous* Dark Substance of an Oval Figure, a *Nail* and a *half* in Length, like to that of a *Camel*, upon which he Rests himself when he Sits, with his Head Upright; and in that Posture *I* think he *Sleeps*, for we could never see him in any Other. His *Wing* is too little to Cover all his Neck. There is also a *Callous* Part upon the *Os Pubis*, Longer than the Former mentioned, but Narrow; upon which together with the *Callous* Part upon his *Breast* he Rests himself. The Length of his *Body* from the Lower part of the *Neck* to the End of the *Rump* is *one Yard*. The Longest Bone in his *Wing* is $\frac{3}{8}$ of a *Yard*, and his *Neck* a *Yard* not Measuring the *Head* with it.

The Top of the *Head* is Flat, in Length $\frac{3}{16}$ of a *Yard*, measuring from Behind the *Head* to the End of the *Bill*. It seems to be *Hairy* rather than Covered with *Feathers*: But the *Neck* hath Beautiful *White Feathers*, contrary to what some Affirm. On the Top of his *Head* there is a Flat Oval Place a *Nail* in Length, which is all *Callous*, and without any *Hair*, or *Feathers*, like the *Callous* Part of his *Breast*, but not so Thick, to Preserve the *Brain* from the *Serenes* that fall in *Hot-Countries*, and other Injuries of the Air, especially in the Night; and the more considerably if he *Sleeps* with his *Head* Upright, and not Under his *Wing*.

The *Gula* is very Large, as well as Long: But Largest at the Top near the *Head*; where it is a *Nail* and a *Half* Broad. The *Os Hyoides* stretcheth

it ſelf down on each ſide of the *Neck*, the Length of $\frac{1}{8}$ of a *Yard* and *half* a *Nail*.

Beſides the many *Muſcles* in the *Neck*, for the Motion of the Numerous *Vertebræ* and the *Head*, there are *Two* moſt Elegant *Muſcles*, which come from within the *Thorax*, ariſing within the *Cheſt* about the *2d Rib*, which inſert themſelves on each ſide of the *Aſpera Arteria*; theſe I may name *Directores Aſperæ Arteriæ*. At the Firſt Dividing of the *Aſpera Arteria*, or its Divarication on each ſide of the *Lungs*, there is a *Ring* Bigger and Stronger than any other Ring of the *Wind Pipe*. There are Divers *Glandules* in the *Neck* near the *Gula*; theſe are of a *Pale* Colour like Aſhes; But there are two moſt Beautiful *Glandules* ſticking to the *Carotidal Arteries*, as they come out of the *Breaſt*, one on each ſide; theſe are *Blewiſh*.

The *Peritonæum* Doubles and Encompaſſes the *Stomach* looſely. He hath *7. Ribs*, and the *Intercoſtal Muſcles* are Broad, Plain, and Beautiful. He hath no Prominent *Breaſt-Bone*, like other *Fowls*, nor a Narrow *Cheſt* like many *Quadrupeds*, but a Broad *Breaſt*, and a Large Firm *Sternon*, of the Shape of a Shield, Broader than the *Sternon* of a *Man*; and indeed when he puts Down his *Head*, and Bends his *Neck* Round to come in at a Door, his *Breaſt* is ſo Broad, and his *Tread* ſo Different, that it is not at all like the Entrance of a *Fowl*, but wonderfully like that of a *Camel*; but with this Advantage, that the *Oeſtridge* bearing his Weight upon *Two* Legs only, his Entrance is more Bold and Graceful.

The *Penis* was about an *Inch* long, with a ſmall *Cartilaginous* ſubſtance in it. The *Teſtes* lye very High near the *Kidneys* and *Back Bone*; and were very ſmall and Slender, of a *Yellow* Colour.

The *Ear* is Round, and the Orifice will receive ones Finger. The *Eye* is Large and *Blewiſh*, and almoſt as big as a *Man's*.

The Natural *Colours* of the *Feathers* of this Fowl were *White*, *Grey*, and *Dun*; the *Feathers* of the inſide of the *Wings*, upon the *Breaſt* and *Belly* and *Neck*, were *White*, and the *Feathers* in the *Tail* alſo *White*; but the reſt are *Greyiſh*, or of a *Dun* Colour; yet it is a moſt Beautiful Creature ſurely in *Barbary*, where the Heat of the Country *Criſps* and Curles all its *Feathers*.

The *Rimula* of the *Larynx* is Long, and the *Cartilages* about it ſtrong, but No *Epiglottis*, or Likeneſs to a *Humane Larynx*; although they that heard its Voice, compare it to the Crying or Shrieking of a Hoarſe Child, but more Mournful and Diſmal. The *Lungs* are of Fine Florid Colours, but Little in Proportion to the Vaſt *Aſpera Arteria*; they ſtick Cloſe to the *Back*, and are *Perforated* like other *Birds*; and upon Blowing into the *Wind-Pipe* with a Pair of Bellows, we could not make them Riſe or Fill. The *Heart* hath 2 *Ventricles* about the bigneſs of a *Man's Heart*; but the Right *Ventricle* is much Thinner, and the *Valves* are more Fleſhy.

There are *Two Stomachs* as in *Granivorous Fowls*, a *Crop* and a *Gizzard*; but the *Crop*, or *firſt Stomach*, Differs much from that of other Fowls, in

that

that it is not placed without the Breaſt but within the *Sternon*; in that it is not Round but longer like a Bag, and of a Vaſt Bigneſs, lying Lengthwiſe in the Body. We found many *Glandules* in the *Coats* of this *Stomach*; a Row of them on the *Back* part of it, Reaching almoſt from one End to the other, about a *Thouſand* of them, about *Ten* in Breadth, and an *Hundred* in Length. Theſe lye Between the *Coats* of the *Stomach*, and every Particular *Glandule* diſcharges it ſelf by a Peculiar Orifice, through the inward Coat of the *Stomach* into the *Cavity* thereof. We found ſome of theſe *Glandules* Round and Globular, ſome Oval, and ſome more Flat, and of an Irregular Figure: thoſe which lye Higheſt are Roundeſt and Thickeſt, thoſe which lye more towards the Bottom of the *Stomach*, or where it Unites with the *Gizzard*, are more Broad and Flat. Theſe bring in a *Juice* which helps to *Digeſt* that Various Nouriſhment which this Fowl makes uſe of. The *Gizzard* was very large; the *Inner Coat* did not Adhere ſo Firmly as in other Fowls, and was very Thick and like *Flannel*, and upon our firſt looking into the *Gizzard* from the *Firſt Stomach* it appeared as a piece of *Flannel*, or *Napkin*, which the *Oeſtridge* had Swallowed, and ſo ſtuck there. The Paſſage out of the *Gizzard* into the *Small Guts* is very Streight.

The *Guts* are about 20. *Yards* in Length; the *Smaller Guts*, beginning from the *Stomach*, are *Ten Yards* Long; and the *Larger Guts* down from thence to the *Anus* are near as much. At the Beginning of the *Great Guts* there are *Two Inteſtina Cæca*; each of them a *Yard* Long: And they have a *Skrue* or *Spiral Valve* within them after the manner of the *Cæcum* of a *Rabbet*; this *Skrue* in both the *Inteſtina* Winds about 20 *Turns*. The Extremity of the *Cæcum* is little, not much Differing from the *Cæcum* of a *Man*. The *Excrement*, which is thrown out by the *Guts* is of Two Kinds; a White Thin Sticking *Excrement*, which it Mutes like a *Hawk*; and after that another ſort of *Excrement* comes, which is very like to that of a *Sheep*, but Bigger.

The *Meſentery* although it holds together ſuch a Number of *Guts*, *Great* and *Small*, yet it is not Thick, but is only a Tranſparent *Membrane*; as generally in *Pennates*: but it is very large, and in ſome places above $\frac{3}{8}$ of a *Yard* Deep or Broad; Meaſuring from the Center to the *Guts*.

The *Liver* hath 4 *Lobes*, and is of a Colour not much Different from that of a *Man's*; We could find no *Bladder of Gall*. There was a *Glandule* Under the *Stomach* which might ſeem to be a *Spleen*: but *Pennata* and *Infecta* are ſaid to have no *Spleens*. The *Pancreas* was Slender, and above a *Foot* long. The *Kidneys* are large, and of the Length of my Hand, as they lye both together; they are of the Shape of a *Guitar*. The *Ureters* are Firm, Strong, White and Long. Behind the *Kidneys* lye two *Glandules* ſomewhat Oval, of about an *Inch* and a *half* in Length, cloſe to the *Back-Bone*.

The *Head* Reſembles that of a *Gooſe*: and is little in Proportion to the Whole Body.

In *Africa* where ſome make *Meat* of *Elephants*, it is no wonder if ſome alſo *Feed* upon *Oeſtridges*: but *Galen*, and Phyſitians, Condemn it as Hard of *Digeſtion*.

The Cuntur *of* Peru; *by Dr.* Hans Sloan. n. 208. p. 61.

XCV. The Magnitude aſcribed to the *Cuntur* or *Condor* of *Peru*, as well as its great Force and Strength, have been the Cauſe that many have Doubted its Being. Capt. *John Strong*, Commander of a Ship which went into the *South-Seas*, through the *Streights* of *Magellan*, and Returned after 23 Months Voyage in the *Year* 1691. gave me this Account, together with a *Wing* or *Quill-Feather* of the Bird, *viz.* That on the Coaſt of *Chili* they had met with this Bird in about 33°. *S. Lat.* not far from *Mocha*, an Iſland in the *South-Seas*, and before they came at a place called *Herradura*; That his Men were very much Amaz'd at the bigneſs of it; and that after they had Killed it, it was 16 *Foot* from *Wing* to *Wing* Extended. The *Spaniſh* inhabitants there told them, it was the *Cuntur*, and that they were Affraid of theſe Birds, leſt they ſhould *Prey* on, or injure their Children. The *Feather* he gave me is 2 *Foot* 4 *Inches* Long; the *Quill* part is 5 *Inches* $\frac{3}{4}$ long, and an *Inch* and $\frac{1}{2}$ about in the Largeſt part; it Weighed 3 *Drams* 17 *Grains* and $\frac{1}{2}$, and was of a *Dark Brown* Colour, very Hollow or Concave on one ſide, and Convex on the other. The Seamen ſhot it ſitting on a Cliff by the Sea-ſide, and Eat it, taking it for a ſort of *Turkey*: in which Miſtake likewiſe the Firſt Comers to *Jamaica* were with a Bird in that place, called a *Carrion-Crow*, which is a ſort of *Vultur*, of which kind *I* believe this alſo is.

Obſervations on the Heads *of* Fowl; *by Dr.* All. Moulen. n. 199. p. 711.

XCVI. 1. In the *Heads* of all *Fowl* that I have had an Opportunity to Examine, I conſtantly found only *One Aquæductus*, or Paſſage from the *Ears* into the *Pallat*; whereas in *Men*, *Quadrupedes*, and ſome *Amphibious Fiſh*, there are always *Two*. 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 *Raven's*, 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 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 *Aquaductus*, 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 Supplyed; no other Creatures that we know of having any thing of it. There are ſeveral *Laminulæ* and *Pillars* of Hard Bone between the *Two Tables* in theſe *Cavities*, Deſigned, as may be ſuppoſed,

partly

partly for their Maintenance at a convenient Diſtance, and partly for *Breaking* of the *Air*, ſo as to Hinder *Ecchoes* and Confuſed Repreſentations of Objects; as it hath been ingeniouſly obſerved by Sir *J. Hoskins*, That *Pillars* in *Churches* very much Prevent *Ecchoes*.

3. In the *Heads* of *Woodcocks*, beſides the *Paſſages* now deſcribed, *I* found one on each ſide the *Bone*, making the Orbit of the *Eye*, proceeding from the *Ear*, and reaching forwards towards the ſetting on of the *Beak*; near which, they Joined in one, and Turned under the *Skull* in a ſmall Paſſage leading to the *Cavity*, by which the *Ears* Communicate, and which is above deſcribed, 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 *Bruiſed*, theſe *Paſſages* cannot be Diſcovered, for *Blood* Extravaſated in them. *Note* alſo, That the *Laminulæ* and *Bony Pillars* are every where to be obſerved where there is a *Paſſage*, excepting under the *Skull*, in the *Paſſage* from the ſetting on of the *Bill* to the *firſt Paſſage* Deſcribed.

4. In the *Heads* of *Parrots* and *Paroquets*, beſides the *firſt deſcrib'd Paſſage*, I obſerved, 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 *Cochineel*, 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 the Numerouſneſs of the *Laminulæ* 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 *Laminulæ* 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* deſcribed *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 deſigned to make them more *Watchful* than *Domeſtick Fowls*, or than thoſe that live much on the *Water*, becauſe they are liable to a great many Dangers that the others are exempt from.

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 *Epiphyſe*, 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*.

8. *I* Obſerved 3 *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*,

Wood-

Wood-Cocks, *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 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 observed above; whence it is Probable that these *Nerves* are Designed for some Great Use, both on the Account of their Number and their Largeness; and that the Use to be Assigned to them, must be to Enable them to *Distinguish* (whether by *Tasting* or *Feeling I* will not now determine) their *Food*, there being a necessity of a more Exquisite Sense in these *Fowl*, than in any other.

Fig. 246. The 246 *Figure* Represents these in a *Duck's Head*; where *aa.* Expresses the Edge of the *Cranium*, which is in part Removed for the more clear View of these *Nerves*; *bb.* Are the *Cells* about the *Ear*, Between the *Two Tables* above described; *cc.* The *Brain* laid bare, with its *Blood Vessels*, *ddd.* The *Three Nerves* on One side; *e.* The *Optick Nerve*; *fff.* The *Skin* and part of the *Bone* Removed, to bring the *Nerves* in view; *gg.* The *Two Nerves* Expanded near the End of the *Upper-Bill*; *hh.* That in the *Lower*.

9. All the *Eyes* of a *Fowl* and of *Fish*, that *I* have Examined, were more or less *Cartilaginous*; for the *Sclerotis* is a *Cartilago sui Generis*, especially near the *Cornea*, in all these Animals. And in the Larger sorts of both I remember to have found the Whole *Sclerotis* such a kind of a *Cartilage*.

10. *I* have frequently Observed in *Smaller Fowl* that the *Membrane* of the *Drum* was *Double*: For by gently pulling away the *Membrane* Lining the Tube of the *Ear*, *I* have observed 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 also sometimes Observed this in *Larger Fowl*, in a *Seal*, and in some Other Animals; and perhaps it may be so in all.

By Mr. J. Clayton. n. 206. p. 990.

2. Dr. *Moulen* and my self, when we made our *Anatomies* together at *London*, shew'd to the *R. 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: This was most Evident in a *Duck's Bill* and *Head*; a Duck having Larger *Nerves* that come into their *Bills* than *Geese*, or any other Bird that *I* have seen, and therefore *Quaffer* and *Grope* out their Meat the Most: But *I* then discovered none of these *Nerves* in *Round-Bill'd Birds*:

Birds. But ſince, in my *Anatomies* in the Country, in a *Rook I* firſt obſerved two *Nerves* that 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 not *I* ſeen them firſt in a *Rook*, *I* ſhould ſcarce have made the Diſcovery. In the *Lower-Bill* alſo there are *Nerves* that have much the ſame Situation with the *Flat-Bill'd Birds*; but very ſmall, and ſcarce diſcernable, unleſs to the Cautious and Curious.

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* call'd the *Drum* on either *Ear*, and Water poured in at one *Ear* will run out at the other. 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 Skulls*, and paſſes all round the *Head*. The *Upper Scull* is ſupported by many *Hundreds* of ſmall Thred-like *Pillars*, or *Fibres*; which, as we ſuppoſed, had another Uſe alſo, *viz.* to *Break* the *Sound* from making any Confuſed *Echo*, and to make it One, and Diſtinct. This *Paſſage* we obſerved was much Larger in *Singing Birds* than in others that do not *Sing*, ſo very Remarkably, 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 Accuracy 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 ſharp, as *g. h. r.* and never have an Aptitude to Learn to *Sing*. *Ib.* p. 993.

I have alſo 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 Skull*, and a great *Cavity* like a *Bird*, and is very Acute of *Hearing*. The *Skull* by reaſon of this Large *Cavity*, being very ſlender is eaſily Cruſhed; ſo that a *Mole* is quickly Kill'd with a Bruiſe on the *Skull* like a *Lark*, and upon the Bruiſe the *Membranes* of the *Skull* turn *Black*; but when *I* have taken care not to *Bruiſe* the *Skull*, the *Membranes* were not *Black* at all.

XCVII. *I* have Obſerved, by Inflation into the *Aſpera Arteria* of *Fowls*, that there is a Continuation of many *Veſicles* extended from the *Bronchiæ* through the *Abdomen* to the *Anus*. This, *I* conceive to be the Cauſe of the Conſtant Motion of the *Anus* in *Fowles*; the Air having Ingreſs and Egreſs there: and alſo that to be the Reaſon why the *Anus's* of *Fowls* are in *Malignant Diſtempers* Applied *The* Anus *of* Fowls *applied in* Malignant Diſtempers; *by Mr.* J. Templer. n. 86. p. 5031.

to Draw the *Infection* out of the Body. For thoſe *Anus's* being like *Cups* or *Ventouſes*, the Fowl has often *Stuck* by it's *Anus* till it *dyed*; in which Caſe I have known 7. *Chickens* Applied to the Groin of one *Viſited* by the *Plague*, that *Stuck* till they Dyed, and the *Eighth* went Quickly off and *Lived* above 1½. *Year* after.

A Blemiſh peculiar to the Eyes *of* Horſes; *by Dr.* Rich. Lower. n. 32. p. 613.

XCVIII. 1. The *Eyes* of *Horſes* are peculiarly Affected with one Defect which no Animal beſides is Troubled withal (as far as *I* have Obſerved;) and that is, a *Spungy Excreſcence* (commonly of a Dark *Musk Colour*) which grows out of the Edge of that *Coat* of the *Eye* call'd the *Uvea*. If this *Spungy Subſtance* be ſo great, or the Number of them ſuch, as that they grow in ſeveral Places about the *Pupil* of the *Eye*, where it *Contracts* it ſelf, the *Pupil* or *Sight* is very much (if not totally) Obſtructed; and conſequently the *Horſe* ſees very little or nothing at all: As *I* have many times taken Notice in ſome *Horſes*, which being brought into the Sun ſhine, could not ſee at all, but ſuffered me to touch the *Sight* of their *Eye* with my Finger without the leaſt Winking, which *Horſes* being led back into the *Stable*, the *Uvea* in that Obſcure place *dilating* itſelf, they could ſee very well again, and would not ſuffer me to ſhew my Finger near to the *Eye* without Frequent Cloſing their *Eye-Lids* and Toſſing their Heads. The ſame *Horſes I* underſtood by the Owners were very Apt to Stumble in the *day-time*, if it were Bright and Sun ſhine, but Travelled very well and Securely in the *Evening* and in *dark Cloudy Weather*.

I cannot think that theſe *Excreſcencies* come from *Straining* in great Draughts and Races, or from Hard Travel: becauſe *I* have ſeen very large *Spunges* (as *I* may call them) in Young Horſes Eyes of 2. and 4. *Years* Old, before they were Backed; which, after they have been taken up from the Graſs, and kept with Dry-Meat, have very much Abated, and afterwards being turned to Graſs in the Spring to Cleanſe and Cool their Bodies, have Increaſed again to the wonted Bigneſs.

It is Remarkable, that the More and greater thoſe *Excreſcences* are, the more the *Pupil* of the *Eye* or the *Sight* is in Danger of being quite Obſtructed; which you may farther Examine by Turning the *Horſes Eye* to the *Light*, and obſerving how much of the *Pupil* they do Obſtruct. That thoſe on the *Upper* Edge of the *Uvea* are apt to grow the Largeſt, and Hinder the *Sight* moſt. And that that which grows on the *Middle* of the *Uvea*, does more hinder the *Sight*, by Diſtracting the Object, than that, which grows in either *Corner* or *Angle* of it.

I ſuppoſe no *Cure* can be expected but from a Drying Kind of Diet: Yet perhaps Outwardly ſomething may be Deviſed to Shadow the *Eyes*, and keep them from being Nakedly expoſed to the Sun, whereby the *Pupil* will not be ſo Cloſely *Contracted*, and conſequently the *Sight* not ſo much Obſtructed.

By ..... n. 37. p. 739.

Two *Horſes* of an *Iron-Gray* or *Dapple Gray* are frequently enclining to looſe one or both *Eyes*, if Backed or Hard Ridden too ſoon.

In

In *Man* and *Beaſt*, (in *Horſes* at leaſt) the *Right Eye* is the *Weakeſt*, and moſt frequently failing.

The *Pupil*, or Black of the *Eye*, is Wider and Larger in thoſe that are *Short-ſighted*, than in thoſe that ſee at greater Diſtance.

I have often noted ſome that are *Short-ſighted*, *I* ſay not *Pore-blind*, to diſcern all things that are done about them, almoſt quite Behind them, more perfectly than the Beſt-ſighted, if the Room was not too Large for the Reach of their *ſight*.

Alſo ſome of Dr. *Lower*'s Obſervations, *I* could Confirm by my own Expe-rience. In my youngeſt Days *I* had a very narrow Eſcape from an excel-lent *Horſe*, which had that only Defect, which they call *Moon-blind* (and they told me of it after the miſchief:) *I* purpoſed to Leap a Ditch, but the Horſe ſaw no Ditch, ſo we fell in together.

As Coach and Cart-Horſes have Flaps on the Ear ſides of their *Eyes*, ſo theſe Flaps may be fitted (and in ſome ſhew of Ornament) to ſhadow the O-ver-part of the *Eyes*, and yet to afford them Light enough to ſee their way. *I* know not whether it be Uſual amongſt you, but *I* have ſeen a Young Child wear a kind of Black Riband, like a Narrow *Mask* before her *Eyes*, the Ri-band or *Mask* having *Holes* made in fit places to Guide the *Eye*: And this was ſaid to be an Effectual Remedy to cure the Child of *Squinting*, which ſhe had Hereditarily from her Mother.

A Horn Hanging at the Neck of an Ox; by S. Malpighi. n. 166. p. 601

XCIX. Duodecimus jam excurrit Annus, quo mactandum Bovem luſtravi cum præclariſſimis Viris D. *Carolo Fracarſato*, & D. *Silveſtro Bonfiliolo*, a cu-jus *Collo* in Dextris, ubi jugum apponitur, inſigne pendebat *Cornu*. Hujus Longitudo 16 *Digitorum* craſſitiem æquabat: Non longe à baſi, ubi Latius erat, 8. *Digitorum* Latitudinem explebat. Ejus forma Conica erat, & in ob-tuſum deducta Apicem, non parum verſas finem Curvabatur. In baſi tamen, ubi *Collo* nectebatur, Arctius erat. Color circa extremitatem *ſubniger Luci-duſque* erat; & perſimilis ei, qui in *Ungula Bubula* paſſim obſervatur. Exte-rior ſuperficies Aſpera erat, præcipue à Baſi uſque ad Medium; etenim *Cuti-cula* & Subjectum *Reticulare Corpus* cum contentis *Papillis* (quæ in aliis Parti-bus Perpendiculariter attolli ſolent, ac *Tactus Organum* conſtituunt) ſenſim produci inclinarique incipiebant, non diſpari ſpecie, ac in noſtrorum *Digito-rum* Extremitate, qui libet prope *Unguium* Radicem obſervare poteſt. *Pa-pillæ* igitur, Laciniata *Cuticula*, & *Reticulari Corpore* circumdatæ, majorem Longitudinem ſortitæ ita Inclinabantur, & invicem hærebant, & ferrumina-bantur Extremis Finibus, ut ſquammoſum *Piſcium* Tegumentum æmularen-tur. Circa Baſim Squammoſa hæc Corpora Brevia erant, ſenſim vero pro-ducebantur & prope Conum Longiſſima reddebantur. Varius quoque erat Subſtantiæ modus; nam in Baſi *Papillaria* hæc Corpora non ita ſibi mutuo connexa conglutinabantur, ſed ſolutis ipſorum Finibus Laciniatum & Aſpe-rum excitabatur Corpus. Ultra tamen Medietatem denſiori donabantur Com-page, unde & Lucida & Lævia videbantur. Interius Expoſitum *Cornu* Con-cavum erat, ita ut Craſſities ipſius in Baſi nativam *Corii* altitudinem parum excederet; gracileſcente tamen & attenuato *Corio*, ad Naturam quaſi *Mem-*

branæ, intus ambiebatur, quod *ſanguinea vaſa* irrigabant; hocque detracto Solidum & Læve corpus occurrebat. Tota Concavitas referta erat *Subflavo*, Turbidoque *ſero*, quod igni appoſitum totum fere in Naturam *Albuminis Ovi* concreſcebat. Sub Baſi *Glandulæ Conglobatæ*, depreſſæ tamen, inſigniter luxuriabant.

Ex hujus igitur diligenti, Inſpectione patet, *Papillas* (quas non incongrue Externi *Tactus Organa* credidi) *Cuticula* & *Reticulari Corpore* cuſtoditas, ubicunque plus juſto producuntur, & invicem intime unitæ ferruminantur, in ſolidum deſinere Corpus: quod commune eſt *Unguibus* & *Cornubus*, quæ ſola Exteriori Configuratione, & majori minorive Partium denſitate donata, ad invicem diſcriminantur; unde veluti *Senſorii* Additamentum cenſenda veniunt, & *Tactui* quoque non parum Conducentia. *Cornuum* è *Cranio* erumpentium obſervata Productio his multum lucis confert: Hanc itaque *Vegetationem* in *Bove* deprehenſum in *Phyſicæ* additamentum audire ne graveris.

In *Fætu* igitur, adhuc in *Utero* contento, *Cranii Os* in ſitu *Cornuum* fere *Cartilagineum* eſt, & poſtremo *Oſſeam* Naturam acquirit. *Pili* ibidem primo erumpunt Glabro exiſtente *Corio* præter Labia, quæ quibuſdam *Pilis* ornantur. Hi taliter locantur, ut ipſorum Ordines à circumferentia verſus Centrum ſituati & inclinati minimum quaſi *Conum* efforment. Poſtremis quoque *Menſibus*, in Fætu adhuc Concluſo, *Oſſeæ* Lamellæ (quibus *Cranium* compaginatur) obliquari incipiunt, & fracta Directione extra eminent, excitatis intro ſubrotundis ſpaciolis, unde ſupra *Cranium Oſſeus* Tumor primo emergit Lenticulare corpus præ ſe ferens. Hoc extenſo *Corio* cooperitur, quod præ reliquis Craſſum eſt, & Turgentes exhibet *Glandulas*. Inter *Oſſeum* Corpus, & *Corium*, *Perioſtion*, ſeu *Oſſeæ* ſubſtantiæ inchoamenta locantur, quæ paulatim manifeſtantur. Extra *Uterum* ſenſim *Oſſeus* Tumor Lenticularis parum aſſurgit, Turgentibus *Oſſeis* Lamellis. Supra *Os* craſſum luxuriat *Perioſtion*, ſeu futuri *Oſſis* Inchoamentum. *Corium* quoque obducitur, à quo *Tactus Papillæ* aſſurgentes *Reticulari* & *Cinereo Corpore* ambiuntur: Hoc copioſis *Pilis*, diverſam Inclinationem ſortitis, cooperitur. Altero elabente *Menſæ*, *Oſſea* ſubſtantia Laminulis & Spatiolis contexta extuberat, ita ut *Cornu* Rudimentum emergat, dimidiam *Digiti* craſſitiem æquans, & *Conoidem Parabolicum* repræſentans. Hujus exterior ſuperficies Lævis & Glabra ſenſim redditur, *Nigroque* inficitur Colore. *Corium* Craſſum de more extenditur, à quo *Tactus Papillæ* erumpentes, ſuperato *Reticulari* Involucro, quod *Cinerem* eſt, elongantur & *Nigro* ambiente Succo conglutinantur. Hæ circa *Cornuum* Baſim inclinatæ verſus Apicem diriguntur. Reliquæ vero ab Apicæ exortæ Perpendiculares quaſi aſſurgunt, & *Reticulari Corpore* cuſtodiuntur; earum Longitudo vix *Serici Villoſi* Lanuginem æquat. Interea incluſa *Oſſea* Appendix Augmentum capit & Interias varie Configuratur: Etenim ut plurimum Radix Fiſtuloſa excitatur ſubſtantia quæ *Oſſeis* Fibris Reticulariter implicitis componitur; reliquum vero uſque ad Apicem Spongioſo conſtat Corpore. *Sanguinea* intercurrunt *Vaſa*, & Apex

Apex perpetuo *Submollis* firma Partium compage non gaudet. *Corium* quoque extenſum *Oſſeam* Subſtantiam inveſtit, & in Baſi Craſſius eſt. Ab hoc itaque emergentes *Tactus Papillæ* ita Proceræ redduntur, ut inclinatæ verſus Apicem, ſimulque *Reticulari Corpore* unitæ, tot *Conica* Corpora Concava efficiunt, & ex horum Unione (quaſi tot Lamellis, Cæparum inſtar intra ſe poſitis) ſolidum *Cornu* Corpus efficiatur. *Papillarum* Ordines in Baſi erumpentes, licet non omnes Apicem attingant, ut plurimum tamen Recta deducunctur, & fere *Cornu* ambiunt ; aliæ quoque ſub diverſis Planis à producto *Corio* propagantur, quæ Longiores redditæ, Breviores Cooperiunt & Includunt; Unde ſecto per Longum *Cornu* non ſolum *Oſſea* ſubſtantia occurrit, ſed etiam *Corium* à quo Molles *Papillæ* emanunt, quæ in *Cornuum* ſubſtantiam immutatæ ſolideſcunt, & Nigreſcunt, avulſoque *Oſſe* cum ambiente *Corio*, Fiſtulæ in *Cornu* à Reticulari Opere excitatæ patent. Occurrunt quoque *Papillarum Tactus* varii Exortus & Plana, ipſarumque Productio uſque ad Apicem ; unde cum diverſa Plana extremum *Conum* conſtituant, hinc eſt, quod Apicis ſubſtantia craſſitiem fere *Digiti* æquat. Exaratæ *Papillæ* Baſim *Cornuum* excitantes Molles adhuc ſunt,& de facili Lacerantur,vel in Furfures abeunt: circa Finem vero & Apicem ita adenſantur, & *Reticulari Corpore* ferruminantur, ut ſolidæ Factæ *Nigro Lucidoque* inficiantur Colore. Harum Progreſſus evidens eſt; nam tot quaſi Filamentis, per longum ductis, coagmentari videntur.

Procerioribus redditis *Cornubus*, ita ut 12. *Digitorum* craſſitiem æquent, incluſa Appendix *Oſſea* Longior redditur: & ubi continuo & pleno *Oſſe* non coagmentatur, Variis *Cellulis* concameratur & excavatur. Secto autem *Cornu* per Longum, Singula dilucidius patent; Primo enim frequenter exarata Appendice *Oſſea* Laminâ componitur, ita ut Tubus efficiatur: Portiones tamen *Oſſeæ* oblique per tranſverſum ductæ inſeruntur,unde relictæ Areæ Concavitate oblongas, in equalis tamen Longitudinis & Figuræ, efficiunt, in quibus aliæ quoque ab aſſurgentibus parum *Oſſeis* Paretibus deſignantur. Omnes hæ Concamerationes *Membrana* tenui obducuntur, ſub qua *Sanguinea Vaſa* in miras propagines diramata cuſtodiuntur. Verſus Apicem *Oſtea* Subſtantia Spongioſa eſt nullis *Cellulis* excavata, unde impenſe Rubet ex innumeris Vaſculis, quibus irrigatur.

Expoſitam Appendicem *Oſſeam* extenuatum *Corium* ambit, à quo Molles de more *Tactus Papillæ* emanant, quæ *Reticulari Corpore* cuſtoditæ, ſimulque ferruminatæ, verſus Apicem deductæ *Cornu* componunt, ita ut *Cornuum* Parietes in Baſi Graciles ſenſim ex *Papillarum* additione reddantur, & tandem in Apice ex omnium Unione, Duorum *Digitorum* craſſitiem æquent.

Horum Interior Superficies *Nigra* eſt, & Fiſtuloſis Foraminulis verſus Apicem directis exaſperatur, quibus *Papillæ* admittuntur. Exterius Apex Acuminatus Solidus, Lucidus & *Ater* eſt; verſus Medium tamen *Subalbeſcit Cornu*, & circa Baſim parum *Nigreſcit*, & de facili in Squammas ſolvitur.

Ulterius tandem Augmentum ſortiuntur *Cornua*, ita ut urgente interiori *Oſſea* Appendice Primi *Papillarum* Ordines à Baſi erumpentes, avulſi à *Corio* Separentur, & ita diverſi Fines & *Papillarum* Limbi apparent; non diſpari ritu ac in *Conchis Marinis* conſpicimus, quarum compoſitio diverſis *Teſtulis* Superpoſitis, in æqualibus tamen, coagmentatur, ita ut Extremi Fines quarumcumque *Teſtularum* minimum eleganſque exhibeant Planum. Hæc eadem Structura evidenter quoque in *Dorcadis Cornubus* eluſceſcit, unde à Radicibus uſque ad Medium Aſperitates, quaſi Nodi, obſervantur, quæ à diverſis *Papillarum* Lamellis vario tempore à *Corio* avulſis, & ſurſum Retractis Excoriuntur, quæ omnia diligenti *Microſcopii* luſtratione patent.

Poſtremo tandem *Cornua* Ultimum ſortita Incrementum non parum immutantur; nam Exterius ipſorum Color Varius efficitur, ſubſtantia quoque ſolidior reddita, Diaphana fere evadit, & continuo uſu Lævigatur. Interius *Oſſea* appendix Obtuſo terminatur Fine, totaque ipſius Longitudo gracilente *Corio* adhuc Tegitur. Ab hac emergentes olim *Tactus Papillæ* obliterantur, præterquam in Apice: Interior enim *Cornuum* Superficies evaneſcentibus Vaginulis, ſeu *Reticularis Corporis* Finibus, ex Ferruminantis Succi exundante copia, tota fere circa Baſim Lævis & Perpolita redditur, ita ut *Papillarum* productiones quaſi obſcurentur.

Analogam quoque Generationem in *Gallorum Calcaribus* obſervamus, quæ ex Cuticula & Subjectis *Papillis Reticulari Corpore* conditis conflantur, ita ut turgente intus *Oſſea* Appendice Exterius quoque *Corium* multiplicibus *Cuticulæ* involucris obductum rapiatur, & Novum quaſi *Cornu*, licet minimum, erumpat.

Ex his igitur conjectari licet, *Monſtruoſum Cornu* in *Bove* ortum traxiſſe non tam ex Ulteriori *Papillarum*, *Corii*, & *Reticularis Corporis* productione, ſed ex conatu Interioris Tumoris, & ex Compreſſione facta in Cervice à proximo Jugo: in Naturali namque *Cornuum* Eruptione emergens *Oſſea* Appendix extenſam ſibi *Corii* portionem ſenſim Urget, ſecumque rapit, ita ut *Papillæ* verſus Apicem inclinatæ elongentur. Proceriores autem redditæ ſunt, in *Monſtruoſo Cornu*, *Tactus Papillæ* ex Copioſo fortaſſe Succo per Filamentorum Reticularem contexturam, qua *Corium* componitur, excurrente vel elabente in continuatas *Papillas*, & in Muſcoſum *Reticulareque Corpus*, ut in *Ungularum* Vegetatione contingit, quæ cum Extremis *Papillarum* Finibus excitentur, in Deformem producerentur Longitudinem, niſi vel Arte, vel Attritu mutilarentur. Probabile quoque eſt ex Urgente aſſidue Jugo proximam *Cervicis* partem Compreſſam & inde *Calloſam* redditam fuiſſe: *Sanguinis* namque Motus non ita feliciter celebratus eſt; *Ichoris* quoque & Lenti *Humoris* per exaratam *Corii* contexturam ulterior Fluxus impeditus eſt; & *Sudoris*, *Halituſque* Effluvia per propria *Sudoris Vaſcula* ſuppreſſa ſunt, unde *Corii Papillæ* ultra Augmentum in Novum Situm & Compagem adaptæ

ſunt,

ſunt & *Reticulare Corpus*, quod alias *Mucoſum* eſt, pene *Oſſeam* nactum eſt Conſiſtentiam. Hæc autem Ferruminatio probabiliter contigit ex *Vitriolato* Humore per *Excretoria Sudoris vaſa* effluente, vel ſaltem ab *Acidis Effluviis* Coercitis & *Fixatis*, dum interim Evaporantibus *Alcalibus* & *Aquoſis* Particulis *Sanguinei* inſtar *Seri* Solidum, Lucidumque fere Corpus excitatum eſt.

A Lamb Suckled by a Weather; by Mr. Tho. Kirke. n. 214. p. 263.

C. Sir *Will. Lowther* (in *Yorkſhire*) had a *Lamb* 1694 which, being Left by the *Ewe*, *Suckt* a Weather (*Aries Caſtratus*) and brought him to *Milk*, and was maintained by him all Summer till the latter End of *Auguſt*, that he was *Weaned*. I ſaw his *Udder* the latter End of *Sept.* each ſide whereof was about the bigneſs of a Hen's Egg; and he had 2 conſiderable *Teats*. I ſaw *Milk* ſpurted out of them, to a *Yard* or *two's* Diſtance, notwithſtanding the *Lamb* had been taken from him ſo long. In *Nov.* I ſaw him again; but his *Udder* was then much fallen, each ſide being now about the bigneſs of a *Walnut*; there is *Milk* ſtill in it, enough to Stream out above *half* a *Yard*.

There is no Tokens at all, of an *Hermaphrodite* in him. I compared him with another *Weather*, who had *Teats* or *Paps* like him, and Differed in nothing but the *Udder*. The *Ewe* Dyed upon *Shearing*, when the *Lamb* was about 5 *Weeks* Old: ſo 'tis likely it might *Feed* partly upon *Graſs*, as *I* ſuppoſe other *Lambs* of the like Age do notwithſtanding what they *Suck* from their *Dams*.

Graſs found in the Wind-Pipes *and* Lungs *of ſome Animals; by Mr.* Rob. Boyle. n. 6. p. 100.

CI. Dr. *Clark* and Dr. *Lower* have given me an Account of a pretty Odd kind of Obſervation: One of them aſſuring me, that he had ſeveral Times, in the *Lungs* of *Sheep* found a conſiderable Quantity of *Graſs*, in the very *Branches* of the *Aſpera Arteria*; And the other relating to me, that a few Weeks ſince, He, and a Couple of Phyſitians, were invited to look upon an *Ox*, that had 2 or 3 *Days* almoſt continually Held his *Neck Straight up*, and was Dead of a Diſeaſe the Owner could not conjecture at; whereupon the Parts belonging to the *Neck* and *Throat* being Opened, they found the *Aſpera Arteria*, in its very *Trunk*, all Stuffed with *Graſs*, as if it had been thruſt there by Main Force: Which gives us juſt cauſe to wonder both how ſuch a Quantity of *Graſs* ſhould get in There; and how, being there, an Animal could Live with it ſo Long.

A Murren *in* Switzerland *and it's* Cure; *by Dr.* Wincler. n. 145. p. 93.

CII. 1. On the Borders of *Italy* a *Murren* infected the *Cattle*, which ſpread farther into *Switzerland*, the Territories of *Wirtemburg*, and over other Provinces, and made great Deſtruction amongſt the *Cattle*. The Contagion ſeemed to Propagate it ſelf in the form of a *Blew-Miſt*, that fell upon thoſe Paſtures where the *Cattle* Grazed, in ſo much that whole Herds have returned home Sick; being very Dull, Forbearing their Food, moſt of them would *Dye* away in 24. *Hours*. Upon *Diſſections* were Diſcovered Large and Corrupted *Spleens*, *Sphacelous* and Corroded *Tongues*, ſome had

had *Angina Maligna's*. Thoſe *Perſons* that careleſly managed their *Cattle* without a due reſpect to their own Health, were themſelves *Infected*, and Dyed away like their *Beaſts*. This *Contagion* may probably proceed from ſome *Noxious Exhalations* thrown out of the Earth, by 3. Diſtinct *Earthquakes* perceived here and in our Neighbourhood in the ſpace of *one Year*.

The Method of Cure was thus; As ſoon as ever there was any Suſpition of the *Contagion* upon any one of the Herd, the *Tongue* of that Beaſt was carefully Examined: in caſe they found any *Aptha* or *Bliſters*, whether *White*, *Yellow*, or *Black*, then they were obliged to Rub, Scratch and Tear the *Tongue* till it *Bled*; then they wiped away the *Blood* and *Corruption* with New Unwaſhen Linnen: This done a *Lotion* for the *Tongue* was uſed, made of *Salt* and good *Vinegar*. The *Antidote* for the Diſeaſed *Cattle*, and the *Medicine* for the Sick was the ſame. *viz.* Take of *Soot*, *Gun-Powder*, *Brimſtone*, *Salt*, Equal parts, and as much *Water* as is neceſſary to waſh it down; give a Large *Spoonful* for a *Doſe*.

By Dr. Fred. Slare. *ib. p.* 94.

2. *I* am aſſured, by 2 ingenious Travellers, that this Contagion reached the Borders of *Poland*, having paſſed quite through *Germany*; That it was obſerved to make its Progreſs daily, ſpreading near Two *German Miles* in 24. *Hours*; That it Continually without Intermiſſion made Progreſſive Voyages, and Suffered no Neighbouring Pariſh to Eſcape, ſo that it did not at the ſame time *Infect* Places at great Diſtances; that *Cattle* ſecured at *Rack* and *Manger* were equally *Infected* with thoſe in the *Field*. It were worth conſidering whether this *Infection* is not carried on by ſome *Volatile Inſect*, that is able to make only ſuch ſhort *Flights* as may amount to ſuch Computations.

The Diſeaſes of Dogs; *by Sir* Theodore Mayern. n. 191. p. 408.

CIII. *Dogs* are ſubject to theſe Diſeaſes. 1. The *Hot-Madneſs*, which is Incurable; they Fly upon every thing, and can hold out but 4 *Days*. 2. The *Running-Madneſs*, which is likewiſe incurable; They Fly Only upon *Dogs*, and that by Fits, and may ſometimes hold out 9. *Months*. 3. *La Rage Mue*, which is a Diſeaſe that lies in the *Blood*. 4. The *Falling Madneſs*, which Seiſes on the *Head*, and is a ſort of *Epilepſie*. 5. The *Blaſting* or *Withering*; this lies in the *Bowels*, which Shrink up Exceedingly. 6. The *Sleepy Diſeaſe*, which comes from Little *Worms* in the *Mouth* of the *Stomach*; Theſe *Dogs* Dye *Sleeping*. 7. The *Rheumatick Diſeaſe*; this Swells the *Head* very much, and makes the *Eye* Yellow. In theſe 5. Latter Diſeaſes the *Dogs* will not *Eat*, (nor at any time when they are *Sick*,) but they Live 8 or 9 *Days* without Hurting any Body, and then Dye of *Hunger*.

The *Two Firſt* are *Catched* by the *Breath* of *Dogs* being together, as in the *Plague* among *Men*: the *Latter* are likewiſe *Contagious*, but *Curable*.

CIV. The

CIV. The *Fore feet* of a *Rat* reſembleth thoſe of the *Caſtor*; The *Hair* is alſo ſome Fine, ſome Courſe, as in that Animal; The *Tail Scaly*, with *Hairs* between every *Scale*, like the *Caſtor's*, which ſhews theſe two Animals to be ſomething a-kin: and indeed the *Water-Rat* comes very near to the *Beaver*, and makes its *Holes* in the bank ſides of Ponds after the ſame manner. *Obſervations on the Diſſection of a* Rat; *by Mr.* Rich. Waller. n. 166. p. 594.

The *Penis* in the *Rat* has a particular Paſſage near the *Navel*, as in *Squirrels*; and not at the *Anus*, as in the *Caſtor*. *Fig.* 241.

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* Rumpled 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.

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 *Spermatick Arteries*.

The *Kidneys* were *Whitiſh*, with their *Succenturiati*.

At the *Neck* of the *Bladder* were inſerted the *Veſiculæ Seminales*; Tranſparent and filled 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*.

A A: The *Kidneys*; *a a*. The *Renes Succenturiati*; *b b*. The *Ureters*; *c c*. The *Crural Veins* and *Arteries*; *D*. The *Arteria Magna*; *e*. The *Vena Cava*; *F*. The *Bladder*; *g g*. The *Spermatick Veſſels*, *Veins* and *Arteries*; *hh*. The *Teſtes*, with the Branches of the *Veins* and *Arteries*; *i i*. The *Epididymides*; *k k*. The *Deferentia*; *l*. The *Penis*; *m m*. The *Veſiculæ ſeminales*; *nn*. Two *Glands*, from whence a Thick Juice might be Preſſed out; *o*. The *Balanus*. *Explication of the* Figure.

CV. 1. The *Sable-Mice* (which were firſt Obſerved in *Lapland* about *Thorne* 1697.) are near as big as a little *Squirrel*: their Skin Streaked, and Spoted *Black* and *Light-Brown*; they have 2 *Teeth* above, and as many under, very ſharp and pointed; their *Feet* like thoſe of *Squirrels*; they are ſo Fierce and Angry, that if a ſtick be held out at them, they will bite it, and hold it ſo faſt that they may be ſwing'd about in the Air; they are Fat and Thick, and without any *Tail*. Sable-Mice; *by Sr.* P. Rycaut. n. 251. p. 110.

In

In their *March* they keep a *Direct line*, generally from *North East* to *South West*, and are innumerable Thousands in each Troop, which for the most part is a *Square:* they *March* by *Night*, and in Twilight, and ly *Still* by *day*. The distance of the *Lines* they go in, is of some *Ells*, and Parallel to each other. If they meet any thing that might stop them, they avoid it not, tho' it were a *Fire*, a Deep Well, a Torrent, Lakes, or Moras, but without any Hesitation Venture through, and by that means, many *Thousands* of them are Destroyed. If they be met Swimming over *Lakes* and be forced out of their Course they presently Return into it again; when they are met in *Woods* or *Fields* and stopt, they set themselves upon their Hinder Feet like a *dog*, and make a kind of *Barking* or *Squeeking Noise*, leaping up as High as a Man's Knee, Defending their *Line* as long as they can: and if at last they be Forced out of it, they Creep into *Holes*, and set up a Cry sounding like *Biabb*, *Biabb*. They never come into any House, nor meddle with any thing that is Man's Meat; if a House happen to be in their Way, there they Stop till they Die, but through a Stack of *Hay* or *Corn* they will Eat their Way; when they *March* through a *Meadow*, they endamage it much, by Eating the *Roots* of *Gras*; but if they *Encamp* there by *day* they quite Spoil it, and make it look as if it were burnt, or strewed with *Ashes*. The *Roots* of *Gras* with Rotten Wood, and the *Insects* in it, are their Chief, if not only *Food*.

These Creatures are very *Fruitful*, yet their *Breeding* does not hinder their *March*; for some of them have been observed to Carry one *Young One* in their *Mouth*, and another on their *Back*.

It is reported that some Poor *Laplanders* have Eat several of them, and found their *Flesh* to *Taste* like *Squirrels*: *Dogs* and *Cats* Eat only the *Heads*, and *Birds* of *Prey* only their *Heart*. During the *Winter* they lie *Under the Snow*, and have their *Breathing Holes* upon the Top of it, as *Hares* and other Creatures use to have. The Country People are very Glad of these Guests, foretelling there will follow great Plenty of *Game*, as of *Fowl*, *Squirrels*, *Lo-Cats*, *Foxes*, *&c.* where of late Years there has been great Scarcity: being told by some old People that these sort of Creatures were seen in *Lapland*, about 20. or 30. Years before, and that thereupon they had Abundance of such *Game*.

By ..... *ib.* p. 112.

2. These *Mice* are the same with those called *Mures Norwegici*, described by *Olaus Wormius* in his *Museum*.

The Russian *Way of curing* Castorium; *by* ..... n. 163. p. 501.

CVI. Take *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 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 Kitchen, or in the Air, for a *Week* or more, until they are perfectly Dry and Hard; after which they may be Packed up in a Cask, or otherwise, for *Transportation*.

CVII. Take

Plate 12. Vol. 2.
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Fig. 230.

Fig. 232.

Fig. 223.

Fig. 220.

Fig. 221.

Fig. 222.

Fig. 217

Fig. 218

Fig. 219.

Fig. 229.

Fig. 225.

Fig. 228.

Fig. 227.

Fig. 226.

Fig. 231.

Fig. 233.

Fig. 239.

Fig. 240.

Fig. 241.

Fig. 242

Fig. 243.

Fig. 244

Fig. 246.

Fig. 243.

Fig. 224.

Fig. 235.

Fig. 234.

Fig. 236

Fig. 237.

Fig. 238.

Fig. 247.

CVII. That the *Teſticles* of the Animal in *New-England* call'd *Musk-quaſh*, do ſmell ſtrong of *Musk*, as Mr. *Joſſelin* ſaith, is moſt certain: For, *I* have known ſome of them kept a Long Time in ones Pocket, till they were become Hard and Black, and yet *Smelt* as ſtrongly as at firſt, which in my Opinion, was nothing inferiour to the *Scent* of that which is commonly ſold for *Musk* in the Shops. I remember, that one of our Seamen, being laid to ſleep too near the Fire-place, with one of theſe Dried *Teſticles* in his Pocket, it happened that a Coal burned through his Breeches to it, and made ſo great a *Scent* of *Musk*, that he might eaſily have been ſmelt a good way off.

The Musk-quaſh *by* ..... n. 127. p. 655.

New-England's Rarities.

This Animal deſerves to be further enquired into, eſpecially if what M. *Thevenot* relates be true; *viz.* That *Musk* is nothing elſe but the *Teſticles* of a *Beaſt* like a *Deer*, found in *China*, in the Province of *Honan*.

CVIII. The whole *Shape* of this Animal (which by ſome Authors is called *Tajacu*) was ſuch, that we may eaſily reduce it to the *Swine-kind*, as plainly appears by the *Figure*: but it was much Leſs than our uſual *Hogs*; for from the End of the Body, where the *Tail* ſhould be, to the Top of the *Head* between the *Ears*, was 2 *foot* and 2 *inches*, from thence to the End of the *Noſe* 11 *Inches*. The Girth of the Body, 2 *Foot*; The Girth of the *Neck* 16 *Inches*; of the *Head*, in the Largeſt place, 18 *Inches*; and of the *Snout* 12 *Inches*: For the *Lower Jaw* in this *Mexico-Hog*, was more Protuberant, and the *Head* leſs Tapering than in our *Swine*, and in the *Sceleton* appears much like that of the *Baby Rouſſa*, only it had not thoſe *Teeth*, and the *Neck* appeared ſo very ſhort and thick, not from thoſe large *Glands*, which in ſome of the *Swine-kind* do ſo ſtuff out their *Necks*, but from the ſhort turning upwards of the *Vertebræ* of the *Neck*, which were kept ſo cloſe to the Body, by the Inſertion of that ſtrong *Ligament* into the *Pol* from the *Back*, which in Animals that are *Prono Capite*, is of extraordinary Uſe, and much adds to the *Strength* of This Animal. The Colour of the Body was *Griſly*; being beſet with *Briſtles*, which were Thicker than thoſe of a *Hog*, and Leſſer than thoſe of a *Hedge-Hog*: but like thoſe of a *Hedge-Hog* or the *Quills* of a *Porcupine*, they were Variegated with *White* and *Black* Rings. The *Belly* was almoſt Bare. The *Briſtles* on the Sides were ſhorter, and gradually increaſed in Length, as they approach the *Ridge* of the *Back*; where ſome were 5. *Inches* Long. Between the *Ears*, on the Head, was a Large Tuft of theſe *Briſtles*; which were for the moſt part *Black*. The *Ears* were about 2½. *Inches* Long and Pricking up; The *Eyes* (as they are uſually in *Piggs*) but *Small*; from the *Lower Canthus* to the End of the *Noſe*, 6. *Inches*; The *Noſe* like that of a *Hogs*; The *Mouth* not Large; The ſide of the *Lower Lip* made Smooth, as it were by the Rubbing of a *Tusk* in the *Upper-Jaw*; The *Feet* and *Claws* perfectly as in Common *Hogs*, only the *Upper Claws* on the ſame Foot proportionably Longer, being one *Inch* and a *Quarter* Long, whereas the *True-Claws* were ſcarce one *Inch* and an *half*. It had no *Taile*. But what is moſt particular, and Differences it from any other Animal I know

The Anatomy of a Mexican Muck Hog; *by Dr.* Ed. Tyſon. n. 153. p. 359.

Fig. 248.

Fig. 249.

Fig. 250.

of in the World, is the *Feet*, or *Navel*, or *Foramen* rather, on the Hinder part of the *Back*.

Theſe Animals are Bred in *New-Spain*, *Nicaragua*, *Terra Firma*, and *Braſile*: They are uſually met with in the Mountains, and Woods, and go in *Herds* together. They Feed on *Roots*, *Acorns*, and *Fruits*: but, as the greateſt Delicacy, they Hunt for all manner of *Poyſonous Serpents*, and *Toads*; and having caught them, holding them with their *Fore-Feet*, with a great deal of Dexterity, with their *Teeth*, they ſtrip off their Skin from the *Head* to the *Tail*; then greedily Devour them. *Poſtea* (ſaith *Jo. Faber*, who had the Account from *F. Gregorius*, who often has ſeen them, and Lived in thoſe Parts 24 *Years*) *Radicem ſeu certæ Arboris Corticem ſibi notum quærit, quem comedit, ne Veneno inficiatur: & hac ratione optime Nutritur, Creſcit & Augeſcit.* When they are made Tame, they will Feed on any thing: But naturally they are very Fierce.

Hiſt. Anim. Mexican.

Ovideus Remarks that the *Swine*, which the *Spaniards* left on the Iſlands of St. *Domingo*, St. *Joannes*, and *Jamaica*, Multiplied and Encreaſed; But thoſe in *Terra Firma* durſt never go in the *Woods*, but were deſtroyed by the *Lions*, *Tygers*, and *Lupi Cervarii*: Yet in theſe *Woods* there are great Herds of theſe *Tajacu's*, that can make their party good with the Fierceſt of them. If any be Wounded, preſently he gets to his Aſſiſtance a great Number of his Kind, and never leaves till he has Revenged the Injury or is Slain. They are always at Enmity with the *Tygers*: and there is often found the Body of a *Tyger*, and abundance of theſe *Tajacu's* ſlain together. If they ſpy a *Man* they will Fiercely ſet on him, and his beſt Eſcape is to get up a Tree, which they will moſt furiouſly aſſault with their *Teeth*: nor will eaſily leave him, till forced by *Hunger*, or Slain by him, by *Club*, *Darts*, or a *Gun*. If they Hunt them, their *Dogs* are often Torn in pieces by them. Their *Fleſh* is Eſteemed very Good, and much Deſired by the Inhabitants. They have but a very Little *Fat*. Our Subject had ſcarce any.

We come now to the *Anatomy*; having therefore Divided the *Muſcles* of the *Belly*, we took notice of the Remarkable Structures of the *Stomachs*; for it had *Three*. Into the Middlemoſt was inſerted the *Oeſophagus*, or *Gullet*; which we therefore ſhall call the *Firſt Ventricle*, or *Stomach*. From this, on one ſide was a Large Paſſage into the *Second*, which Pouching out had its Two Ends winding like a *Horn*, and on the other ſide of the *Firſt* or *Middle-Stomach*, was a free Open Paſſage into the 3*d*. which Emptied it ſelf into the *Duodenum*. The *Firſt Stomach* was Lined within, with a White thick Hard *Membrane*; almoſt like the inward Pellicle of the *Gizard* of *Fowls*: with which none of the other Stomachs were endowed. For the *Inward Surface* of the *Second*, was ſmooth and ſoft; its *Membranes* thin, and more Enclining to the Common make of that of *Carnivorous Animals*: The 3*d*. ſomewhat like this, but Thicker and Rimpled within, with large *Plicæ*, or *Folds*. Dr. *Grew* takes Notice that in the *Common-Hog*, againſt the *Pylorus*, ſtands a Round *Caruncle*, as big as a ſmall *Filberd kernel*, like a ſtopple to the *Pylorus*; for Preventing (as he Conjectures) a too

Fig. 253.

Fig. 254.

Sto. and Guts of Quadrup, c. 3.

Suc-

Sudden and Copious Irruption of the *Aliment*. This is ſufficiently Provided for in our Subject, by the great ſtreightning of the *Pylorus* here, and the great Aſcent it muſt take, before it can go out: which may be the Reaſon too, of Natures making theſe ſeveral Cells, or Partitions, for the better *Digeſtion* and *Maceration* of the *Food*; for it being *Frugivorous*, *Graminivorous*, and *Carnivorous* too, the *Stomachs* are ſo Contrived, that as the *Firſt* here, by its *Inward Pellicle* ſome- *Fig.* 252.
what reſembles that of *Birds*, that are *Carpophagous*, ſo the others, thoſe of *Quadrupeds*.

The *Small Guts*, which in other Animals being faſtened to a Large *Meſentery*, uſually do Hang down, were here Cloſer gathered, by the ſhortneſs of this *Membrane*, to the *Spine*: and the *Colon*, which in others is Suſpended, here by its Peculiar ſtructure lies Looſe, and Falls down; For the *Duodenum*, ariſing from the *Pylorus* with a Short Turn, and the other *Small Inteſtines*, made abundance of *Convolutions* and *Windings*. And altho' the *Meſentery* was but very ſhort from the *Spine*, and its Circumference ſeemingly but very little, yet in this Compaſs it contained 27 *Foot* of theſe *Inteſtines*; for ſo much they meaſured from the *Pylorus* to the *Colon*. The *Colon* was not faſtened to the *Periphery* or *Rim* of the *Meſentery*, as ordinarily: but ariſing from the *Center*, or Middle, made a *Spiral Line*, its End hanging Looſe, and its Turnings Cloſely United one to another by *Membranes*. This *Colon* was very Large, in reſpect of the other *Guts*; and as *I* meaſured it, it was 9 *Foot* long. It had a ſhort *Cæcum*, but pretty Wide, and fill'd with *Fæces*. What Dr. *Grew* obſerves, that 'tis peculiar to the Cæcum of a *Hog*, and that of a *Horſe*, to have the ſame Structure with the *Colon*, is true Here too: And it may be reckoned as an *Appendix* of the *Colon*. The *Meſaraick Veſſels* were alſo extraordinary: for Here we obſerved a large *Vein* and *Artery*, running a ſmall and equal Diſtance from the *Inteſtines*; and from them, ariſing an infinite Number of Leſſer, but Straight *Veſſels*, which going Regularly to the *Guts*, and in great Numbers, afforded a very pleaſant Proſpect.

The *Spleen* was about 10 *Inches* long almoſt; almoſt of the ſame breadth throughout, and in the Middle was *one Inch* and *half* broad; it was of a *Lead-Colour*, a little Speckled, or Marbled. The *Liver* conſiſted of 4 large *Lobes*, and was of a *Dark Red* Colour; it appeared plainly *Glandulous*; and had no *Veſica fellea*; but it had a *Ductus Bilarius*, which went from the *Liver* to the *Duodenum* as uſually. The *Pancreas* was about 5 or 6 *Inches* long; and was made up of ſeveral *Glands*.

The *Teſtes* were *two Inches* long; Larger at the Upper end, than the Lower; and in the Middle, about an *Inch* broad; they were placed in the *Scrotum*. Their Colour *White*, their Structure Cloſe, ſo that the Veſſels, which compoſed them, did not ſo plainly appear as in an Ordinary *Boar*. Notwithſtanding which, no doubt their whole Compages was *Vaſcular*, tho' here Cloſer wrought together, and United. Their *Uſe* is to Prepare the *Semen*; which is conveyed thence by the *Vaſa Deferentia* to the *Veſiculæ Seminales*.

Theſe *Deferentia* ariſe near the Lower part of the *Teſtes*; and are ſo Inſerted, that they might alſo equally empty themſelves, either into the *Veſicæ Seminales* or *Urethra*. The *Veſiculæ Seminales* were 1½ *Inches* Long; in ſome places ¼; in others *half* an *Inch* broad.

Tho' call'd *Veſiculæ*, yet here they appeared more *Glandulous*; nor was their Cavity any thing conſiderably Large. The common Orifices to them, and the *Vaſa Deferentia*, made a Riſing in the Inſide of the *Urethra*; which *de Graef* calls, *Caput Gallinaginis*.

In other Animals at this place, is ſeated that *Glandulous* Body, called the *Proſtatæ*: But the *Veſiculæ* Here being ſo *Glandulous*, poſſibly they may perform their Office; unleſs we ſhould aſcribe their Uſe to thoſe two *Glands*; which lay on each ſide the *Urethra*, and Emptied themſelves, with two Orifices, near the Root of the *Penis*. Theſe *Glands* were *Cylindrical* of a *Whitiſh Yellow* Colour; an *Inch* and *half* long; and ⅛ of an *Inch* in Diameter. Their Subſtance Cloſe, like that of the *Teſtes*, and no perceptible Cavity within; and they lay along the Outſide the *Urethra*, reaching from the *Muſculi Erectores Penis*, to the *Glandulous Veſiculæ* before deſcribed. Theſe *Veſiculæ Seminales* being *Glandulous* muſt therefore ſecrete ſome Juice; which in all likelyhood is ſome ways ſerviceable, tho not Principally, in *Generation*. The *Penis* was a long ſlender Body; made up of ſeveral *Muſcles* whereof two were very long. The *Veſica Urinaria*, or *Bladder* of *Urine*, was Rounder than in ſome other Animals, where uſually 'tis more Oblong. The *Ureters* were inſerted at the *Neck* of the *Bladder*, not *Sides*, as in ſome.

In the *Thorax* we were ſurpriſed at the ſtrange Formation of the *Arteria Aorta*; which as it Deſcends along the *Spine*, in all other Animals, *I* have obſerved its *Trunk* is almoſt of an Equal Bigneſs, only a little Tapering downwards: But Here, between the *Heart* and its Branchings into the *Iliac Arteries*, we found 3 large *Swellings* out. The Largeſt was that neareſt the *Heart*, which after a ſmall ſtraightning again, Emptied it ſelf into the *Second*; which though ſomething leſs than the *Firſt*, yet was much larger than the 3*d*, which was near the Diviſion of the *Aorta* into the *Rami Iliaci*. *Two* of theſe *Swellings I* opened, and found within ſeveral Unequal Cells, or Hollows; but withal could not perceive but the *Membranes* here were altogether as Thick as where the *Artery* was nothing Extended. But this being the only one of the Kind *I* have Diſſected, *I* know not how far it may be *Præternatural*.

The Aperture of the *Eye* was but ſmall, as in the *Hog kind*; The *Membrana Nictitans*, Plainer than uſually in *Quadrupeds*, which might be convenient, ſince wallowing in Mud, they might the better rub off any Filth that might happen there; the *Muſcles* not ſo Diſtinct, as in ſome Brutes, and hence the *Motion* of their *Eyes* not ſo Quick nor Regular; the *Pupil* Round; the *Optick Nerve* Inſerted almoſt in the Axis of the *Eye*, and on the Inſide made a ſmall Dint; The *Choroides* of a *Pale Violet*, and *Browniſh* Colour.

Juſt on the Ridge on the *Back*, over the Hinder Legs, is ſeated a *Glan-*

dulous

dulous Body, which all Authors call the *Navel*. It is ſo Covered by the Long *Briſtles* there, that it was not to be Obſerved, but by opening of them with the Hand: And then you ſhall find a ſmall ſpace there almoſt Bare; only beſet with Fewer, Shorter and Finer *Hairs*; and in the Middle of it, the Protuberant *Orifice* of the *Gland*, by which it diſcharges it ſelf of the Liquor, which is ſeparated by it within. This Orifice, or *Foramen*, had its Lips a little Reflected, and Protuberant above the Surface of the Skin. It would eaſily admit of a Large *Probe*, which *I* could turn into ſeveral parts of the *Gland*. Upon a gentle Preſſure with my Finger, *I* could obſerve a ſmall Quantity of a *White Yelloviſh* Juice, and ſome part of it of a little *Darker* Colour; which yielded a very Pleaſant and agreeable Scent, and was judged by my ſelf, and ſeveral others who ſmelt it, to be much like that of *Musk* or *Civet*. The *Gland* it ſelf was ſeated between the Skin and ſome part of the *Panniculus Carnoſus*: For in the Middle of that Part, or Surface, which reſpected the Back, 'twas Bare, and not Covered with that *Muſcle*, but only the Edges of it incloſed within it; ſo that in taking off the Skin, the *Gland* too, as *I* have obſerved, could not eaſily eſcape, but go with it. However this *Muſcle* may be aſſiſting to it, by its Contractions, in Preſſing out of its Liquor; as the *Sphincter Muſcle* is to thoſe *Scent Bags* placed at the Extream of the *Rectum* of other Animals. This *Gland* was *Conglomerated*, or made up of ſeveral Minute, and Small *White Glandules*; it had no conſiderable *Cyſtis*, or Cavity within: but like the *Pancreas* or *Salivatory Glands*, it had abundance of *Secretory Ductus's*, which terminating at laſt in one, Diſcharged its ſeparated Juice by a Common *Orifice*. *Fig.* 251.

This *Orifice*, having ſomething of a Reſemblance of a *Navel*, has impoſed almoſt upon all who have writ of this Animal, (and have only ſuperficially Viewed this Part, without Examining any thing further,) to believe it an *Umbilicus*; and thoſe who have deviated from this Sentiment, have been as Unhappy, in delivering altogether as Abſurd, and Extravagant Conjectures about it.

But there is nothing *I* can Parallel this *Gland* with, more than thoſe *Scent-Bags*, or *Scent Glands*, I have formerly mentioned to be in other Animals. This *I* firſt took notice of in *Polecats*; in which, juſt at the Extream of the *Rectum*, were placed *two Bags* fill'd with a *Craſſe* and *Whitiſh* Liquor, whoſe *Stink* was ſo very great, that *I* could not well endure the Room, till *I* had removed them; and then the whole Body ſeem'd very inoffenſive. The ſame *I* have Obſerved in abundance of other Animals; as in all the *Polecat-kind*; in our Common *Cats*; in a *Lyon*; in *Dogs*; in a *Fox*, *&c.* Thoſe Bags in the *Civet Cat*, or *Hyæna Odifera* are nothing but the ſame; as are likewiſe thoſe of a *Muſquaſh* mentioned above: For they are not the *Teſticles* of that Animal, for having ſeen the Skins here in Town, and thoſe *Musk-Cods*, *I* find them to be only theſe *Scent Bags*. So the *Caſtoreum* we have in our *Shops*, is not the *Stones* of a *Beaver*, as formerly Reputed; but of the ſame Nature altogether with our *Scent-Bags*. Plot's Nat. Hiſt. Oxfordſhire. *Vid. Sup.* §. CVII. *Vid. Sup.* §. CVI.

And

And indeed in moſt *Species* of Animals, there may be obſerved ſomething the ſame, or Analogous to it, which gives them their peculiar *Fætors*, or *Smells*. Thus *I* have obſerved in *Reptiles*, as in the *Rattle-Snake*, in *Vipers*, in our common *Snake*, *&c.* *Two* long *Bags* in the *Tail*, which Empty their *Fætid* Liquor, near the Verge of the *Rectum*. But in All Animals, *I* find not theſe *Bags* or *Glands* ſeated Here, but in ſome, in different parts of the Body. In *Fowl* and *Birds*, in the *Rumps* you will meet with *two Glands*, which have 3 *Pipes*, or *Secretory Ductus*, ariſing on the Top of it, above the Surface of the Skin, which diſcharges a *Fætid* Liquor. *I* find theſe *Glands* the Largeſt in *Geeſe*, and the *Duck-kind*, which uſe the Water; and any one at the Table, by Taſting, may perceive in a *Duck* how ſtrong *Scented* they be. In *Turkeys* 'tis leſs *Glandulous*; but they have a larger *Cyſtis* within. In the *Oeſtridge* indeed, *I* did not obſerve it on the *Rump*, but ſomething higher on the Back, where it made two Bunchings out, and under the *Skin I* found a *Cyſtis* fill'd with a Concreted *Yellowiſh* Juice. This ſomething approached near the Place, where was ſeated the *Gland* in our *Mexico-Hog*, which *I* call the *Scent-Gland*; and it yielding ſo Grateful a *Perfume* (for ſo it was eſteemed by my ſelf, and ſeveral others who ſmelt it) from it, *I* have named it, the *Mexico Musk-Hog*. But this is Remarkable; that as our *Musk-Hog* has its *Scent-Gland* ſeated on the *Back*, ſo the *Gazella*, or *Musk-Deer* has his *Musk-Bag* on the *Belly*, near the *Umbilicus*. Every one Obſerves what an Horrid *Stink* the *Urine* of *Catts* will make where it Lights; perhaps in rendring their *Urine*, at the ſame time, they may empty their *Scent-Bags* ſeated at the *Rectum*, which Mixing with it, in a great Meaſure, may give it its ſtrong *Fætor*. So the ſame of *Rats* and *Mice*, of a *Fox* when *Hunted*, *&c.*

No Author indeed has called the *Scent* of this Animal a *Perfume*; on the contrary, they have all branded it as a *Stink*: But even the Beſt *Perfumes* ſometimes makes the greateſt *Stinks*. *Civet*, nay, *Musk* it ſelf, when Freſh and Green, and in large Quantities, are no ways agreeable, but very offenſive to the *Smell*, as many have obſerved: And what is more too, ſuch is *Ambergreaſe* at the firſt, as *Gul. Piſo* does Aſſure us.

Our *Tajacu* therefore, when young, and when but a ſmall Quantity of this Liquor is ſeparated by this *Gland*, may afford but little or no *Scent*; and *Foxes*, till they are well Grown, do not much *ſtink*; but afterwards when in great Plenty, this Juice is voided, by its Copiouſneſs, and being Thin and Fluid, and ſo more Vapourable, it may ſtrike our Organs with ſuch Brisk and Nimble Strokes, as to create a Pain; whereas a more Leiſurely Appulſe of its Particles from a Leſſer, and Concreted Body, may give a Pleaſure. So our *Tajacu*, when this *Gland* does very Liberally diſcharge its Liquor, may be thought to *ſtink*; and yet this *ſtink* in time, may become a *Perfume*. Thus that *Fætid* Liquor in the *Scent Bags* of a *Weaſel*, having formerly put it on a Paper, and

kept

kept it a little while, afforded me a *Pleaſant Smell*. Why therefore we perceived no *Stink* at firſt, upon the Diſſection of this *Gland*, but rather a *Sweet* and *Pleaſant Smell*, (if it is otherwiſe in the Countries where they Breed,) this may be the Reaſon; becauſe it had been Dead ſome Days, before *I* examined this Part; and then *I* found but a ſmall Quantity of an incraſſated Liquor there; tho' *I* muſt acknowledge that I was informed, that when it was Alive, it was obſerved by the Family where 'twas kept, that wherever it went, it left a good *Perfume* behind it. This *I* am ſure of, that when 'twas Dead, and obſerved by me, and ſeveral others, it Yielded a *Fragrant* one: which *I* think is ſufficient to Juſtify, or at leaſt to excuſe, the name *I* have given it.

We further obſerved, that the *Cranium* ſeem'd entire, without *Sutures*; From the *Noſe* to the End of the Pole, $8\frac{1}{2}$ *Inches*. Here the *Cranium* grew very Narrow, and then did ſpread it ſelf again Triangularwiſe, and Behind made a Large Hollow where it Reſpected the *Back*; and where were inſerted ſtrong *Muſcles*, and the *Ligament* from the *Back*, *I* formerly mentioned, by which means the *Head* is kept ſo ſtraight up, that when Alive he ſeemed to have but a very Short, if any *Neck* at all. The *Porus Auditorius*, or Paſſage to the *Ear*, was ſomething Remarkable; being placed near the *Pole*. In the *Upper Jaw* before, were 4 *Teeth*, or *Inciſores*; a little farther, was placed a large Flat *Tuſk*, Sharp Edged, and ſtanding Outwards; and beyond that, of each ſide, *ſix Double Teeth*, or *Molares*. The *Lower Jaw* was $6\frac{1}{2}$. *Inches* long, $1\frac{1}{2}$. Broad at the *Firſt Double-Tooth*, of which there were 6 of each ſide. The Bone of the *Lower Jaw* here, from the *Dentes Molares* to the *Inciſores*, ſeem'd Spongy and Curious; and the *Tuſks* in this *Jaw*, were Rotted out; as were *one* or *two* of the *Inciſores*, which in all were about *four*.

There were 7 *Vertebræ* of the *Neck*, which meaſured in length $4\frac{1}{2}$ *Inches*; *Fig.* 249. The *firſt* or *Atlas*, had two Broad *Tranſverſe Proceſſes*, but no *Spine*; The *Second* had a Broad Large *Spine*; The 3*d*, 4*th*, 5*th*, had no *Spines*; the 6*th* and 7*th*. had Large *Acute* ones. There were 19. *Vertebræ* of the *Back*; the *Spines* of the *firſt*, 2*d*, and 3*d*, were about 3 *Inches* long, but they gradually Decreaſed, as they approached the *Tail*. The *Firſt Vertebra* of the *Os Coccygis*, was 2 *Inches* long: But *I* thought, that at firſt it might have been ſeveral, tho' now it was but One Bone. There were about 6 *Vertebræ* more, which ran no farther than the Extent of the *Os Iſchii*. There were 14 *Ribbs* of each ſide; the *Os Sterni* jutted out about an *Inch* beyond the ſetting on of the *Firſt Ribbs*.

The *Scapula* was 5 *Inches* long; the *Os Femoris* of the *fore Foot*, $5\frac{1}{2}$ *Inches* long; The *Os Tibiæ* of the *Fore-Foot*, about the ſame Length in the whole: but from the Juncture with the *Os Femoris* to the *Os Metatarſi*, was but 4 *Inches*; for from the Juncture with the *Thigh-bone*, it jutted out farther, as in the *Figure*. The *Bones* of the *Tarſus* were 5, of the *Metatarſus* 3, about 2 *Inches* long; the Bones of the *Digiti* 9, there being 3 to each *Claw*, and 3 *Claws* to each *Fore-Foot*. The *Os Femoris* of the *Hinder Foot*, was almoſt 6 *Inches* long; and near its Juncture with the *Os Tibiæ*, it had a ſmall Bone,

like

like the *Patella* in the *Knee* of a *Man*. In the *Leg* Here were 2 *Bones*; the *Focile Majus* and *Minus*, 5 *Inches* and a *half* Long: But this part in the *Fore-Leg* was only a Single Bone; tho' in a *Dog*, a *Munkey*, and ſome other Animals, there are *Two Bones* in the *Fore-Leg* likewiſe. The *Os Calcis* was almoſt 2 *Inches* long; and there were 4 other *Bones* of the *Tarſus* or *Inſtep*. The *Metatarſus*, or *Foot*, was compoſed of 4 *Bones*; and the Two inwardmoſt much the Largeſt, being $2\frac{1}{4}$ long; there were 4 *Digiti*, and in each 3 *Bones*, whereof the Laſt was Covered with a *Nail*.

Explication of the Figures.

Fig. 248. Repreſents the Natural Shape of this *Mexico-Hog*: and the *Line a.* points to the *Scent Gland.*

Fig. 249. Fig. 249. The *Sceleton. a.* The *Fore-Teeth*; *b.* The *Tuſk*; *c c.* The *Grinders*, or *Molares*; *d.* The *Lower-Jaw*; *e.* That part of the *Lower-Jaw*, which was *Carious*; *f.* The *Cranium*; *g.* The *Orbit* of the *Eye*; *h.* The *Porus Auditorius*, or Paſſage to the *Ear*; *i.* The Triangular Expanſion of the *Cranium* Backwards; *k.* the *Vertebræ* of the *Neck*; *l l.* the *Vertebræ* of the *Back* and *Loyns*; *m.* the *Vertebræ* of the *Os Coccygis*; *n n.* the *Ribs*; *o.* the Protuberant Bone of the *Sternum*; *p.* the *Scapula*, or *Shoulder-Blade*; *q.* the *Os Iſchii*; *r r.* the *Os Femoris*, or *Thigh-Bones*; *s.* the *Patella* of the *Hinder-Legs*; *t.* the *Tibia* of the *Fore-Leg*; *v.* a Large Protuberancy of the *Tibia*; *w.* the *Tibia*, or *Foſſile Majus* of the *Hinder-Leg*; *x.* the *Fibula*, or *Foſſile Minus* of the *Hinder-Leg*, *y y.* the *Tarſus*, or *Inſtep*, on Both *Legs*; *z.* the *Calx*, or *Heel*, in the *Hinder Leg*; *α α α.* the *Bones* of the *Metatarſus*, or *Foot*; *β β β.* the *Digiti*, or *Toes*; *γ γ γ.* the *Nails*.

Fig. 250. Fig. 250. The *Orifice* of the *Scent-Gland*, as it Naturally appeared on the Outſide of the *Skin* of the *Back*: A little ſpace round this *Orifice* was almoſt Bare of *Briſtles*.

Fig. 251. Fig. 251. The *Scent-Gland* it ſelf, which was *Conglomerated*.

Fig. 252. Fig. 252. Moſt of the *Viſcera*; *a.* the *Oeſophagus*, or *Gullet*, *b.* the *Firſt Ventricle*, or *Stomach*; *c.* the 2*d. Ventricle*, or *Stomach*; *d d.* the *Cornua* or *Horns* of the 2*d. Stomach*; *e.* the 3*d. Stomach*; *f.* the *Pylorus*; *g g g.* the *Inteſtina Tenuia*, or *Small Guts*. *h h h.* the *Colon*; *i.* the *Cæcum*; *k.* the *Rectum*; *l.* the *Meſentery*; *m m.* the *Meſaraick Veſſels*; *n* the *Pancreas*. *o.* the *Spleen*; *p.* the *Liver*; *q.* the *Ductus* of the *Gall* from the *Liver* to the *Duodenum*

Fig. 253. Fig. 253. The *Outſide* of the 3 *Stomachs*, more in their natural Situation; *a.* the *Gula*; *b.* the *Firſt Stomach*; *c.* the 2*d. Stomach*; *d.* the 3*d. Stomach*; *e.* the *Pylorus*; *f f f.* the *Blood Veſſels*.

Fig. 254. Fig. 254. The *Stomach opened*; *a.* the *Oeſophagus*, or *Gula*; *b.* The Entrance of the *Gula*, or *Gullet*, into the *Firſt Stomach*; *c c.* the *Inſide* of the *Firſt Stomach*, which was inveſted with a Strong Thick White *Pellicle*, or *Membrane*; *d d* the *Second Stomach*, *e e.* the *Third Stomach*, in which were remarkable ſeveral *Plicæ*, or *Folds*; *f.* the *Pylorus*.

Fig. 255. Fig. 255. The *Genital Parts*, and the *Bladder*; *a.* the *Bladder* of Urine; *b.* the *Neck* of the *Bladder*, *c c.* the *Ureters*, *d d.* the *Teſtes*, or *Stones*, *e e.* the *Vaſa Deferentia*, *f f.* the *Veſiculæ Seminales*, which here were *Glandulous*,

g. the

g. the *Caput Gallinaginis*, where the *Veſiculæ Seminales*, and *Vaſa Deferentia* Empty themſelves into the *Urethra*; *h h*. *Two Glandulous* Bodies, which poſſibly may be reckoned the *Proſtatæ*; *i*. the *Orifices*, by which theſe *Glandulous Bodies* Empty themſelves into the *Urethra*; *k*. the *Urethra* Opened; *l*. the *Penis*; *m m*. two *Muſcles* belonging to the *Penis*; *n n*. Other *Muſcles* aſſiſting to the ſame.

Fig. 256. The *Heart*, and the *Aneuriſmata* of the *Arteria Aorta*, or *Great Artery*; *a*. the *Heart*; *b b*. the *Aſcending Branches* of the *Great Artery*; *c*. the *Deſcending Trunk* of the *Great Artery*; *d*. the *Firſt Aneuriſma* or Diſtenſion, of the *Great Artery* Opened to ſhew its ſeveral *Cells* within; *e*. A ſtraightning of the *Artery* again; *f*. the 2*d*. *Aneuriſma* Opened likewiſe; *g*. the 3*d*. or Smalleſt *Aneuriſma*; *h h h*. the *Iliac Branches* of the *Great Artery*. *Fig.* 256.

CIX. This Animal, which was brought alive from *Virginia*, has many Names given it by Different Authors: And Generally, by the *Engliſh*, it is called *Opoſſum* or *Poſſum*. In *Latin*, it is Named *Simi-Vulpa*, and *Vulpi Simia*; as if it were of a Middle Nature between a *Fox* and an *Ape*. But I think a *Denomination* might be beſt given it, from that Particular wherein 'tis moſt Diſtinguiſhable from all other Animals; which is that remarkable *Pouch*, or *Marſupium*, it has in the *Belly*, into which upon any Occaſion of Danger it can receive its Young; whence it may properly be Named *Marſupiale Americanum:* And *I* am apt to think it may be Reduced to the *Vermine-kind*. *The Anatomy of an* Opoſſum; *by Dr.* Edw. Tyſon. n. 239. p. 105. *Fig.* 257.

It Meaſured, from the Extremity of the *Noſe* to the Tip of the *Tail*, 31. *Inches*; the Length of the *Head* was 6 *Inches*; the *Tail* was *one Foot* Long; the *Neck* and the *Body* was the Complement of the firſt Dimenſion, the *Girth* of the *Body*, now Dead, was 15½ *Inches*; when alive and Well, it ſeemed much Thicker. The *Fore-Legs* were 6. *Inches* long; the *Hinder-Legs* but 4½ *Inches*. The *Girth* of the *Tail*, near the Root, was 3 *Inches*; near the Tip but *one Inch*. The *Head*, about the *Ears* was Largeſt, meaſuring on the *Forehead*, from one *Ear* to the other, 3 *Inches*; thence gradually *Tapering* towards the *Noſe*, and more reſembling that of a *Pig* than a *Fox*. The Aperture of the *Eye-Lids* were not *Horizontal*, but lying in a Strait Line from the *Ears* to the *Noſe*; and not *Large*. The *Ears* were about *one Inch* and an *half* long; not Sharp but of a Roundiſh Figure. The *Rictus* of her *Mouth*, from the Corner, on one ſide, to the end of the *Noſe*, meaſur'd 2½ *Inches*.

The *Fore-Feet* had 5 Long *Claws* or *Fingers*, equally ranging with one another, and a *Hooked Nail* at the end of each *Finger*. The *Hinder-Feet* had 4 *Fingers*, armed with *Hooked Nails*, and a Perfect *Thumb*, ſet off at a Diſtance from the Range of the other *Fingers*; and as in a *Humane* Body, this *Thumb* was ſhorter than the other *Fingers*, and had not a *Hooked* or Curved prominent *Nail*, but a Tender *Flat* One. This Contrivance of the *Legs*, *Feet*, and *Nails*, ſeems very Advantagious to this Animal in Climbing up Trees (which it does very Nimbly) for Preying upon *Birds*, which it is moſt Fond of; tho it Eats other Things too. Theſe *Fingers*, *Toes*, or *Claws*, were Naked, without *Hair*; the Skin looking of a *Reddiſh* Colour here.

They were about an *Inch* long, and the *Thumbs* almoſt as long. The *Palms* of all, eſpecially if Dilated, as it does in *Climbing*, were large; but ſo contrived, as to be able to be Contracted, as in *Walking*: but that they might here be better ſecured from injury, *I* find at the Setting on of Each *Toe*, in the *Palms*, a Protuberant Fleſhy and almoſt *Cartilaginous* Body. In *Feeding* it ſelf, it makes uſe of the *Fore-Feet* in bringing the Food to his Mouth; as do the *Monkey* and *Squirrel-kind*. The *Tail* was without *Hair*, (only for a little way near the ſetting on, and Tapering from the Root towards the Tip was Covered with a Regular Order of ſmall *Whitiſh Scales*; which, for the moſt part, were Oblongiſh *Hexagons*: between each of which one might Obſerve a little Skin or *Membrane* in which they are Fixed. The Colour of theſe *Scales*, makes the *Tail* to appear *Whitiſh*, though the Skin ſeems of a *Darker* Colour.

The *Ears* were alſo Bare, and without *Hair*: And although Soft and Slender and in Colour and ſubſtance almoſt reſembling the *Membrane* of a *Bat's Wing*, yet they were Erect and of an Oval Figure. I could not perceive that *Cartilaginous* Body, which Uſually is to be met with in the Structure of this Part: ſo that if it did at all enjoy a *Cartilage*, 'twas at leaſt much Finer than in moſt other Animals. The *Concha*, or Paſſage to the *Porus Auditorius*, was very Capacious. But 'twas Obſerved that when our Subject began to grow ill, the Verge or Rime of the Outward *Ear* ſeemed to be Crimped; and when it Dyed, to be ſo Shrivel'd, as if Burnt up; not making a Smooth, but a Jagged Edge.

The *Upper Jaw* was ſomewhat Longer than the *Under*; the *Noſtrils* were large; The *Eyes* Black, Small, Vivid, and Exerted, when Alive; now Dead very much Sunk. The *Neck* was ſhort, and the *Breaſt* Broad. It had *Muſtacio's* like a *Cat*. The *Fur* upon the *Face*, was ſhorter and *Whiter* than the reſt of the Body; On the *Back* and ſides it was of an *Aſh Colour*, or Dappel'd with *Black-Hair* in Spots, intermixt with *White*, eſpecially on the *Back*; on the *Belly* 'twas more of an *Umber-Colour*; and of a *Darker* on the *Legs*. The Longeſt *Hairs*, which were Stronger and Courſer than the reſt, meaſured 3 *Inches*; being *White* towards the Ends: But perhaps the *Fur* may Vary in Different Subjects.

Fig. 258. At the Bottom of the *Belly*, in the Middle between the *Two Hinder Legs*, we obſerved a *Slit*, or aperture, moderately Extended about 2 *Inches* Long; capable of a Larger Extenſion by dilating it with ones Fingers, even when it is Alive. It can ſo exactly cloſe and contract it, that the Eye does not readily diſcover it. On each ſide of this Aperture there is a *Reduplication* of the skin inwards, which forms a *Hairy Bag*: But the *Hairs* here are ſo Thinly ſet, that almoſt every where you may Obſerve the Skin. All Authors agree that the *Uſe* of this *Bag*, *Pouch*, or *Marſupium*, is for the *Preſervation* of the *Young* Ones, and *Securing* them upon any Occaſion of Danger: And the Deſign of Nature is admirable in forming and adapting this Part ſo ſuitably to that End. There are Two Remarkable Strong *Bones* not to be met with in any other *Sceleton*, which from their Office *I* take Leave to call *Oſſa Marſupialia*, or *Janitores Marſupii*. Theſe *Bones* are ſo

Fig. 257.

Fig. 260. 15. 15.

faſtened

faſtened to the Upper and inward Edge of the *Oſſa Pubis*, that at their *Baſis* here, they Touched one another, juſt at the Coalition of the *Bones* that form the *Oſſa Pubis*: The other Extremes of theſe Bones were ſo Diſtant from one another; that it meaſured $2\frac{1}{2}$ *Inches*. The Baſis of theſe *Bones*, where Joyned to the *Oſſa Pubis*, was $\frac{1}{2}$ *Inch* broad, having two *Heads*; the Larger lying near the Coalition of the *Oſſa Pubis*, and the Leſſer towards the *Os Coxendicis*; having in the Middle a *Sinus*, into which was received a Protuberance of the *Oſſa Pubis*. By this Contrivance it appears, there can be no *Motion* of theſe *Bones*, nearer or Farther from one another, but that they muſt ſtand always at an Equal Diſtance: Nor did *I*, upon Trial, find it otherwiſe, but Obſerved they were capable of a ſmall *Motion* inwards towards the *Spine*, and Outwards from it. Theſe *Bones*, as they aſcended from the *Os Pubis*, grew Slenderer, being about the Middle but $\frac{1}{4}$ of an *Inch* broad: and they were each 2 *Inches* Long. To theſe *Bones* there were beſtowed 4 *Pair* of *Muſcles*: and there was another *Pair* that did run Over them, to which theſe *Bones* did perform the Office of a *Trochlea*. The *Firſt Pair* of *Muſcles* (*i. e.* which *Firſt* came to be Diſſected upon the Pronation of the Animal, and which from its Figure *I* ſhall call *Triangularis*) ariſes *Fleſhy* from the whole Length of the internal ſide of theſe *Bones*, and inſerted their Oppoſite *Tendons* on Each ſide of the *Rima*, or Aperture of the *Marſupium*. Under part of theſe *Muſcles*, lay another or a 2*d*. *Pair*, Flat and Thin, having their Origin from the Upper part of the Internal ſide of the *Oſſa Marſupialia*, and inſerting their oppoſite *Tendons* a little above the *Tendons* of the former *Muſcles*: The Tendence or Direction of the *Muſcular Fibres* of this *Pair*, in Relation to the Firſt, made a *Decuſſation*. The *Third Pair* of *Muſcles*, we ſhall take Notice of, had their Riſe from the Fore-part of the *Baſis* of theſe *Bones*, where they were Joynted to the *Os Pubis*; and were afterwards inſerted into the *Linea Aſpera* of the *Thigh-bone*. The *Fourth Pair* did ariſe from the External ſide of theſe *Bones* near the Baſis, and are inſerted into the Fore-part of the *Thigh Bone* near the Middle. The *Laſt Pair* of *Muſcles* ariſes more immediately from the *Marſupium*, or *Pouch*, it ſelf. For ſpreading their *Muſcular Fibres* all over this *Bag*, as they iſſue from it, by joyning their *Fibres* together, they more remarkably Form a *Solid Muſcle*; which of each ſide paſſing Over the middle of theſe *Bones*, (*i. e.* in the Prone Poſture we are Diſſecting it) at length were inſerted into the *Spine* of the *Os Ilii*. The *Two Firſt* of theſe *Muſcles* muſt ſerve towards the *Dilatation* or *Opening* this *Marſupium* or *Pouch*: For theſe *Bones* are a Fulciment or Baſis; their *Articulation* will not admit of a *Contraction* Inwards or Nearer to one another, wherefore, when the *Firſt* and *Second Pair* of *Muſcles* Act or Contract, they muſt neceſſarily *Open* or *Dilate* the Mouth of the *Marſupium* or *Pouch*. The *Third* and *Fourth Pair* of theſe *Muſcles* may ſerve to *Extend* theſe *Bones* Outward: ſo that when this Animal *Hangs* by its *Tail* (as it does frequently) the Weight of the *Fætus* in this *Pouch* by this means will not Preſs ſo much upon the inward *Viſcera*. The *Fifth* and *Fig.* 261. *cc.*

laſt Pair, as they may ſerve to *Dilate* the *Capacity* of the *Pouch* itſelf, ſo likewiſe may ſerve the better to ſuſpend it's Weight, when the Animal is *Prono Capite*: and if it Gravitates too much, they may Retract it up; and the Eaſier, becauſe paſſing Over theſe *Bones* like a *Pully*, their force is more Augmented. The *Antagoniſt* to theſe *Muſcles* is, the *Sphincter Marſupii*; an Oval Series of Strong *Fleſhy Fibres*, which ſerve to *Conſtringe* and *Cloſe* the *Orifice* of the *Pouch*: which it does ſo Perfectly (as I have already obſerved,) that one would think the Skin here not to be *Slit*.

Fig. 259. A. The *Pouch* or *Marſupium* it ſelf, was a *Membranous* Body, not very Thick tho' conſiſting of ſeveral *Coats*: and is to be reduced into the *Claſs* of the *Veſiculous Parts* of the Body; which according to my Notion, are part *Muſcles*, part *Glands*; and do Perform the Office of both *Motion* and *Secretion*. For the Concave or Hollow of this *Pouch* (as *I* have remarked) was ſomewhat *Hairy*, and at ſeveral places I could Obſerve them Matted or Cling'd together by a *Yellowiſh* Subſtance, which did Ouze out of the *Cutaneus Glands* there; as under the *Arm Pits* in a *Man*, it is Obſerved.

This *Liquor* thus Emptied into the *Pouch* from the *Glandulous Coat*, I found was *Strong Scented*, and had more of the *Peculiar Fætor* of this Animal, than any part beſides: being no ways Grateful, but Unpleaſant to the *Smell*; as has been Obſerved of this Creature when Alive. But after the skin with the *Pouch* had been kept for ſome Days, and was grown Dry, I found ſo great an Alteration here in the *Smell*, that what before was ſo Diſagreeable, now was become a perfect *Perfume*, and *Smelt* altogether like *Musk*; which made me Call to mind what formerly I had remarked of theſe *Scent Baggs* in other Animals. And *I* am apt to think that 'twas by Removing this *Marſupium*, rather than taking away the *Kidneys*, that theſe Animals are made *Edible*, which otherwiſe *Stink* ſo much, that the *Barbarous* Nations Refuſe them, as out of *Lerius*, *Joh Faber* takes Notice: for *I* could not ſmell in the *Kidneys*, or *Fat* about them, any thing Ungrateful or *Ill-Scented*. This *Marſupium* had likewiſe a *Muſcular Coat*, beſides thoſe ſeveral other *Muſcles* beſtowed upon it, which we have Obſerved already, that gave it *Motion*. It had likewiſe a *Vaſcular Coat* too, being plentifully Irrigated with *Blood Veſſels*: eſpecially by Two Large *Branches* that came from the Upper part of the *Thorax*, and might be reckoned the *Mammaria*, as they are Stiled in other Animals.

Vid. Sup: §. CVIII.

This *Pouch* was faſtened by ſeveral *Membranes* to the *Muſcles* of the *Abdomen*, and the Skin, but ſo as I could ſeparate it, for the moſt part, with my *Fingers*.

In this *Marſupium* or *Pouch*, moſt Authors place the *Mammæ* or *Teats*; and they tell very odd Stories about it: But upon what Obſervation *I* could make, *I* did not Find any *Teats* here; nor indeed could *I* find them in the Outward Skin, as is Uſual in other *Multiparous* Animals.

Poſſibly

Poſſibly this Subject never had a Litter; ſo for want of Drawing they might be Leſs; ſo as to Eſcape our View. The *Male* alſo (if we may believe *Piſo*, or the Author of the *Preſent State of his Majeſty's Territories in America*, has ſuch another *Purſe* under His *Belly* and takes his *Turn* to carry the *Young* Ones, to Eaſe the *Female*.

This Contrivance of Nature for *Securing* the *Young* Ones from any Danger, till they are able to ſhift for themſelves, *I* think is not to be Parallel'd in any *Species* of Animals, at leaſt of the *Quadruped-Kind*, beſides.

Oppianus indeed, in his Excellent *Poem* of *Fiſhes*, tells us of the *Dog-Fiſh*, that upon any Storm, or Danger if purſued, the *Young* Ones run into the *Mothers Belly*; and when the Fright and Danger is over, they come out again; He alſo inſtances the ſame Care in the *Squatina* and the *Glaucus*, tho' theſe receive their *Young* into Different Receptacles: but if there be any *Truth* in theſe ſtories, 'tis Requiſite that it were Confirm'd by more Evident Proof and Obſervation. Halieutic. *Lib.* 1.

In the *Thorax* of the *Poſſum*, *I* obſerved that the *Lungs* had 3. *Lobes* on one ſide, and but *One* on the other: But this One was as large as the other *Three* They were Soft and Spongy, and eaſily Dilated, and Large, proportionably to the Animal. The *Heart* was Included in a *Pericardium*, as uſual, but the *Heart* it ſelf *I* thought proportionably Larger, in reſpect to the Bulk of the Body, than is commonly; nor was it's *Cone* ſo ſharp, but rather more Obtuſe. It had *Two Auricles*, and *Two Ventricles*. About the *Throat* there were Large *Glandulæ Maxillares*; the *Tongue* was a little above 3. *Inches* Long and about $\frac{1}{4}$ of an *Inch* broad; 'twas Rough, having Protuberance whoſe Points looked Inwards; the *Voice*, or *Noiſe* it made, was a little *Growing*.

The *Abdomen*, or *Belly*, was Divided from the *Thorax*, or *Breaſt*, by a Large, Strong Fleſhy *Diaphragm*: For the Compaſs of the *Thorax* in this place was very Great and Large, which might be rendered ſo the more, by Reaſon it often *Hangs* by it's *Tail*, and when it does ſo, the *Viſcera* in the *Abdomen* can't but Preſs upon it

The *Ventricle* or *Stomack* ſomething reſembled the Figure of a *Half-Moon* as uſually: but the *Two Orifices* of the *Gula* and *Pylorus* were placed ſo near one another, that they ſeemed to touch or meet; and when *I* Opened the *Stomach*, *I* found only a very Slender *Iſthmus*, or *Wall*, parted them. Theſe *Orifices* were Inſerted almoſt in the Middle of the Upward part, but more inclining towards that, that reſpects the *Duodenum*. It appeared but ſmall being much Contracted; for it had not Eaten any thing for ſome Days; it meaſured about $3\frac{1}{2}$ *inches* in Length, and about 2. *Inches* in Depth. The *Gula*, which conveys the Food into the *Stomach*, conſiſted of Strong *Muſcular Fibres*, and was in all about 9. *Inches* in Length. The *Pylorus*, that Carries out, ſeem'd to have its Paſſage Free and Open, without that *Annular Conſtriction*, or *Valve*, as in moſt other Animals; though here we Obſerved a Larger Body of *Muſcular Fibres*, than in the other *Inteſtines*. *Fig.* 263. *BB*

At

Fig. 263. C. At one ſide I obſerved a *Perforation*, or *Hole* through, about the bigneſs of an ordinary *Pea*, and Round. That this was occaſioned by an *Ulcer* there, *I* plainly perceived by the *Lips* or *Edges*, which were not Freſh, but had an *Ulcerated* Matter about them; and this, without doubt, was the Occaſion of its *Death*; for it had fallen from its *Food*, and had Pined away for ſome Time before, and by its Uneaſie Motion, made its Keeper ſuſpect, it had ſwallowed ſomething that ſtuck in its Throat, or Injured its *Stomach*. A like Accident I have three times met with in the Diſſection of *Humane Bodies*. Perhaps ſome of the *Glands* in the *Stomach* (ſuch as *Payerus* and Dr. *Grew* deſcribe in the *Inteſtines*) being become *Scrophulous*, or *Steatomatous*, might *Impoſtumate*, and ſo *Corrode* the *Coats* of the *Stomach*, and Cauſe this *Perforation*: And the rather *I* am of this Opinion, becauſe *I* found, in other Places of the *Stomach*, theſe *Glands* very Large and *Steatomatous*; tho' Naturally they are but Small, and often not Obſerved. Where there is a *Perforation* of the *Stomach* upon an *Inflammation*, and upon that an *Impoſthumation*, there the *Foramen* is *Larger* and not Regular; as remarkably *I* once met with it in a *Child*, where a *Large* part of One ſide of the *Stomach* was *Sphacelated*. So likewiſe upon a *Corroſive Poiſon* taken, its Effects dilates it ſelf more, and is not confined to ſo Narrow a Compaſs; as *I* obſerved once in one who had taken *Rats-Bane*.

De Glandul. Inteſtin.

Comparative Anat. of the Stom. and Guts.

[Fig. 266. There was nothing Contained in the *Stomach*, but a Body of *Clotted Hair*, formed into the Shape and Figure of the *Stomach*, ſomewhat like an *Half-Moon*; covered with a Slimy *Viſcid* Subſtance, which did ſerve the better to glue theſe *Hairs* together. Theſe *Hairy Tophy* are frequently to be met with in the *Stomachs* of *Oxen*; and the *Butchers* inform me, that they chiefly meet with them in the *Winter* Seaſon, after the *Hair* begins to ſhed, and the Cattle feed upon Hay or Dry Meat; but after the *Spring*, and in *Summer*, they do more ſeldom find them; as if the *New Graſs*, which *Purges* them, did contribute to *Diſſolve* theſe *Tophi* likewiſe. But our Animal is *Carnivorous* and (in which all Accounts agree) moſt *Rapacious* of the *Winged Kind*; and where it can't find its Prey on the Land, it will Hunt for it in the Trees, moſt nimbly Climbing them up; and if the Tender Bough cannot Bear the Weight of its Body on its *Feet*, by twiſting its *Tail* about the Twig, it can Hang thereby, and ſtretch it ſelf the farther, to Obtain its deſired Food, or Rob a Neſt. Nay, if I am not miſinformed, by this Means it can *Fly*, or Paſs from one *Tree* to Another, without deſcending down; for thus *Hanging* by its *Tail*, and Waving and Swinging its Body like a *Pendulum*, it can fling it ſelf into the Boughs of a Neighbouring *Tree*, where his *Tail* is ſure to take faſt hold of the firſt Bough it lights on, if otherwiſe it miſſes its *Footing*; and, as *I* have ſhewn, his *Hinder Legs* being made like *Hands*, with a *Thumb*, it can more readily raiſe its Body up by them. But tho theſe Animals be *Carnivorous*, yet when *Need drives* them, they can take up with other *Food*; for this we Diſſected would *Eat* Any thing that was brought from the *Table*.

The

The *Meſentery* is that *Membranous* Part, which Colligates the *Inteſtines*, and Fixes their Situation; and gives to them the Order of their Figure. For the *Inteſtines* are not juſt Faſtened to the *Peripherie*, or Outward Circumference of the *Meſenterie*; but the Outward *Membrane* of the *Meſenterie* of both ſides, is entirely Projected and Continued over the whole *Canalis*, or *Duct* of the *Guts*; and is to them the Outward or Common *Membrane*. So that often, by ſeparating this Outward *Membrane* from what lies under it, the *Muſcular*, *I* have Extracted the whole length of the *Guts*, leaving only the Common *Membrane*, as 'tis Continued from that of the *Meſenterie*; which *I* could Inflate, as if the whole of the *Guts* Remained. Now here we obſerved that Remarkable Difference from what is in many other Animals, that we cannot but make *Two Meſenteries*: one peculiar to the *Small Guts*, the other belonging to the *Great Ones*. *Fig.* 26.

The Former *I* ſhall call *Meſenterium Minorum*, and the Latter *Meſenterium Majorum Inteſtinorum*: For as the *Duodenum* Deſcended from the *Stomach*, it ran under the *Colon* (juſt where 'tis joined to the *Cæcum*) towards the Middle of the *Spine*. Hence I found a *Projection* of the *Firſt Meſenterie* into a *Spiral* Line, like a *Cochlea* or winding Pair of Stairs: So that upon *Inflation*, theſe *Inteſtines* here made ſeveral *Convolutions* tho' not exactly *Spiral*. The *Second Meſenterie* was Projected more in a *Plain*; and made almoſt a *Circular* Figure at its Peripherie: So that the *Cæcum*, and *Colon*, did almoſt entirely Encircle the *Small Guts*.

The Reverſe of this Structure of the *Inteſtines I* formerly found in the Anatomy of the *Tajacu*, for there the *Colon* made a *Spiral* Figure, and the *Small Guts* made a *Plain*. But this *Spiral Convolution* of the *Inteſtines* is alſo to be met with in ſeveral other Animals, though their Structure be Different; as in the *Goat* and *Deer kind*; and very Remarkably in a *Wood Cock*. *Vid. Sup:* §. CVIII.

The *Small Guts* Meaſured about $6\frac{1}{2}$ *Feet* in Length; the *Cæcum* was about 6 *Inches* Long; and the *Colon* and *Rectum* 2 *Foot* long. The Girth of the *Duodenum* (*I* mean all along here as Inflated) was 3 *Inches*; the *Ileon* $2\frac{1}{2}$ *Inches*; the Girth of the *Cæcum*, in the Largeſt place, was 6 *Inches*; of the *Colon* 4 *Inches*: And the *Rectum* was 3 *Inches* about. From the *Spine* to the Utmoſt Projection of the *Small Guts*, (under the ſame Circumſtance of Inflation) we Meaſured about 6 *Inches*; the greateſt Diameter that the *Colon* in this *Circular* Figure made, was ſomewhat above 7 *Inches*. In the whole *Duct* or *Canalis* of the *Inteſtines*, *I* could not obſerve any *Valves*; no not at the *Cæcum* it ſelf. 'Tis True, that the *Foramen* into the *Cæcum*, was a great deal leſs than the Capacity of the *Gut* it ſelf: However the Paſſage into it was ſo Open and Wide, as readily to Receive or Emit its Contents.

But the *Length* and frequent *Gyrations* and *Windings* of the *Inteſtines* ſupply this want of *Valves*; they Prevent the Danger of a Too Haſty *Deſcent* of the *Fæces*, and give a greater Opportunity to the Separation of the *Chyle* into the *Vaſa Chylifera*. And the *Cochlea* or *Spiral Figure* of the *Firſt*

Meſentery

Meſentery eaſily Prevents the *Regurgitation* of the *Contents* of the *Inteſtines* again into the *Stomach*, upon a *Declivity* of the Body of this Animal; as it is frequently in, when it Hangs by its *Tail*. For tho', as *I* obſerved, the Paſſage from the *Stomach*, by the *Pylorus* into the *Duodenum*, is Large and open, yet in this *Poſture* of the Body, there cannot but be a *Reduplication*, or Folding over of the *Duodenum*; ſince the Great Bulk or Wallet of theſe *Inteſtines* muſt Incline and Swag towards the *Diaphragm:* by which *Reduplication*, the Paſſage at the *Pylorus* muſt, in a great Meaſure, be Occluded; and the *Aſcent* of the *Contents* now, be altogether as Difficult and Great, as when the Animal ſtands upon its 4 *Feet*.

Fig. 267. *BBB.* The *Pancreas* was Large, having one part (if I miſremember not) running towards the *Spleen*, and the other Down by the *Duodenum*. The *Liver* was very Large, of a *Bright Red* Colour, conſiſting of 3 *Lobes*; two of them were much Larger than the 3*d*. which was not to be ſeen, but upon Inverting the *Liver*. And here we found not only at the Edges of one of the Larger *Lobes*, Deep *Inciſures*, which rendered it *Jagged*: but alſo in the Middle of the Concave part of the ſame *Lobe*, ſeveral Deep *Fiſſures*; poſſibly for this Reaſon, that ſo it might Yield and give way the better, when 'tis Inverted, as 'tis al-

Fig. 264. *AA.* ways, when this Animal *Hangs* by its *Tail*. The *Bladder* of *Gall* was very Large. The *Kidneys* of each ſide were a little above an *Inch* and *half* Long, about $\frac{3}{4}$ of an *Inch* broad, and of the Figure almoſt of a *Kidney Bean*. The *Emulgent veins* and *Arteries* were very plainly Seen: But on the Inſide of the *Kidneys*, towards the Upper part, were placed the *Glandulæ Renales*, which were very Large and of the ſame Colour with the *Kidneys* themſelves; which was a *Deep-Red*.

Fig. 264. *f.* The *Ureters* were about $5\frac{1}{2}$ *Inches* Long, and were Inſerted into the *Neck* of the *Bladder* of *Urine*, as is repreſented, firſt running Under, then Aſcending up by the two Extreams of each *Uterus*, as they lie Duplicated. The *Bladder* of *Urine*, being Inflated, was about the bigneſs of a *Hen's Egg* and of that Figure. The *Neck* of the *Bladder*, or *Urethra*, (which was about an *Inch* Long) lay over the *vaginæ Uteri*: and here the *Urethra* and the *vaginæ Uteri* Emptied themſelves into one *Common Canalis* or *Paſſage*, which Meaſured about an *Inch* and *Half* in Length In moſt Animals, about the *Kidneys* there uſes to be obſerved a large Body of *Fat* Covering them, being contained in the *Membrana Adipoſa:* But here we found 4 Large *Protuberant Lumps* of *Fat*, two of each ſide; two of them lying in the *Pelvis* of the *Abdomen*, near the *Bladder* of *Urine*, and the *Uterine Parts*, and the two others, between them and the *Kidneys*.

They Conſiſted of Regular Large *Laminæ*; which were eaſily Separable from one another, in broad Fleaks; ſo as *I* have never Obſerved before.

Fig. 264. 265. Amongſt the *Uterine Parts*, which were very Surpriſing, we found *Two Ovaria*, *Two Tubæ Fallopianæ*, *Two Cornua Uteri*, *Two Uteri*, and *Two vaginæ Uteri*. The *Ovaria* were placed one of each ſide near the Extreams of the *Cornua Uteri*, being faſtened to the *Alæ Uteri*, and were about the Bigneſs of a *vetch*. The *vaſa Preparantia* (the *Arterie* and the *vein* that did go to and from them)

were

were very plain, and as *I* have repreſented them; though the greateſt part of theſe *Veſſels* were beſtowed upon the *Cornua Uteri*. Near the *Ovaria*, *I* obſerved the *Fimbriæ Foliaceæ*, and thence a Paſſage into the *Tubæ Fallopianæ*. The *Tubæ Fallopianæ* were Two Fine Slender *Canales* or *Ducts*, ſupported by the *Alæ Uteri*, and running waving, and Led into the Extreams of the *Cornua Uteri*. The *Cornua Uteri*, being inflated, were about the bigneſs of a *Gooſe Quill*, about an *Inch* and *half* long; and were faſtened to the *Alæ Uteri*; towards both Ends a little Crooked, but where they paſs into the *Uteri*, they were Reflected Inwards, and at the other Extream Reflected Outwards. Their Subſtance ſeemed rather Thicker than the *Uteri* themſelves, and not ſo Tranſparent, by Reaſon of the numerous *Blood-Veſſels* which irrigated them almoſt all over; for in the Inſide, both above and under, there ran the whole length of the *Cornua*, large *Trunks* of *Blood-Veſſels*, ſending from the ſides all along Numerous Branches; which is very Requiſite: For in Animals that are *Multiparous*, as is our Subject, (having 5 or 6 *Young Ones* at a time) the *Litter* or *Fœtus* do Lie, and are Formed in the *Cornua Uteri*. And *I* did here take notice of ſome little Riſings of the *Inward Membrane* of the *Cornua*, whereby they were ſomewhat Divided into *Cells*, but very imperfectly. However for the *Nouriſhment* and *Formation* of the *Embrio*'s here, ſo great a Number of *Blood-Veſſels* is Highly Neceſſary, and they were far more Numerous here than in the *Uteri* themſelves. Theſe two *Cornua* do Empty themſelves into the *Two Uteri*, juſt in the Middle where they are Conjoined together, and ſo outwardly ſeem to form, but as it were one Continued Body. In *Lobſters* and *Crabs*, in the *Female* there are *Two Uteri*, as in the *Male* there are *Two Penes*; ſo *Two Penes* and each *Forked* too, I have obſerved in the *Rattle Snake*: But I think this is the only Inſtance of a *Land Quadruped*, that has *Two Uteri*; and each of theſe too, ſeemingly Double by the *Reflection* they make, and by an Imperfect *Diaphragm*, which Divides the Cavity of each *Uterus* a conſiderable way.

Fig. 264. *mm.* 0000.

Fig. 264. *xx.* *Fig.* 265. *ee.*

Vid. Sup. §. XLIII.

Theſe *Uteri* are not faſtened to the *Alæ*, as are the *Ovaria*, *Tubæ* and *Cornua*; but where they are Conjoined near the Inſertion of the *Cornua*, they do Adhere very Firmly to the *Neck* of the *Bladder*, not eaſily to be ſeparated thence; and by *Membranes* to the *Rectum*, where they are more ſeparable. So that the *Neck* of the *Bladder* lies over that *Diaphragm*, or *Membrane*, which parted them (as *I* ſaid) into *two* Diſtinct *Uteri*. Here the Body of the *Uteri* meaſur'd in Compaſs (thus Inflated) about $1\frac{3}{4}$ *Inch*: Hence they were Projected towards Each Side, and not according to the Length of the *Spine*, gradually Inlarging the inward Cavity, as 'tis Extended; For here about the Angle of *Reflection*, if Meaſur'd in Compaſs 2 *Inches* and an *Half*. The *Uteri* being thus Extended towards Each ſide about the Space of $1\frac{3}{4}$ *Inch*, are then *Reflected* back again towards the *Neck* of the *Bladder*; and ſo paſs into the *Two Vaginæ* which lie under the *Urethra*. From this Angle of *Reflection*, the Cavity of each *Uterus* gradually Leſſens, and is much ſmaller than the other part of the *Uterus*; the Capacity of Each *Uterus* being the Largeſt at the Outward Elbow, where it Begins to be *Reflected*; for here,

here it was made, as 'twere, one Common Cavity for almoſt the Length of an *Inch*. But on the Inſide, *I* obſerved a *Membrane* to be Projected from the Internal ſide of the *Uteri*, juſt from the Corner where the ſides of the *Uteri* are *Doubled*, whereby this Cavity is in part Divided; and for this Reaſon, ſhall call this *Membrane*, the *Second*, or an *Imperfect Diaphragm* of the *Uteri*. In theſe *Uteri* I obſerved four large *Trunks* of *Blood Veſſels*, which did run the whole Length of them, ſending from their ſides Numerous *Branches* and *Ramifications* all along. Theſe *Trunks* were Propagated from the *Hypogaſtrick* and *Spermatick Veſſels*. I did alſo here obſerve in theſe *Uteri* (this by *Inflation* Extended and Dried) ſeveral *Faſciuculi* of *Muſcular Fibres*, placed at a Regular Diſtance from one another; which did Run the whole Length of the *Uteri* likewiſe: By means of whoſe *Contraction*, the *Fætus* may be more eaſily forced out.

Theſe *Two Uteri* Empty themſelves into the *two Vaginæ*; for at this Extream, the *Uteri* making a *Turn* at the *Neck* of the *Bladder*, are continued thence into the *two Vaginæ*, which lie juſt under the *Urethra*, and are much of the ſame length with it, which was about an *Inch*. Their Capacity was about the bigneſs of a *Wheat-Straw*: Both theſe *Vaginæ*, and *Urethra* too, Emptied themſelves into a *Common Paſſage*, or *Canalis*, which was as Large as all the other *Three*, and about $1\frac{1}{2}$ *Inch* Long. It looked *Reddiſh* by means of the Numerous *Blood Veſſels* it enjoyed, and at laſt had its Exit ſo near the *Fundament*, that when alive, there was not obſerved any other *Foramen* outwardly, but that which led into the *Rectum*: But when I came to Diſſect it, by Elevating the Skin here, which ſeemed to cover it, like a *Valve*, I obſerved the *Foramen* that led into this *Common Paſſage*, and putting a Blow-Pipe into it, at the ſame time, by *Inflation*, I extended the *Bladder* of *Urine*, and the *Uterine Parts* too, *viz.* The *Vaginæ*, the *Uteri*, and the *Cornua*. So that in the Skin here, there was only one *Foramen* for the Exit of the *Fæces*, and the *Urine* and the *Fætus* too.

I have not had an Opportunity of Diſſecting a *Male Poſſum*; and the Account we find of it in Authors is very Short and Imperfect; ſo that Mr. *Ray*, with good Reaſon, Queries whether the *Tai ibi* of *Brazile*, deſcribed by *Margrave*, differs from our Subject, the *Poſſum*, only in *Sex*.

[*Fig.* 260. The *Skeleton* of the *Head*, from the End of the *Occiput*, to the Extream of the *Nares*, was 4 *Inches* and $\frac{3}{4}$ long; of which the *Roſtrum* meaſured 3 *Inches*; and juſt where the *Roſtrum* and the *Cranium* met, the *Bones* were ſo Pinched in at the ſides, that here 'twas very narrow; and *I* may ſay, in proportion to the Bulk of the Animal, this was the leaſt *Cranium I* ever met with in a *Quadrupede*. On the *Forehead*, the *Roſtrum* was an *Inch* broad, having on each ſide a Protuberance jetting out. There was a large *Suture*, juſt in the Middle, which divided the *Upper Bones* of the *Nares* lengthways; and though they ran ſlender towards the Extream of the *Nares*, yet theſe *Bones* towards the *Forehead*, ſpread into a Triangular Figure, and as they are Joined together, they form a *Rhomboide*, or a *Lozinge*. There was a Remarkable Riſing Ridge like a *Creſt*, that runs

the

the Length of the *Cranium*, from the *Forehead* to the *Occiput*, juſt in the middle; where the *Sutura Sagittalis* is in other *Skuls*. This Ridge, for Diſtinction ſake, *I* ſhall call, *Protuberantia Oſſea Longitudinalis*; and *I* obſerved, it Jutted out from the *Cranium*, above a *Quarter* of an *Inch*. Juſt at its Upper Edge, *I* could perceive a *Seam* like a *Suture*: So that though now, theſe *Bones* are ſo wellUnited together,that they appeared as one EntireBody,yet in the *Fœtus*, without doubt, they are ſeparable, and are two; and this *I* rather think, becauſe in the upper part of the *Cranium I* could not find any *Sutures* at all. So likewiſe anſwerable to the *Lambdoidal Suture*,may be thoſe other *Ridges* in the Extream of the *Occiput*, which *I* ſhall call, *Protuberantiæ Oſſeæ Laterales*: Which ariſing on each ſide from the *Proceſſus Styloides* aſcend obliquely up the Hinder part of the *Occiput*, and juſt in the Middle at the Top, are joyned with the *Longitudinal Ridge*, *I* have Deſcribed. Theſe *Ridges*, although as Deep as the *Firſt*, yet were not ſtanding ſo Upright, but Projected rather like a *Pent-houſe*, over this Hinder part of the *Cranium*: By both which *Ridges*, the *Cranium* is ſo well Guarded and Defended, that 'tis almoſt impoſſible, the *Skull* ſhould be any ways *Cracked* or Broken. Something like theſe *Ridges*, but nothing ſo Large, *I* have obſerved in the *Skull* of a *Weaſel*. The *Eyes* likewiſe are very well Guarded, and Defended, by the *Os Zygomaticum*; which is very Broad and Strong; in the Broadeſt place being above $\frac{3}{4}$ of an *Inch*, and in the Narroweſt *half* an *Inch*; being very Thick on its Under Edge, but at its Upper, growing Thin and Sharp. But for the Greater ſtrengthning this *Bone*, (which is Formed by a *Proceſs* from the *Os Temporum*, and another from the *Maxilla Superior*) where they Meet they Lap Over one another, and ſo become the Stronger. This *Os Zygomaticum* was $2\frac{1}{2}$ *Inches* long, and ſtanding off from the *Cranium* an *Inch* in Diſtance. In the *Orbit* of the *Eye*, at the *Inward Canthus*, there was a Large *Foramen*, which Led into the Cavity of the *Noſe*: and by a *Duct* placed here, the *Tears*, or *Moiſture* from the *Eyes*, is Conveyed into the *Noſtrils*. In the *Upper Jaw Bone* likewiſe, there was a Large *Foramen*, which was for the Paſſage of ſome *Veſſels* from the *Inward Orbit* of the *Eye*. The *Cranium*, which encompaſſed the *Brain*, in the largeſt place, was about an *Inch* over, and about an *Inch* and *half* in Length; but its Cavity Jutted out ſomewhat farther towards the *Nares*, making as it were, a particular *Cell* here, and pretty Capacious, for the receiving the *Proceſſus Mamillares*, and that Fore-part of the *Brain*. And afterwards *I* obſerved the *Os Cribriforme*, very Remarkably *Perforated* with Holes like a Sieve; and indeed in Forming this *Organ* of *Smelling*, nature ſeems very Careful, and Solicitous, the *Roſtrum* making ſo great a part of the *Head*, that the *Cranium* it ſelf ſeemed very inconſiderable in Reſpect to it; its inward Capacity containing not above the Quantity of a *Valnut*. The *Os Spongioſum* in each *Noſtril*, ſeemed very Curiouſly Contrived, by the Abundance of *Laminæ* it enjoys; ſo that the *Membrane* that Covers them, by this means, is Rendered more Capacious, and Capable of receiving more plentifully the *Effluvia's* of thoſe Animals, it would either Catch, or Avoid; and in this *Senſory* 'tis known that *Brutes* excel even *Man* himſelf, and their *Organ* is more Adapted for it.

The *Under-Jaw* consisted of Two Strong *Bones*, Joyned together only at the *Mentum*; each Measured 4 *Inches* in Length. The *Head* of this *Bone* (which was *half* an *Inch* broad) was Received into a *Sinus* of the *Os Temporum*, and very firmly *Articulated* there. It had two *Processus*; the *Anterior* or *Superior* is Large and Thin, into which is inserted the *Temporal Muscle*: The *Inferior Processus* is smaller, and runs to a Sharp Point; Here at this *Proces*, the Edge of the *Mandible* is so Dilated, that it Measured above *half* an *Inch*. On the Inside of the *Jaw* here is a Large *Sinus*, which leads to a *Foramen* that goes into the Body of the *Jaw Bone*, and affords a Passage for the *Vessels* thither. In the *Upper Jaw* before were 8 small *Dentes Incisores*, 4 of each side; then a *Void Space*, almost a *quarter* of an *Inch*; then two Large Prominent *Dentes Canini*, one of each side, which Jutted out of the *Jaw* about *half* an *Inch*; these were succeeded of each side, with 3 *Dentes Incisores*: but these were much stronger and Larger than the *Fore-Teeth*, and imitated the *Dentes Molares*, in that they were inserted into the *Jaw-Bone* with *Two Phangs*: But the *Heads* of these *Incisores* were *Acuminated*, whereas the *Heads* of the *Molares* were *Flat* and almost of a *Triangular* Figure; There were 4 *Dentes Molares* of each side; in all 24 *Teeth* in the *Upper Jaw*. But the *Double Phangs* of the *Molares* and the *Incisores Majores*, were such as at first Sight, one would think them two Distinct *Teeth*; each *Phang* being inserted into a Distinct *Alveolus*, or *Socket*, in the *Jaw*, and remaining Separated some Way above the *Jaw-Bone*, and only Joyned at the *Head*. In the *Under-Jaw Bone*, there were likewise of Each side, 4 *Dentes Incisores Minores* Before; then a little *void Space*; after that, the *Dens Caninus*; then 3 *Dentes Incisores Majores*; and last of all 4 *Dentes Molares*; answerable to those in the *Upper Jaw*, but somewhat smaller. In both *Jaws*, in all 48 *Teeth*.

There were 7 *Vertebræ* of the *Neck*; 13 of the *Back* or *Thorax*; 6 of the *Loins*; 3 of the *Os Sacrum*; and 22 of the *Tail*; 51 in all. The *First Vertebra* of the *Neck* (to which the *Head* is fastened, and is therefore call'd the *Atlas*) had
Fig. 268. two Broad Transverse *Processes*, but no *Spine*. The 2*d. Vertebra* of the *Neck* had a very large and thick *Spine* of a Triangular Figure: and in it was observed a large Semi-circular *Sinus*, which was so Deep as to receive into its Bosom, a great part of the *First Vertebra*; by which means, the *Articulation* was very much
Fig. 268. *d.* strengthned. This *Vertebra* is called *Dentata*, from that *Tooth-like Protuberance* I have Represented, and which is receiv'd into the *Hollow* of the *First Vertebra*, where the *Medulla Spinalis* runs. This *Vertebra* backwards, had two *Processus obliqui Su-*
Fig. 269. *periores*, and two *Obliqui inferiores*. The 3*d. Vertebra* of the *Neck*, had the same *Processes* both before and Behind; but the *Spine* here was about 3 *quarters* of an *Inch* in Height; about the 3*d.* of an *Inch* Thick; and just at the Top seemed to be a little *Cleft*. The 4*th.* and 5*th. Vertebræ* had the same *Processes*, as the 3*d Vertebra*; and the *Spine* here likewise was very Thick, and *Cleft* at the Top; but gradually Lessening in Height, as also Thickness. The 6*th. Vertebra*, besides the former *Processes*, had likewise an *Acute-Transverse* One, on each side; and its *Spine* much shorter and more *Acuminated* than the Former. The 7*th. Vertebra* of the *Neck* had only two *Oblique Processes* before, and none Behind; and two *Acute Transverse Processes*, and a very short and Sharp *Spine*: So that upon hold-

ing

ing-up the *Head*, the *Spine* of the *Firſt Vertebræ* of the *Thorax* would touch the Top of the 5*th*. *Vertebra* of the *Neck*. Theſe *Vertebra* are ſo ſtrongly and Cloſely locked into one another, that though each of them are Large in themſelves; yet thus *Articulated*, they do not make full 2 *Inches* in Length This Thickneſs and Strength of the *Vertebræ* of the *Neck*, and likewiſe of ſeveral of the *Vertebræ* of the *Thorax* and *Loins*, and the *Prominent Bony Ridge* in the *Cranium*, ſo well ſecure his *Neck*, *Back*, and *Head*, that ſhould it happen to *Fall* to the Ground there would be no Danger of *Breaking* any of them.

The Firſt 7 *Vertebræ* of the *Thorax*, have *two Oblique Proceſſes* forwards, *Fig.* 270. which runs Under the Hinder *Oblique Proceſſes* of the Preceeding *Vertebra*, and have *Two Oblique Proceſſes* backwards, which ride Over thoſe of the Succeeding *Vertebra*; as likewiſe *Two Tranſverſe Proceſſes*, which at their Ends have ſmall *Acetabula's* or *Sinus's*, for the Receiving the *Heads* of the *Ribs*, which are faſtened to them. The *Spines* of theſe *Vertebræ* are Slender, Thin, and ſharp; about $\frac{3}{4}$ of an *Inch* long. The 6 following *Vertebræ* of the *Thorax*, have ſhort, Thick, and Flat *Spines*. The *Oblique Proceſſes* being continued on each ſide of the *Spine* make, as 'twere, a *Gutter*: and the *Tranſverſe Proceſſes* here, are ſomewhat Different from the Former. The *Spines* of the *Vertebræ* of the *Back*, or *Fig.* 271. *Loins*, the more they Approached the *Os Sacrum*, ſo they Leſſened Gradually in their Thickneſs on the Edge. But here were *Double Oblique Proceſſes*, *viz.* 4 at each end of the *Vertebra*; and the Undermoſt ſpreading themſelves out Broad. The 3 *Vertebræ* of the *Os Sacrum*, are firmly faſtened to the *Os Ilium*; but the Laſt not ſo entirely as the two Former: But this at each ſide had a Broad *Tranſverſe Proceſs*, and the *Spines* of theſe were Thin. The Two *Firſt Vertebræ* of the *Tail* had only one ſmall *Acute Spine*: But in all the other *Vertebræ* of the *Tail*, both at the *Head* and *Tail* of each *Vertebra*, I obſerved *Two Spines*; but thoſe at the *Head* of the *Joynt*, the larger. In the 6 Firſt *Vertebræ* of the *Tail*, there was, of each ſide, a Broad *Tranſverſe Proceſs*, the length of the *Joynt*: In the other *Vertebræ*, only at the *Head* and *Tail*, a Jutting out at the ſides. The *Vertebræ* about the Middle of the *Tail*, were the Longeſt; being there about an *Inch* long; near the Root of the *Tail*, and at the End, not ſo Long.

The *Spines*, or *Hooks*, placed in a Line, in the Middle of the Underſide of *Fig.* 272. the *Vertebræ* of the *Tail*, are a Wonderful Piece of Natures *Mechaniſm*. 'Tis true, the Firſt 3 *Vertebræ* had none of theſe *Spines*, but in all the reſt they were to be obſerved; but as they approached the Extream of the *Tail*, they grew Leſſer and ſhorter. Theſe *Spines* (where Longeſt) were about a *quarter* of an *Inch*, or ſomewhat more. They were placed juſt at the *Articulation* of each Joynt, and in the Middle from the ſides; and ſeemed to be *Articulated*, both to the Preceeding and following *Vertebra*; not being an Entire Solid Body, but ariſing from the *Vertebræ* with two Legs or *Crura*, become afterwards perfectly United at the Ends. By this means, the *Bones* are rendered more Firm and Strong; and this *Hollow* ſerves for the Tranſmitting of the *Blood Veſſels* through them; and one may Obſerve here a *Stria*, or *Furrow*, all the Length of the *Vertebra*, for the receiving them, whereby they are the better ſecured from *Compreſſion*, when this Animal *Hangs* by his *Tail*. And for the

the Performing this Office, nothing, *I* think, could be more Advantageously Contrived: For when the *Tail* is Twirled or Wound about a Stick, this *Hook* of the *Spine* easily sustains the Weight, and there is but little Labour of the *Muscles* required; only enough for the Bowing or Crooking the *Tail*; for then, as by a *Hook*, the Weight of the whole Body is hereby Suspended. And for the doing this, 'twas Observed, that in each Preceeding *Vertebra*, there did a *Muscle* arise, which was Inserted on each side of the Succeeding *Vertebra*; which *Acting*, or *Contracting*, must necessarily Bend and Curve that *Joynt*: But for the Strengthning the whole there was observed 4 *Muscles* to arise from the *Os Sacrum*, which did run the whole Length of the *Tail*; Two on the Upper side, and two on the Under: sending each a *tend on* to each *Internode* or *Vertebra*. So that when the Skin was stript off, the Outward parts of these *Muscles* seemed to have Tendinous Expansions over them the whole length of the *Tail*, and almost to be Covered by them: which must needs very much Contribute and add strength to the *Tail*; besides what may be the Effect of their Insertion of *Tendons* into each *Joynt*, or *Vertebra*, in *Curling* and *Unbending* the *Tail*.

Fig. 66. To the *Vertebræ* of the *Thorax* are fastened the *Ribs*, and there are 13. of each side. The 7 Foremost are more perfectly *Articulated* with the *Sternum*. The 6 succeeding may be reckoned in some sense, *Costæ Nothæ*: For though they are Long, and as they proceed from the *Vertebræ*, are Inclined Backwards towards the *Hinder-Legs*, yet afterwards they are Reflected Forwards towards the *Sternum* or *Cartilago Scutiformis*. And tho' in other Animals, that part of the *Ribs* that is fastened to the *Os Pectoris*, or *Sternum*, be usually *Cartilaginous*; yet here, in our Subject, *I* Observed it to be all *Bony* throughout. However, this Difference *I* found, that the *Ribs* did look *Redder*, by Reason of the *Blood Vessels* in them, and this Part was *Whiter*, and where it was Fastened to the *Ribs*, one might plainly see; so that it may well pass for a *Bony Cartilage*, as often the *Cartilages* do become Bony.

The *First Rib* was only an *Inch* long, and its *Bony Cartilage* a *quarter* of an *Inch*: hence Gradually the *Ribs* Encrease in Length; for the *7th. Rib* was 3 *Inches* Long, and its *Cartilage one Inch* and a *half*. The 4 *Last* of the *Costæ Nothæ* gradually Lessen again in Length; for the *Last Rib* of all was only *one Inch* and $\frac{3}{4}$ Long; and it's *Cartilage* did not run Home to the *Os Pectoris* or *Sternum*, though the *first*, *second* and *third* of the *Costæ Nothæ* did. The *Os Pectoris*, or *Sternum*, consisted of 7 *Bones*, according to the Number of the *Fore Ribs*, that are Fastened to them. At the Begining of the *Sternum*, there Jutted out a sharp *Bony Cartilage*, which, from its Figure I shall call *Cartilago Ensiformis*: And here was fastened one Extream of the *Claviculæ*. At the End of the *Sternum*, towards the *Belly*, there was a Broad Roundish *Cartilage*, which therefore *I* shall call *Cartilago Scutiformis*.

There were 2 *Claviculæ*, or *Collar Bones*, each an *Inch* and $\frac{1}{2}$ long; having one Extream Fastened to the *First Bone* of the *Sternum*, or the *Cartilago Ensiformis*, and the other End to the *Spine* of the *Scapula*, near the Conjunction of it to the *Os Humeri*. By means of this *Bone*, it can more advantageously

bring

bring its *Fore-Feet* to its *Mouth:* as it uſes to do when it Feeds its ſelf, as do the *Monkey-kind*, who have *Claviculæ* too as well as *Man*; though many Animals want theſe *Bones*.

The *Scapula*, or *Shoulder-Blade*, was about 2 *Inches* long, about an *Inch* and $\frac{1}{2}$ broad: its *Spine*, though Thin, yet the nearer it approached the *Shoulder* it grew Larger and Flatter. Into the *Sinus* of the *Neck* of the *Scapula*, was received the *Head* of the *Shoulder-Bone*, or *Fore-Thigh-Bone*; as to that Protuberance called the *Acromium*, was faſtened the End of the *Clavicula*. This *Thigh Bone* of the *Fore Legs* was about $2\frac{3}{4}$ *Inches* Long: 'twas Thick and Strong, having a large rough *Spine* jutting Forward, and running half the Length of it. The Lower Extream of this *Thigh Bone*, to which was faſtened the *Tibia* and *Fibula*, grew very Broad, being almoſt an *Inch* broad. Above, where this *Bone* began to grow Broad, on the Outſide was a Large Protuberance: and on the Inſide there was a great Oblong *Foramen*, or Hollow Paſſage, formed by a ſmall *Bone* ariſing from the Inward Fore-part of the *Thigh-Bone*, where it begins to grow Larger, and was afterwards United to that part of the *Baſis* of this *Bone*, where the *Fibula*, or *Minus Facile*, is Joyned. Juſt in the Middle of the *Baſis* of this *Bone*, there was a Large *Sinus*, which Backwards appeared Deeper, which did look into another Deep *Sinus* of the *Tibia*: by which Means theſe *Bones* were ſo firmly *Articulated* together, as they were not eaſily, if poſſibly, to be put out of *Joynt*. The *Tibia*, or *Focile Majus*, was a ſtrong *Bone*, about 3 *Inches* Long, which was Extended upwards about $\frac{1}{4}$ of an *Inch* above it's *Articulation* with the *Thigh Bone*: and at the Other End was faſtened to the Outward *Bone* of the *Tarſus*. The *Fibula*, or *Focile Minus*, was a Smaller *Bone*, placed more Inward and Forwarder, and not ſo long as the *Tibia*; being *Articulated* Above (but not ſo Firmly) with the *Thigh Bone*, and Below, with the Inward *Bone* of the *Tarſus*; For there were but 2 *Bones* of the *Tarſus*, having each a ſmall *Sinus*, for the receiving the *Heads* of the Two *Fociles*. The *Bones* of the *Metatarſus* were 4 or it may be 5, to which were Joyned the 5 *Fingers* or *Toes*, of the *Fore-Feet*. The Innermoſt *Toe* had but 2 *Articulations*, or *Joynts*; but at the End had a Large Hooked Strong *Nail*: The other 4 *Fingers* had each, 3 *Articuli* or *Joynts*, armed with Hooked *Nails*, as the *Firſt*. *Fig.* 262.

The *Hinder Legs* were faſtened to the Trunk of the Body by the *Os Innominatum*; which in the whole in a Straight Line was 3 *Inches* long. In the *Os Iſchii* was the *Acetabulum*, being a Large *Socket*, for the receiving the *Head* of the *Hinder Thigh Bone*, and Deeper in, there was a ſpace for the Faſtening the *Ligament*; from which Space, there was a *Sinus* which led Outward; ſo that the Brims of the *Acetabulum* was not an entire Circle, but Broken off here. *Fig.* 265.

Here alſo are the *Oſſa Marſupialia*, or *Janitores Marſupii*. The *Hinder-Thigh Bone* was a little above 3 *Inches* Long; 'twas Roundiſh, and a ſtrong *Bone*: But the *Tibia*, or *Majus Focile*, of the *Hinder Leg*, was ſomewhat Longer, a little Curv'd. The *Fibula*, or *Minus Focile*, was about the ſame Length, Straighter and Slenderer. This, towards the *Foot*, was Articulated

to

to the *Os Calcis*, as the *Tibia* was to the *Talus*, or *Astragalus*; and these two *Bones I* make the *Tarsus*; and Joyning to them, were the *Bones* of the *Metatarsus*; and to these the *Phalanges* of the *Fingers* or *Toes*. In the Innermost, or the *Thumb*, there were only *Two Articuli*, or *Bones*: in the other 4 *Toes*, or *Digiti*, in each there were 3 *Articuli*, or *Joynts*. The end of the *Thumb* was more Flatted, than the Ends of the other *Toes*: For the *Thumb*, as *I* have Observed, had a *Flat Nail*, like a *Human Thumb*; in the Others, the *Nails* were long, and Curved. *I* observed likewise, at the *Articulation* of each *Joynt* of the *Toes*, on the Underside, there were Two Small *Bones*, that are called *Ossa Sesamoidea*; and these both in the *Fore*, and *Hinder-Feet*.

Fig. 257. Represents the *Possum* drawn from the *Life*.

Explanation of the Figures.

Fig. 258. The *Slit*, or *Aperture*, in the *Belly* that goes to the *Marsupium*, or *Pouch*.

Fig. 257.
Fig. 258.
Fig. 259.

Fig. 259. *A.* The *Marsupium* Turned the Inside Outwards; where may be observed the *Hair*, or *Fur*, that Covers it, and may help the better to keep the *Young* ones Warm. *BB.* The two *Hinder Legs* Cut off. *C.* The *foramen* of the *Anus*; which is also the *Common* Outward Vent, or Exit, to the *Rectum*, the *Bladder* of *Urine*, and the *Uteri* too. *D.* The Beginning of the *Tail*.

Fig. 260. The *Sceleton*. *A A.* The *Nostrum*, or *Snout*. *b b.* The *Cranium*, or *Skull*, that did contain the *Brain*. *ccc.* A *Bony Ridge*, or *Protuberantia Ossea Longitudinalis*, that did run the length of the *Cranium*, and over a part of the *Rostrum*. *d.* the *Lateral Ridge*, which like a Pent-house, Jutted over the Hinder part of the *Cranium*; *Protuberantia Ossea Literalis*. *e. f.* the *Os Zygomaticum*; *e.* its *Process* from the *Os Temporum*, and *f.* that from the *Maxilla Superior*, or *Upper Jaw*. *g.* A *Foramen*, or Hole, in the *Inward Canthus* of the *Orbit* of the *Eye*, that leads into the *Nostrils*, and by a *Duct* conveys the *Tears*, or *Moisture* of the *Eyes* into them. *h.* A *Foramen*, or Hole, in the *upper Jaw*, for a Passage to the *Vessels*. *i.* A *Protuberance* of the *Os frontis*. *K.* A *Suture* of the *Os Narium*. *l l.* The *Lower Mandible*, or *Jaw Bone*; *Maxilla Inferior*. *m.* The *Superior Process* of the *under Jaw*. *n.* The *Inferiour Process* of the *under Jaw*. *o.* The *Clavicula* of One side. *p.* The *Cartilago Ensiformis* of the *first Bone* of the *Sternum*. *q.* The *Scapula* or *Shoulder Blade Bone*. *r.* The *Spine* of the *Scapula*. *S S S S.* The *Thigh Bones* of all the *Feet*. *T T T T.* The *Tibia* or *Focile Majus*, of all the *Feet*. *u u.* Part of the *Tibia* in the *Fore Legs*, Extended beyond the *Articulation*. *W W W W.* The *Fibula*, or *Focile Minus*, in all the *Legs*. *x x x x.* The *Bones* of the *Tarsus*. *y y y y.* The *Bones* of the *Metatarsus*. *z z z z.* The *Toes*. *a a* The *Thumbs* in the *Hinder Feet*. 1. The *First Vertebra* of the *Neck*; called the *Atlas*. 2. 3. 4. 5. 6. 7. The 2*d*. 3*d*. 4*th*. 5*th*. 6*th* and 7*th*. *Vertebra* of the *Neck*. 8. The *First Vertebra* of the *Thorax*. 9 The *First Vertebra* of the *Loyns*. 10. The *First Vertebra* of the *Os Sacrum*. 11. The *First Vertebra* of the *Os Coxygis*, or *Tail*. 12. 12. 12. 12. the *Spines*, or *Hooks*, on the *Inside* of the *Tail*. 13. 14 the *Os Innominatum*; where 13 is the *Os Ilium*, 14 the *Os Ischii*, or Coxendicis. 15. 15. the *Ossa Marsupialia*, seu *Janitores Marsupii*. * * * *. the *Ribs*, 13 in all. ⊙. the *Cartilago Scutiformis*.

Fig.

Fig. 261. The Situation of the *Ossa Marsupialia, &c. aa.* The *Ossa Pubis. b.* The *Coalition*, or the Joyning of the *Ossa Pubis. cc.* The *Two Ossa Marsupialia*, or *Fanitores Marsupii. d e.* The Basis of the *Ossa Marsupialia*, where Joyned to the *Ossa Pubis*; *d.* the *Inward Head* of the *Basis*, *e.* the *Outward. f f.* The *Acetabulum*, or *Socket*, for receiving the *Head* of the *Thigh-Bone. g g.* The *Os Ilium. h h.* The *Vertebræ* of the *Os Sacrum. i i.* The *Os Ischii*, or *Coxendicis.* *Fig.* 261.

Fig. 262 The Fore side of the *Thigh-Bone* of the *Fore Leg. a.* The *Head* of the *Thigh Bone*, where 'tis Fastened to the *Scapula. b.* A large Rough *Spine*, which runs above Half the Length of this *Thigh Bone. c.* A *Protuberance* of this *Bone* on the Out side. *d.* A large *Foramen*, or *Hollow* Passage. *e.* A *Sinus* for Receiving the *head* of the *Tibia. f. g.* The *Basis*, or lower Extream of the *Thigh-Bone.* *Fig.* 262.

Fig. 263. The *Stomach*, and *Guts. A* the *Gula. BB.* The *Stomach. c.* A *Perforation* of the *Stomach*, caused by an *Ulcer* there. *dd.* The two Pouchings out of the *Stomach* at the two Ends. *e* The *Pylorus. f.* The Beginning of the *Duodenum. g h i K L M N o p q.* Represent the *Small Guts*, and the *Coyles* and *Convolutions* they do make; some of the *Coyles* lie Hid, and out of Sight: but the Order how they follow one another, is signified by the Order of the Letters of the *Alphabet*; so that *g.* Follows *f.* and *g.* is Succeeded by *i.* and *i.* by *K.* and so on to *q* where the *Ilion* is Discharged and Emptied into the *Cæcum*, or if that is full, into the *Colon*, at the first Letter *S.RR.* The *Cæcum. SSS.* The *Colon. T.* The *Rectum. V.* The *First Mesenterie*, or *Mesenterium Minorum Intestinorum. w.* The *Second Mesenterie*; or *Mesenterium Majorum Intestinorum.* *Fig.* 263.

Fig. 264. The *Urinary*, and *Uterine Parts. AA.* the *Two Kidneys. bb.* the *Emulgent Veins*, *c c.* the *Emulgent Arteries. d d.* the *Glandulæ Renales. e e.* the *two Ureters. f.* the Insertion of the *Left Ureter*, into the *Neck* of the *Bladder. G.* the *Bladder* of *Urine*, turn'd aside. *h.* the *Urethra. i i.* the *two Vaginæ Uteri. K.* the *Common Passage* from the *Urethra*, and the *two Vaginæ. l.* the *Arteria Aorta*, or *Great Arterie. m.* the *Vena Cava. n n n.* the *Spermatick Arteries. o o o o.* the *Spermatick Veins. p p p.* the *Hypogastrick Arteries* and *Veins. r r r.* the *Alæ Uteri, seu potius Cornuum. S S*, the *Ovaria. t t.* the *Tubæ Fallopianæ. u u.* the *Cornu Uteri* of the *Left Side* opened. *w.* the *Cornu Uteri* of the *Right Side* not Opened. *x x.* the *two Uteri* Opened. *y.* the *Diaphragm* that Divides the *Two Uteri. z z.* the *Imperfect Diaphragma* which Partly Divides each *Uterus*, and lies over the Passage of that part of the *Uterus*, which is Doubled and Tends to the *Vaginæ.* *Fig.* 264.

Fig. 265. The *Uterine Pars* more Particularly. *A A.* the *two Ovaria. b b.* the *Fimbria Foliacea. c c.* the *Tubæ Fallopianæ. d d.* the *two Cornua Uteri. E E.* the *Two Uteri* Reduplicated. *f.* A *Slit* in the *Neck* of the *Left Uterus* to shew its Passage into the *Vagina* on that side. *g.* the *Left Vagina* Opened. *h.* the *Ostium*, or *Mouth*, of the *Right Vagina. i.* the *Common Passage* from the *Urethra* and *Vaginæ. K.* the *Urethra. l l.* the *Bladder* of *Urine* cut off. *Fig.* 265.

Fig. 266. the *Hairy Tophus.* *Fig.* 266.

Fig. 267. *Fig.* 267. The *Liver*. *A.* the *Vena Cava*. *BBB.* the 3 *Lobes* of the *Liver*. C. the *Bladder* of *Gall*. *d d d.* the *Fiſſures* in the Body of the *Liver*. *e e e.* the *Inciſures* at the Edges of the *Liver*.

Fig. 268. *Fig.* 268. *A.* the *Spine* of the 2*d*. *Vertebra* of the *Neck*. *b.* Repreſents its Thickneſs. *c.* A Large *Sinus* for the Receiving the *Firſt Vertebra*. *d.* the *Dens*, or *Tooth*, of this *Vertebra*. *e* the *Proceſſus Obliquus Superior* of one ſide. *f.* the *Proceſſus Obliquus Inferior* of the ſame ſide.

Fig. 269. *Fig.* 269. *A.* the *Spine* of the 3*d*. *Vertebra* of the *Neck*, where is ſhewn its Natural Thickneſs. *b* the *hole* through which the *Medulla Spinalis* Paſſes. *c c.* two ſmall *Foramina* for the Paſſage of the *Veſſels*. *d.* Repreſents the *Cleft* at the Top of the *Spine*. *e e.* the *Two Proceſſus Obliqui Superiores* Before. *f f.* the *Two Proceſſus Obliqui Inferiores* Before.

Fig. 270. *Fig.* 270. The *Firſt Vertebra* of the *Thorax*. *A.* the *Spine*, which is Long and Acute. *bb.* the *Oblique Proceſſes* Before. *cc.* the *Oblique Proceſſes* Behind. *dd* the *Tranſverſe Proceſſes*. *ee.* Where the *Ribs* are Faſtened. *f.* the *Hollow* where the *Medulla Spinalis* paſſes.

Fig. 271. *Fig.* 271. The 4*th Vertebra* of the *Loins*. *a a.* the *Two Upper Oblique Proceſſes* Behind. *b.* the *Spine*. *cc.* the *two under Oblique Proceſſes* Behind

Fig. 272. *Fig.* 272 the 2*d*. and 3*d*. *Vertebra* of the *Tail*. *aa*. *Two Vertebræ* of the *Tail*. *b b b.* the *Spines*, or *Hooks*, on the Inſide, by means of which it can better *Hang* by its *Tail*. *c c.* A *Hollow*, or *Foramen*, in the Middle of theſe *Spines*, through which *Blood Veſſels* Paſs.

A Monſtrous DoubleTurkey; *by Sr.* J. Floyer, n. 259. p. 434.

CX. At *Thorpe* in *Staffordſhire*, *two Young Turkeys*, were taken out of *one Egg*, (of the Ordinary Size,) when the reſt of the *Egs* were well Hatched, which *Grew together* by the *Fleſh* of the *Breaſt Bone*, but were in all other Parts *Diſtinct*. They ſeemed Leſs than the Ordinary thickneſs of *Turkeys*: for there wanted both *Nutriment* and *Room* for their *Growth*; which was the Occaſion of their *Cohesion* and *Smallneſs*. They had *Diſtinct Cavities* in their *Bodies*, and *two Hearts*: ſo that they had *two Diſtinct Cicatricula's*, and Conſequently the *Eg* had *two Yolks* in it, from whence they were Produced; which Accident is very Common. But *I* have a dryed *Monſtrous Chicken* which had but *one Head*, 4. *Wings*, 4. *Legs*, and *one Cavity* in the *Body*, and Conſequently had but *one Heart*: in this Caſe this *Monſtrous Chicken* was Produced from one *Cicatricula*. So *Paræus* mentions a *Double Infant* with *one Heart*. In theſe Caſes the *Original* of the *Infant* was *One*, and the *Veſſels Regular*; but in the Extremity, the *Arteries* and *Nerves* were divided into more *Branches* than Ordinary, and Produced *Double Parts*. And this is like the *double Flowers* of *Plants*, which are Produced ſo, by the *Richneſs* of the *Soil*. And, thus it is in the *Egs* of *Quadrupeds*; they are *Joyned* in the *Ovarium*, and as they *Grow*, their *Bodies* do Externally *Cohere*. So that I may Obſerve, that there are theſe two Reaſons of the *Multitude* of the *Parts* in an *Embryo*; the *Joyning* of *two Perfect Animals*, or elſe the Extraordinary *Diviſion* of the *Original Veſſels*, the *Arteries* and *Nerves*.

CXI.

CXI. The *Body* of this *Colt* appeared to the Eye *Compleatly Formed*, without any *Monſtroſity* to be taken Notice of in it: But the *Head* being Opened, and Examin'd, it was Found, that it had no Sign of any *Noſe* in the Uſual place. The *Two Eyes* were United into *One Double Eye*, which was Placed juſt in the Middle of the *Brow*, the *Noſe* being Wanting which ſhould have Separated them: Whereby the two *Eye-Holes* in the *Skull* were *United* into *One* very Large Round *Hole*, into the Midſt of Which, from the *Brain*, entered *One* pretty Large *Optick Nerve*, at the End of which Grew a Great *Double Eye*; that is, that *Membrane*, called *Sclerotis*, which Contained *Both*, was *One* and the ſame, but ſeem'd to have a *Seam*, by which they were *Joyned*, to go quite Round it, and the *Fore* or *Pellucid Part* was diſtinctly Separated into *two Cornea's*, by a *White Seam* that divided them. Each *Cornea* ſeem'd to have it's *Iris*, (or *Rainbow-like Circle*) and *Apertures*, or *Pupills*, *Diſtinct*; and upon Opening the *Cornea*, there was found within it *two Balls*, or *Chryſtalline Humours*, very well Shaped. The *Eye Lids* were alſo a little *Divided* in the Middle. Juſt above the *Eyes*, as it were in the Midſt of the *Forehead*, was a very *Deep Depreſſion*, and out of the Midſt of that, Grew a kind of *Double Purſe* or *Bag*, Containing Little or Nothing in it: but to ſome it ſeemed to be a *Production* of the Matter Deſigned for the *Noſe*, but Diverted by this *Monſtrous Conception*; perhaps the *Proceſſus Mammillares*, Joyned into *One*, and were Covered with a Thin Hairy *Skin*.

A Monſtrous Colt; *by Mr.* R. Boyle, n. 5. p. 85.

Fig. 273.

CXII. *A Butcher* (at *Limmington* in *Hampſhire*) having Killed a Fatted *Cow*, and Opening the *Womb*, found in it a *Monſtrous Calf*, which begun to have *hair*. The *Feet* of this *Calf* were ſo Parted as to be like the *Claws* of a *Dog*; the *Legs* had no *Joynts*; and the *Tongue* was, *Cerberus like*, *Tripple*, to each ſide of his *Mouth* One, and one in the Midſt. Between the *Fore Legs* and the *hinder Legs* was a *Great Stone*, on which the *Calf* Rid. The *Skin* of the *Breaſt*, and between the *Legs*, and of the *Neck* (which Parts lay on the ſmaller End of the *Stone*) was much thicker, than on any other Part. The *Stone* (which was Bigger at one End then the other) Weighed 20½ *Pounds*; the outſide was of a *Greeniſh Colour*; and not *Plain*, but full of little *Cavities*; when Broke, it appeared full of ſmall *Pebble Stones*, of an *Oval Figure*; its *Colour Gray* like *Freeſtone*, but intermixt with *Veins* of *Yellow* and *Black*.

A Monſtrous Calf; *by Mr.* Dav. Thomas, n. 1. p. 10. n. 2. p. 20.

CXIII. *Jan.* 11. 167⅞. *A Cow* of Mr. *Will. Dabs's*, at *Milnecoat* in *Warwickſhire*, brought forth a *Monſtrous Calf*; having *one* perfect large *Head*, and on the Right Side of that, grew another, almoſt as Large, and of true Shape, having both *Tongue* and *Teeth*; and from the *Roof* of the *Mouth* of the *Monſtrous Head*, hung down a piece of *Fleſh*, with the ſhape of a *Tongue* upon it, and a Row of *Teeth*, as on an *Under Jaw*: which occaſioned the Man who ſhewed it, to ſay that it had 3 *Mouths*. It had to each *Head* 2 *Eyes*, only thoſe of the *Monſtrous* were very ſmall, and *I* believe had *no Sight*. It had only 2 *Ears* to *both Heads*, one of which was Placed on the Far-ſide of the *Monſtrous Head*, the other as

A Monſtrous Calf *with* 2. Heads; *by Sr.* Rob. Southwel, n. 238. p. 79.

Uſual in other *Calfs*. It *Breathed* equally at *Both Mouths*, and had Communication with the *Same Throat*, but took its *Nouriſhment* only at the *Perfect Mouth*, the *Under-jaw* of the Other being ſo Weak, that the *Mouth* always ſtood open and Drivell'd. It appeared on the Left ſide to be a *Perfect Calf*, and look'd very Lively, and was at 3 *Days* Old, as Large and Strong as Other *Calfs* Uſually are at 10 *Days*, or a *Fortnight*.

Two Monſtrous Lambs, *by Mr.* Colepreſs. n. 26. p. 480.

CXIV. *Feb.* 24. $166\frac{6}{7}$. *Rob. Cloak*, of *Beer Ferris* in *Devonſhire*, had a *Black Ram-Lamb* Fallen with *One Head*, but 2 *Diſtinct Bodies*, with 8 *Legs*, which Bodies were *Joined* in the *Neck*. It had 2 *Eyes* and as many *Ears*, in the Uſual Places; and *One Extraordinary Eye* in the *Niddock*, with *One Single Ear*, about an *Inch* diſtant from the *Eye* Backwards. Its Dam uſually brought forth *Two Lambs* every Year, as ſhe did this Year alſo; which with the Ewe remains *Alive*; but this *Monſter* was found *Dead* by the Hedge.

About the ſame time, *John Cauce*, of the ſame Pariſh, had a *White Lamb* Fallen, with 2 *Diſtinct Heads* and *Necks*, *joined* at the *Shoulders*, but *One Only Body*; and that well Formed, yet having *Double Entrals* in all Reſpects. The Ewe remains *Well*, but the Monſter *Dy'd*.

A Monſtrous Pig. *by* ------ n. 147. p. 188.

CXV. In *Decemb.* 1682. Among many *Pigs* of a *Sow*, there was One which had *No Paſſage* for the *Fæces*, either *Solid* or *Liquid*, although the *Anus* was not outwardly *Cloſed Up*; and being Diſſected, we found the *Guts* very much Diſtended and Tranſparent, and thro' them appeared the *Fæces* very *Liquid*, accompanied with no Small Quantity of *Wind*. The End of the *Rectum* was entirely *Cloſed* like a *Bladder*, and *Sealed*, as it were, *Hermetically*, *Pendulous* in the *Cavity*, and not in the leaſt Continued to a *Sphincter*, of which there was no Sign. There was *No Bladder* to be found, nor *Uterus*, nor any Mark of what *Sex* it was deſigned for: But both the *Ureters* were Inſerted into the *Rectum*, within an *Inch*, or thereabouts, of the End. The *Stomach* was Full, even to *Diſtenſion*, of an *Hard Subſtance*, which appeared exactly the Same with *Hard Preſs'd Curds*. The *Chyle* came Freely enough out of the *Ductus Pecquelitanus*, where it was inſerted into the *Jugular*, upon the ſmalleſt preſſure of the *Inteſtines*: But I could not Urge the *Liquid* or *Flatulent Contents* of the *Guts* Upwards, within two *Inches* of the *Pylorus*, tho' *I* preſſed them till they Brake.

Two Monſtrous Pigs; *by Sir* J. Eloyer. n. 259. p. 431.

CXVI. In *May*. 1699. There was ſhewed to me a *Pig* at *Weeford* in *Staffordſhire*, with a *Face* ſomething Repreſenting that of a *Man's*, and the *Chin* was very like that of an *Humane Fætus*. But when *I* had well conſidered the *Head*, *I* Obſerved there was a *Depreſſion* of the *Bones* of the *Noſe*, in that Place which was betwixt the *Eyes*, in which the *Pigs Face* ſeemed to me to be Broken, and the *Noſe* drawn Up to appear like an *Humane*. The *Under-Jaw* was *Inverted*, to grow up to meet the *Upper*; the *Tongue* and *Mouth* were made more like an *Humane*, being altered by ſome *External Preſſure* upon the *Mouth* of the *Pig*, which Broke the *Bones*

of

of the *Nose*, and Caused their *Depression* towards the *Palate*, and the *Inversion* of the *Under-Jaw*. This *Pressure* on the *Mouth* Forced the *Bones* Upward, so much as to Cover the *Eye-Holes*; and the *Pig* appears *Blind*. *A.* is the Place of the *Bone Depressed*; *B.* is the Depth of it. It Closed it self with a *Spring*, when we Opened it by Force; so that it had Grown Closed up, ever since it was *Cartilaginous*. By this *Breach*, or *Depression* of the *Pig's Face*, *I* was first Convinced, that this *Monster* was not produced by the *Copulation* of *Two Species*, as was Usually Apprehended, but only Occasioned by the *Perversion* of the *Compression* of the *Womb*, or *Placenta*, or *Other Pigs* in the same Part of the *Womb*. And that the *Pig's Head* was streightned in its Growth, appeared by the *Flatness* of the *Ears*; and that this *Depressure* happen'd whilst the *Bones* were *Cartilaginous*, appears by the *Bones depressed*, which remain'd *Cartilaginous*, and at the same time the *Under-Jaw* was *Inverted*, and the *Head* made more *Round*. *I* farther Observed, that All the *Head* was *Covered* with *Hair*, as the Other *Pigs* were; that the *Teeth* in the *Mouth* were *Pig's Teeth*; the *Hair* of the *Pig's Head* was *Yellow*, as that of the *Sow's* was; the *Monstrous Pig* was as Big, and as well Grown as the rest of the *Pigs*, and therefore *begot* by the *Boar* at the *Same Time*; the *Nose* was a *Perfect Pig's Snout*, and there was no *Upper Lip*, as in the *Humane Kind*. In all the Other Parts, it appeared to be a *Perfect Pig*; no Parts were wanting, but those of the *Face*, Distorted by some *External Accident*. At the Beginning of the 17th *Week*, from that Time when the *Sow* took the *Boar*, which is the Usual Time the *Sow* Pigg'd 8 *Pigs*, the *first* 5 were *Perfect Pigs* the 6*th*. was the *Monster*, and after that two more *Perfect Pigs*. This *Monster* was *Pigg'd Alive*, but *Dyed* because it could not *Suck*, the *Nose* being *Stopped*. The *Cry* of the *Pig* was not like the *Other Pigs*, because of the *Stoppage* of its *Nose*, and the *Alteration* of the *Figure* of its *Mouth*.

This Kind of *Monstrous Pigs*, produced by the *Unnatural Situation* of *Parts*, by some *External Compression*, I believe is very Frequent; because *I* had Another of the same Kind, sent me out of *Darbyshire*, which had a *Resemblance* of a *Man's Face*, and All the Other Parts of a *Pig*, and This had the same *Chin*, and *Depression* betwixt the *Eyes*, the *Roundness* of the *Head*, and *Flatness* of the *Ears*, *I* have above Described. But this *Derbyshire Monster* wanted *Hair*, as *Pigs* which come too Soon do; and No *Sex* could be Distinguished in it: But the Former Described was a *Boar-Pig*.

The Anatomy of a Monstrous Double-Cat; *by Dr.* Mullen. n. 174. p. 1135

CXVII. This *Monstrous Catling* was *Dead* when *I* met with it; and I am perswaded that it was so brought forth; the *Lungs* being Compact and Free from *Air*, which they could not be, if it had ever *Inspired*. It was *Double* from the *Navel* downwards, having 4 *Hind feet*, *Two Tails*, *Two Anus's*, and *Two Pudenda*; for they were *Females*. They were Joined into *One Trunk* at the *Navel*, and were Continued so Upwards: but yet this *Monster* had *Two Pair* of *Fore feet*, one of them on the *Back*, and the other on the *Breast*. The *Head*, though *single*, had *Two Pair* of *Ears*; one Naturally Seated, and another at the Hinder part of the Head, between the *Processus Mamillares*, to which the *Vertebræ* of both the *Necks* were Joined. There

Fig. 175.

There was only *One Stomach* under the *Liver* in the Right ſide, reaching under another *Liver* in the Left. The *Guts* were *Single* till within 6 or 7 *Inches* of the *Anus*; and there was a *Diviſion* into *Two Branches*, one going to each *Fundament*; below the *Diviſion* there were plainly to be ſeen *Two Cæcums*, within about 3 *Inches* of the *Anus* each. There were *Two Livers*, one much ſmaller than the other; that which was in the Right ſide was the leaſt, the other lay Lower down in the Left ſide; they were both Entire without any *Diviſion* or *Lobes*. There was a *Vena Umbilicalis* inſerted into Each of them. There were *Two Arteries* inſerted into the *Liver* in the Left ſide, both coming from the *Aorta*; and theſe *I* ſhall call the *Cæliacæ*; But there was only *One* inſerted into the *Liver* placed in the Right ſide. There was no *Vena Cava* Below the *Livers*; for all the *Veins* coming from the Lower parts entered the *Livers* as the *Vena Porta* does naturally. There was a Branch of a *Vein* on Each ſide proceeding from the *Loins* inſerted into the *Back-parts* of the *Liver*; and beſides theſe, there was not a Branch to be ſeen, but what was inſerted into the Middle of the *Livers*. There were *Two Kidneys* on Each ſide furniſhed with *Ureters*. There was neither *Spleen* nor *Pancreas* in Either ſide.

There was a *Double Diaphragm* meeting in the Middle between the *Two Back Bones*, and making a *Membrane*, which to me ſeemed to be a *Mediaſtinum*; for it reached up to the *Thymus*. There were *Two Hearts* in it; one placed above the other, and a little to the Right ſide, it was much Higher than ordinary, and it had a *Vein* coming to it from the little *Liver* in the Right ſide, which (together with 3 other ſmall *Veins*, one from each of the *Fore-Feet*, and one from the *Head*) furniſhed this *Heart* with what *Blood* was to be *Circulated* by it. It had only *One Auricle*, and *One Ventricle*: ſo that it ſeemed to be but *Half* a *Heart*. There was a pretty large Paſſage into the *Arteria Aorta*, the Contrivance of which was very Singular; For above this *Heart* it was made like an Arch of a *Circle*, into which there was a Direct Paſſage from the *Heart* for the *Blood*. When *I* further Examined this *Artery*, *I* found that it went down on Each ſide on the *Vertebræ* of the *Backs* between the *Kidneys*, and Divided it ſelf on Each ſide after the Uſual manner, after it had Lent Each *Kidney a Branch*, the *Liver* in the Right ſide *One*, and the *Liver* in the Left ſide *Two*. Below the former, a little towards the Left ſide of it, there was another *Half Heart*, having only *One Auricle* and *One Ventricle* like the Former. This received a little *Blood* but what was Tranſmitted from the *Large Liver* in the Left ſide, by that that is call'd the *Truncus Aſcendens* of the *Vena Cava*. The *Artery* carrying the *Blood* from this *Heart*, was inſerted into the *Artery* lately Deſcrib'd, as well as that of the other *Heart*. So that if the *Blood Circulated* through either of them the Whole Animal muſt neceſſarily be ſupplied with *Blood*; a Contrivance not unlike that of the *Arteries* under the *Brain*, where the *Arteriæ Carotides* and *Vertebrales* do Empty themſelves into *One Common Channel*, from which all parts of the *Brain* may eaſily be ſupplyed with *Blood*.

The

The *Head* was *Joyned* to *Two Necks* about the *Proceſſus Mamillares*. *Fig.* 278.
There were 4 Orders of *Ribs*, though the *Body* was but *One* above the *Navel*. *Fig.* 279.

Explication of the Figures.

Fig 275. Expreſſes to the *Life* the *Outward Shape*, when placed on its Back. *Fig.* 275.

Fig. 276. The *Cat Opened* 1. the *Stomach*, Pull'd from behind both the *Livers*, ſo as to be plainly ſeen. 2. the Beginning of the *Guts* below the *Pylorus*. 3. the *Diviſion* of the *Gut* into two Branches, whereof One went to Each *Anus*. 4. 4. the *Two Cæcums*. 5. 5. 5. 5. the *Two Pair* of *Kidneys*, furniſhed with *Emulgent Arteries* and *Veins*. 6 A Large *Liver* in the Left ſide, much Lower ſituated than the *Liver* in the Right ſide. 7. the *Liver* in the Right ſide, with a *Vein*, 8. Coming from the *Kidneys* of the ſame ſide, after it had *United* above the *Emulgents*; This ſupplies the Office of the *Vena Cava* and *Vena Porta*. 9. 9 Two Large *Branches* of the *Big Artery* going into the Body of the *Big Liver*. 10. 10. 10. 10. the *Great Artery*, Supplying both ſides with *Blood*, and Receiving of it from the *Two Hearts* 11. the *Vein*, bringing the *Blood* from the Lower Parts of the Left ſide into the *Liver*, 6. of the ſame ſide. 12. 12. the *Big Artery*, ſending *Branches* to each of the *Kidneys*. 13. the *Upper Heart*. 14. The *Artery* that ſupplied the *Head* with *Blood* 15. 15. The *Axillary Arteries*. 16 the *Vena Cava*, coming from the *Liver* in the Right ſide to the *Heart*. 13. 17. The Paſſage from the ſaid *Heart* to the *Aorta*. *Fig.* 276.

Fig. 277. 1. The *Liver* in the Left ſide, Freed from all things that kept it any way out of Sight. 2. the *Vena Cava* paſſing from it to the *Lower Heart*, 6 3. A Skirt of the *Diaphragm* turned to the Left ſide, that the Former *Vein* ſhould better appear. 4. the *Stomach*, Diſplaced for the former Reaſon. 5. 5. 5 5. the *Kidneys*. 6. the *Lower Heart*, in its Due Situation. 7. the *Upper Heart*, drawn out of its place Upwards that the Other, 6. with the *Paſſage*, 11. from from it to the *Aorta*, 9. 9. might be well Repreſented. 8. 8. the *Liver* in the Right ſide, Doubled and Turn'd over the *Heart*, 6. that it might be the better ſet forth. 9. 9 9. the *Aorta*, where it is not Hid by the Parts Diſplay'd for the former Reaſon. 10. the *Lungs*, not well Repreſented. 11. the *Paſſage* from the *Lower Heart* into the *Aorta*. *Fig.* 277.

Fig 278. The *Skull* Opened, and Freed from the *Brain*. 1. 1. the *Hollows*, through which the *Medulla Oblongata* was Continued to the *Medulla Spinalis* 2. 2. the *Two Necks*. *Fig.* 278.

Fig. 279 1. 1. The *Two Diaphragms* ſeparated from the *Cartilages* of the *Ribs*, that their *Junctures* may be ſeen. 2. 2. 2. 2. The *Vertebræ* of *Both* the *Backs*. 3. 3. 3. 3. 3. 3. the *Juncture* of the *Two Setts* of *Ribbs* that were at the *Back*. 4. 4. 4. 4. the *Two Setts* of *Ribbs* that were Joyned to the *Breaſt*. 5. the Tips of the *Diaphragms*, pull'd downwards to ſhew the *Ribbs* plainly. 6. 6. the *Vertebræ* of the *Two Necks*. *Fig.* 279.

An Animal reſembling a Whelp *Voided* per Anum *by a* Male-Grey-hound; *by Mr.* Edm. Halley. n. 222. p. 316.

CXVIII. The Account you had from *Cheſter*, in 1695. of a *Greyhound Dog* that Voided an Animal, Reſembling a *Whelp*, *per Anum*, as ſtrange and incredible as it may ſeem, is yet here ſtedfaſtly Believed; and the Creature was kept for ſome Time in *Spirit* of *Wine*, having *Lived* for ſome ſhort time after it came into the World; and it was ſeen *Alive* by Mr. *Roberts* of the *Society*, then in *Cheſter*. They ſay, it Exactly Reſembled a *Grey-hound-Whelp*, and had on its ſide a large ſpot, in the ſame place, as the *Dog* it proceeded from, had ſuch another; and that with it was *Voided* a Whitiſh Mucous matter, ſo that the People here at *Cheſter* will not permit me to Queſtion the *Truth* thereof.

A Bitch with Puppy *tho ſhe had loſt the* Spleen; *by* .... n. 105. p. 117.

CXIX. 'Tis Notorious all over *London*, that divers Years ſince, a *Bitch*, yet Alive, of a conſiderable *Noble-man*, after ſhe had loſt her *Spleen*, hath been ſeveral Times with *Puppys*; of which ſome, out of Curioſity, were Opened, and found to have a very *Fair Spleen*. *Vid.* Diemerbroeck *de Anat. Corp. Hum*

A Cow with Four Calves; *by Sir* J. Floyer. n. 259. p. 435.

CXX. I am informed, that this *Year* 1699. at *Duncburch* in *Warwick-ſhire*, a *Cow* Calved *Four Calves*, Perfect and all *Living*.

A Hen with a perfect Chick *in the* Ovarium; *by* ..... n. 50. p. 1019.

CXXI. About 2 or 3 Years ſince, there was a *Hen* at *Wackton* in *North-folk* which being big with *Eggs*, upon ſome account could not *Lay*, but after a time Dyed; and then being Opened, there was found in the *Ovarium* a *Perfect Chick*.

An Egg *found* within Another Egg; *by* ..... n. 230. p. 632.

CXXII. In *France*, a *Small-Egg* of about 7 *Lines* from End to End, and $4\frac{1}{2}$ of bigneſs, was found *Included* in a *Hen's Egg*, which appeared to have nothing Extraordinary on its Outſide. The *Small Egg-Shell* was faſtened to the *Shell* of the *Greater* by one of its Extremities.

Ova *found in a* Cow; *by* ..... n. 74. p. 2218.

CXXIII. There hath been very Lately made, by two Phyſitians at *Paris*, a Diſſection of a *Cow*, *in cujus* Teſticulis Ova *reperta fuerint*, *uti* Kerkringius *obſervaſſe ſe ſcripſerat*, *in* Anthropogeniæ Ichnographia.

The Ova, *after a 2d.* Conception, *diſperſed in the* Abdomen *of a Bitch, tho' the* Cornua Uteri *were Fill'd with the* Bones *and* Fleſh *of a* Former Conception; *by* ... n. 147. p. 183.

CXXIV. The Sagacious *Harvey*, after many repeated Diſſections of *Impregnated Deer* aſſerts, that nothing for about 6 or 7 *Weeks* can be ſeen in the *Horns* of their *Wombs*; that then there appeared ſomewhat like an *Egg*, a Tranſparent Liquor included in a very thin *Membrane*, in which after a *Week* he could plainly ſee the *Rudiments* of a *Fœtus*. He is well ſatisfy'd (after ſeveral Tryals) that no *Liquor* can be ſo Forcibly injected into the *Womb*, as to make its Paſſage into the Place of *Conception*: Nor would he ſuſpect that the *Seed* of the *Female* Lay till the *Egg* appear'd, in any *Crannies* or *Receſſes* of the *Horns*; which he aſſerts are then as Smooth and Soft, as the *Corpus Calloſum* of the *Brain*. After Dr. *Harvey* had thus ſufficiently Confuted the Opi-

nion

Fig. 248.

Fig. 250.

Fig. 249.

Fig. 251.

Fig. 252.

Fig. 257.

Fig. 260.

Fig. 261.

Fig. 262.

Fig. 258.

Fig. 259

Fig. 279.

Fig. 276.

Fig. 277.

Fig. 255.

Fig. 256.

Fig. 254.

Fig. 253.

Fig. 264.

Fig. 263.

Fig. 272.

Fig. 271.

Fig. 266.

Fig. 267.

Fig. 270.

Fig. 265

Fig. 269.

Fig. 268

Fig. 273.

Fig. 275.

Fig. 278.

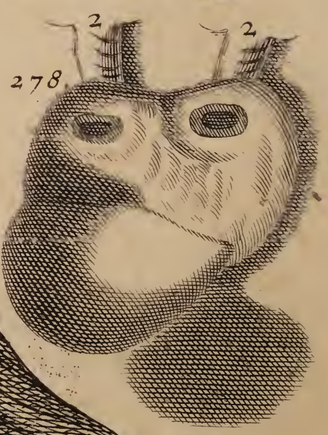

Fig. 274.

nion of the *Production of Animals* from the *Mixture* of the *Seminal* Matter of *Both Sexes*, 'twas not ſo Difficult to Diſcover, whence the *Egg* came, which he ſaw about 7 *Weeks* after *Impregnation*. The *Fallopian Tubes*, which joyn to the *Horns*, and Terminate very near the *Ovaria* (as the *Teſtes Muliebres* are generally now call'd) directed the ingenious and induſtrious *de Graff* to make more Accurate Diſſections of them: And he has ſo very Nicely Obſerv'd the Progreſs of the *Eggs* in *Conies*, the very time of their Paſſing into the *Tubes*, and appearing in the *Horns* of the *Womb*, (which comes very near that Proportion of Time Dr. *Harvey* obſerved the *Eggs* in his *Deer*) that the Opinion of the *Production* of all *Animals* from *Eggs* is now almoſt Univerſally Received.

Some time ſince indeed the Learned *Diemerbroeck*, and very lately M. *Verney*, have endeavoured to Confute this Opinion and Expoſe it. The moſt Conſiderable Argument they Uſe is taken from the *Narrowneſs* of the *Fallopian Tubes*, where they Open into the *Womb*, and at their Extremities. But Dr. *de Graff* Prevented this Objection, by alledging that the *Hole* by which it has its Exit out of the *Ovarium* is as *Narrow*; that no Force is uſed to Open it, but it Expands it ſelf, as the *Os Uteri* before the *Birth*: As *Nuts* and *Peach-Stones*, *&c.* give Way to the *Germinating Plant*, which is leſs able to make its way than the *Egg*. But beſides, (which theſe Authors urge,) tho' the Extremity of the *Tube* be *Membranous* in moſt *Quadrupeds*, in which its Poſſible a *Seminal Liquor* might be Tranſmitted to the *Womb*, in *Women* its *Divided*, like a *Knot* of *Ribbon*, and is no more Adapted to receive any thing but an *Egg*, than the Fingers Expanded to Receive and Contain a *Fluid*. The *Egg* has not been able ſometimes to get into the *Womb*; *Riolanus* ſpeaks of a *Humane Fœtus* ſeen in one of the *Tubes*: and Dr. *Harvey* aſſures you he has ſeen it himſelf.

Vid. inf. Vol. III. *Cap.* IV. §. CVIII. *&c.*

In the Diſſection of a *Bitch* at *Oxford* it was Obſerv'd, that the *Embryo's* either could not get into the *Womb*, the *Membranous Expanſion* being Hindred from aſcending to and Clipping the *Ovaria*, by the Fulneſs of the *Womb*, or from the ſame Cauſe were Forc't Back again. She had been with *Whelp*: by a Blow ſhe received the *Fœtus* Died within her. She Diſcharged by the *Pudendum* a great Quantity of Putrid Fleſh and Matter. She was afterward able to Run in the *Pack*. After the 2*d*. *Impregnation* ſhe was obſerved to have a very Ill Shap't Belly. When Dead the Owner, a Perſon of Quality, ſent her to *Oxford*. The *Horns* of the *Womb* were ſo Stuft up with the *Bones* and Firmer *Muſcles* and Thicker *Skin* of the *Fœtus*'s, (ſome of them lay in the Uſual Poſture, the *Sceletons* of which were Entire, the interſtices of the *Bones* only fill'd up with *Skin* and *Fleſh*,) that no *Seminal Matter*, or *Aura Seminalis*, could poſſibly find a Paſſage to the *Ovarium*. The *Eggs* Affected in the 2*d*. *Impregnation*, finding no Room in the *Horns*, were Forc't Back into the *Abdomen*: Where they were found Affixt to the *Meſentery*, *Kidney*, *&c.* Only *Two* of the *Bags* had a Communication with the *Womb* by a Slender *Duct*. Theſe *I* ſuppoſe fell into the *Horns* Firſt, and began to Faſten to them, but growing Larger were forc't to Retire: The other *Three* had no Reception there at all. The *Membranes* which Contained the *Embrio's*

were all of them very Thin, and the *Animalcles* in them had wanted a Due ſupply of *Nutritious* Matter. This ſeems to give as Clear a Proof of the Truth of the *Modern Opinion*, as can be Expected or Deſired.

But if *Anatomy* had not Diſcovered *Eggs*, and Demonſtrated their *Uſe*, and Progreſs to the *Womb*, it would be very Difficult to Conceive how an *Animal* could be Produced from the *Mixture* of the *Seminal Liquors* of *Both Sexes*. Every *Animal*, (tho' upon other Accounts eſteem'd the moſt Deſpicable,) is made up of ſo many Different Parts, and thoſe of ſo Excellent a Contrivance, and ſo Wonderful a reſpect to one another, that 'tis not to be Imagined, that the *Seminal Fluids* lying Looſe and at Large in the Capacity of the *Womb*, and Expoſed to ſo many Accidents, could give a *Production* ſo Admirable. Every Jog of it from the Frequent Motions of the *Female*, would Diſturb and Diſtract the Preſent Deſigns of the *Plaſtick Power* they ſpeak of. The *Humors* and *Vapours* which have a Paſſage to, and Humect all the Parts of the Body, would in the *Womb* break in on the Soft *Seminal Maſs*, and break off the Tender *Filaments* when firſt a forming. In *Quadrupeds* the *Periſtaltick Motion* of the *Horns* wou'd perpetually ſeparate the Parts of the *Seminal Collection*, and ſcatter thoſe Pieces, which *Nature* is putting carefully together into the Fabrick of an *Animal*. From this Way of *Conception*, *Monſters* would be very frequently brought forth, and would be much leſs Wondred at, than a Perfect Production is Now. Wee ſee how very induſtrious *Nature* is in Preſerving the *Species* of *Vegetables*. When the Tender *Seed* is firſt Formed, its ſecured from External injuries by Various ſorts of *Caſes*. The *Embrio* of the *Plant* contained in the *Seed* hath 3 or 4 *Coats* to Encloſe it; the Outermoſt is Deſign'd of ſufficient ſtrength to Preſerve it. None of the *Juices* of the *Earth* are Permitted to Enter in, but ſuch as are Fit to put into Motion, or ſupply the *Liquor* contained in the *Inner Membrane*, from whence it has its Firſt Encreaſe. And as the *Eggs* of *Animals* are Deſigned for the ſame Purpoſe the *Seeds* of *Vegetables* are, ſo there is very great Agreeableneſs between them. The *Shell* and *Membranes* of *Eggs* (except thoſe which are brought to Perfection in the *Female*) are very like thoſe of *Seeds*; both have a *Colliquamentum*, or more Fine and Spirituous *Liquor*, which is Firſt to be Spent before thoſe which are Groſſer can be Receiv'd in the Extremely Fine and Small *Pores* of the *Fœtus*, when only juſt Begun to be Formed; and in Both, the Parts of the *Embryo* are deſigned and drawn out, before the *Egg* has been at all Affected by the *Maſculine-Seed*, or the *Vegetable-Seed* put into the *Womb* of the *Earth*: The *Figure* of the *Plant* may be ſeen in the Larger *Seeds*, and *Miniature* of a *Chick* in the *Spot* of the *Yolk*.

But if ſo great and ſo Various an Artifice is neceſſary to Raiſe a *Plant*, ſhall *Nature* be thought Leſs Careful and induſtrious in the *Propagation* of *Animals*, whoſe Parts are more Numerous and of a much Finer Texture? And ſince thoſe *Animals* and *Vegetables* are by ſome Allowed to take their Original from *Eggs* and *Seeds*, whoſe Largeneſs will permit them to Obſerve them, it ſeems an Opinion with too much Precipitancy taken up, that ſup-

poſes

poſes ſome of the *Greater Animals*, and the *Leaſt* of *Theſe*, and *Plants*, are ſupplyed from *Equivocal Generation*; that *Corrupted Matter* from the *Warmth* of the *Air*, or the *Motions* of its *Own Principles*, can Form the Parts of the One or the Other. For the *Heat* of the *Air* endeavours to Diſſipate and Remove the Thinner Parts from the more Groſs; ſince no *Membrane* is ſuppoſed to Confine them: And the more *Active Principles* are from their Own Nature always ſtrugling to be quit of them: And this Way, the *Parts* of an *Animal* would be ſooner Broken into pieces, than a New one *Generated*.

But they believe it may allowed, that the *Leaſt* and moſt *Inconſiderable Animals* and *Plants*, are this way Formed. But their *Minuteneſs* makes the Difficulty Greater: A *Membrane* to include the *Conception* with its Firſt Nouriſhment ſeems more Neceſſary Here, where the Parts are more Delicately put together, and from their exceeding Fineneſs might more Eaſily Miſcarry. But if after this Method ſome *Animals* and *Plants* can be Produc'd, why is the ſame *Species* and theſe very *Individuals* they ſuppoſe ſo made, furniſh'd with *Organs* for *Univocal Generation*? If *Slime* and *Mud* can afford *Frogs* and *Eels*, why does the firſt *Spawn* ſo many *Eggs*, and are the other *Viviparous*? Why does not ſo great a Diverſity of Putrid Parts in the Earth, Differently Affected by unaccountable Accidents, often preſent us with *New Living Creatures*, and *Vegetables* of *Peculiar Species*? But no ſuch *New Plants* are taken Notice of; and the *Mites* are of the ſame ſort from *Cheeſe* and from *Meal*. The Objection which is offered againſt *Epicurus*, will be made with the ſame Force againſt This Opinion: If the *Earth* at Firſt *Equivocally* Produc'd *Men*, *Quadrupeds*, *Birds*, and *Fiſh*, why has it not done it very frequently or at leaſt ſome Times ſince? We begin to Suſpect the *Cheat*, when the Artiſt is not Able to Perform the ſame Again.

CXXV. 1. Upon comparing the Obſervations and Diſcoveries of Dr. *Harvey*, S. *Malpighi*, Dr. *de Graaf* and M. *Leewenhoeck*, with one another, theſe *Three* things ſeem to me very Probable. 1. That *Animals* are *ex Animalculo*. 2. That the *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 Modern Theory *of* Generation; *by Dr.* Geo. Garden. n. 192. p. 474.

The *Firſt* of theſe ſeems Probable from theſe 3 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 *Fœtus* were both *Formed* 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 30 *Hours*, are to be ſeen the *Head*, the *Eyes*, and the *Carina*, with the *Vertebræ*, diſtinct, and the *Heart*. After 40 *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 *Fœtus*, by the *Microſcope*, is not the Diſcerning of Parts newly Formed, but only more Dilated and Extended by receiving of *Nutriment* 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 *Tranſmutation* of *Inſects*, gives no ſmall Light to this, whilſt he makes appear in the *Explanation* of the 13*th 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 *Transformed* into *Aurelias*, and Plunged often in Warm Water to make a Rupture of the *Outer Skin*, you will diſcern through 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 *Changed* into an *Aurelia*, none of theſe *Parts* can be Diſcerned, they are ſo drencht with Moiſture, though they be there Actually *Formed*.

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 *Joints* and *Plicatures*, which are afterwards Enlarged, and Diſtended, as we ſee in *Plants*. Now though this Conſideration alone may ſeem not to bear much weight, yet being Joined 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 *Formed* 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 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

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 *Animalcles* are Originally *in Semine Marium & non in Fœminis*: And this *I* Collect from theſe Conſiderations.

1. That there are Innumerable *Animalcula in Semine Maſculo Omnium Animalium.* M. *Leewenhoeck* has made this ſo Evident by ſo many Obſervations, that *I* do not in the leaſt Queſtion the Truth of the thing.

2. The Obſerving of the *Rudiments* of the *Fœtus* in *Eggs*, which have been *Fœcundated* by the *Male*, and the ſeeing no ſuch thing in thoſe which are not *Fœcundated*, as appears from *Malpighius* his Obſervations, makes it very Probable, that theſe *Rudiments* proceeded Originally from the *Male*, and not from the *Female*.

3. The Reſemblance between the *Rudiments* of the *Fœtus 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 M. *Leewenhoeck* gives us of the *Animalcule*; *Malpighius* likewiſe gives us of the *Rudiments* of the *Fœtus*, both before and after *Incubation*; yea, and even the *Fœtus'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 Fœtus's* at *One Birth*, eſpecially that of the Counteſs of *Holland*, and how at leaſt a Whole *Cluſter* of *Eggs* in a *Hen* are *fœcundated* 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 mention'd, 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 it ſelf*; and we may rationally conjecture ſome ſuch *Analogy* in the *Propagation of Animals*.

The 3*d.* particular which Later Diſcoveries make Probable is, that *Animals* cannot be *Formed* 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 *One 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 Proportioned to their Bulk, that it can hardly contain more than

One

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 *Vivipara* 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 termed an *Uterus* 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 *Animalcle* cannot *come forward* without ſome ſuch proper *Nidus*, M. *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*, at leaſt whilſt ſcatter'd in ſo Large a Field.

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 26 *Years* in the *Woman* of *Tholouſe's Belly*; and the *Little Fœtus* found in the *Abdomen* of *Mad. de S. Mere*, together with the *Teſticle* Torn and full of Clotted Blood; ſuch alſo ſeem to be the *Fœtus* in the *Abdomen* of the Woman of *Copenhagen*, mentioned in the *Nouvelles des Lettres*, for *Sept.* 85. 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 4 *Years*: And the 7 *Years Gravidation* related by Dr. *Cole*. Now granting 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 though 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 Fœmineis*; 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*.

Vid. Inf. Vol. III. *cap.* IV. §. CXIII. *&* CIX.

Vid. Inf. Vol. III. *Cap.* IV. §. CXVII.

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 *Animalcle's 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

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 Formed *ex Animalculis* without the *Ova in Fœminis*. 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 *Testicles*, and this will Determine whether they be absolutely Necessary for the *Formation* of *Animals*.

It is indeed Difficult to Conceive, how these *Eggs* should be *Impregnated per Semen Maris*, both because there is no *Connexion* between the *Tube* and the *Ovary* for its Transmission; and for that Dr. *Harvey* could never Discover any thing of it *in Utero*. But as to the last, M. *Leewenhoeck* has Cleared that Difficulty, by the Discovery of Innumerable *Animalcula Seminis Maris in Cornubus Uteri*, and those Living a considerable time after *Coition*. 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 through 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, M, *Leewenhoeck* to weaken this Consideration, about the *Conception's* n. 174. p. 1129.
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 M. *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 *fastened* 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 Changed after having Cast an outer Skin, but is rather

rather the *Cicatricula*, or little *Egg*, into which the *Animalcle* has Entered as its *Punctum*, 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.

By Sir J. Floyer. n. 259. p. 433.

2. *I* have oft Reflected on the Figure of a *Mule*, that being an *Animal* Produced by the *Copulation* of an *Aſs* and a *Mare*, the *Extremities* of the Body, the *Feet*, *Tail* and *Ears*, and that *Black-Croſs* on the *Back* Reſemble that of the Aſſes. By this we may Obſerve, that the *Female* contains in her *Eggs* the Firſt Rudiments of the *Animal* of her Own *Species*, and that the *Impregnation* only Changes ſome of the *Extremities* into a Reſemblance of the *Male*. This ſeems to Contradict our New Diſcoveries: For if the *Male* ſupplies the *Animalculum*, the *Fœtus* muſt always be of the ſame *Species* as the *Male*; if the *Female* ſupplies it, of Her *Kind*; whereas *Monſters* are Obſerv'd to be a *Mixture* of *Both Species*.

CXXVI. Papers *of Leſs General Uſe*, Omitted.

n. 77. p. 3004. 1. QUæries concerning *Vegetable Excreſcencies*, and the *Inſects* Bred in them; *by Dr.* Liſter.

n. 249. p. 50. 2. Several *Inſects* found near *Colcheſter*; by Mr. *Dale*.

n. 8. p. 137. 3. Prodigious *Swarms* of *Locuſts* in *Ukrania*: Extracted from M. *de Beauplan's Deſcription of the Countries of Poland*, and M. *Thevenot's Voyages. pt.* 1.

n. 72. p. 2171. 4. Some General *Inquiries* concerning *Spiders*; by Dr. *Mart. Liſter*.

n. 77. p. 3002. 5. *Quæries* concerning *Tarantula's*; by Dr. *M. Liſter*.

n. 105. p. 96,99. 6. Some *General Quæries* concerning *Land* and *Freſh Water Snails*: And Part of a *Table* of them, with their *Figures*; by Dr. *M. Liſter*.

n. 222. p. 322. 7. An Account of ſeveral Rare and Curious *Shells* to be met with in *Scotland*; by Sir *Rob. Sibbald*.

n. 100. p. 7002. 8. To Prevent the *Rot* of *Sheep*, by giving them *Spaniſh Salt*; Extracted from Mr. *Boyle's Uſefulneſs of Experimental Philoſophy. Tom.* 2 *p.* 15.

n. 103. p. 50. 9. *Inquiries* and *Directions* concerning *Sheep*; to Preſerve them; and to improve the *Race* of *Sheep* for *Hardineſs*, and for the *Fineſt Drapery*; by Dr. *J. Beale*.

CXXVII. *Accounts of Books*, Omitted.

n. 28. p. 535. n. 64. p. 2078. n. 76. p. 2281. 1. HIſtoriæ Generalis *Inſectorum*, *J. Swammerdami*, Pars Prima. *Ultraject.* 1669. 4°.

2. Johannes

2. Johannes Goedartius of *Insects*, Done into *English*, and Methodiz'd: with the Addition of *Notes*; by *Mart. Lister* Esqr. 1682. *in* 4°. n. 143. p. 22.

Joh. Goedartius de *Insectis*: cum Appendice ad *Historiam Animalium Angliæ*; a *Mart. Lister*. M. D. n. 166. p. 833.

3. *Marc. Malpighii* Dissertatio Epistolica de *Bombyce*; *Regiæ Societati* Dicata *Lond. in* 4°. n. 49. p. 987.

4. *Instructions* for the *Planting* of *White Mulberries*; the *Breeding* of *Silk Worms*; and the *Ordering* of *Silk* in *Paris*, and the Circumjacent Parts; by M. *Isnard*. n. 5. p. 87.

5 Experienze Intorno alla *Generatione* Degl' *Insetti*; fatte da *Francisco Redi*, Academico della *Crusca*. In *Firenze*. 1668. in 4° *The Opinion of that* Author *concerning the* Generation *of* Insects *is here Opposed by Dr.* M. Lister. n. 57. p. 1175. n. 75. p. 2254.

6. Ricreatione dell *Occhio* é della *Mente*, Nell' Offervation delle *Chiocciole*; dal P. *Filippo Buonanni. &c.* in *Roma*. 1681. n. 156. p. 507.

7. Relatione del Ritrovamento dell' *Uova* delle *Chiocciole*; di A. F. M. in una Littera al S. *Marcello Malpighi*. in *Bologna*. 1683. n. 152. p. 356.

8. Dr. *Kormannus*, concerning the *Tinctures* of the *Excrements* of *Insects*. n. 74. p. 2218.

9 *Swammerdam's* M S. Treatise *de Apibus*; *'tis Fear'd to be Lost by Dr. Hotton.* n. 257. p. 365.

10. *Mart. Lister* Historiæ Animalium *Angliæ* Tres Tractatus; Unus *de Araneis*; Alter de *Cochleis* tum *Terrestribus*, tum *Fluviatilibus*; Tertius de *Cochleis Marinis*. Quibus adjectus est Quartus, de *Lapidibus* ejusdem *Insulæ*, ad *Cochlearum* quandam *Imaginem Figuratis*. *Lond.* 1678. n. 139. p 982.

11. *Mart. Lister* Exercitatio Anatomica, in qua de *Cochleis* maxime *Terrestribus*, & *Limacibus* agitur. Omnium *Dissectiones Tabulis Æneis*, ad ipsas Res a Fabre Incisis, illustrantur. Cui accedunt Digressiones de *Respiratione*, *Generatione Androgynâ*, *Sæpia*, *Loligine*, & *Polypo*, aliisque Rebus Naturalibus. 1694. *in* 8°. n. 208. p. 65.

12. *W. Sengwerdius* Ph. D. de *Tarantula*. In quo, præter ejus Descriptionem, Effectus *Veneni Tarantulæ*, qui hactenus fuere *Occultis Qualitatibus* adscripti, Rationibus Naturalibus deducuntur, & illustrantur. *Lugd. Bat.* 1668. *in* 12°. n. 34. p. 660.

13. A Dissertation of *Vipers*; by S. *Redi*. n. 8. p. 145. n. 9. p. 160.

14 *Nouvelles Experiences* sur la *Vipre*; par M. *Charas*. a *Paris*. 1669. *in* 8°. n. 54. p. 1091.

Lettera di *Francesco Redi* sopra alcune *Oppositioni* fatte alle sue *Observationi Intorno* alle *Vipre*. In *Firenze*. 1670. 4°. n. 66. p. 2036.

Suite des *Novelles Experiences* sur la *Vipre*: avec un Dissertation sur son *Venine*; par *Moyse Charas*, a *Paris*. 1671. *in* 8°. n. 83. p. 4073.

A Letter of *Francesco Redi* concerning some Objections made upon his *Observations* about *Vipers*; together with a *Reply* to that Letter by *Moyse Charas*. *Lond.* 1672. *in* 8°. n. 87. p. 5082.

15. Recherches & Observations sur les *Vipres*; faites par M. *Bourdelot*. a *Paris*. *in* 12. n. 77. p. 3013.

n. 178. p. 1301. 16. *Franc. Willoughbeii* Armig. de *Hiſtoria Piſcium* Libri Quatuor Juſſu & Sumptu *Societatis Regiæ Lond.* Editi Totum Opus Recognovit, Coaptavit, Supplevit, Librum etiam *Primum* & *Secundum* Integros adjecit *Joh. Raius. è Soc. Regia. Oxon.* 1686.

Ph. Coll. n. 1. p. 42. 17. Oſſervationi Intorno alle *Torpedini*, fatte da *Stephano Lorenzini Fiorentino.* in *Firenze.* 1678.

n. 28. p. 535. 18. Obſervations faites ſur un *Grand Poiſſon*, & un *Lion*, Diſſeques dans la *Bibliotheque du Roy* a *Paris*, le 24. & le 28. *Juin.* 1667.

n. 205. p. 972. 19 *Phalænologia* Nova; ſive Obſervationes de Rarioribus quibuſdam *Balænis*, in *Scotiæ* Littus nuper Ejectis. Auth. *Rob. Sibbald. Edinb.* 1692. *in* 4°.

Ph. Coll. n. 2. p. 37. 20. *Phocæna*; or the Anatomy of a *Porpeſs*, Diſſected at *Greſham College*: With a Preliminary Diſcourſe concerning *Anatomy* and a *Natural Hiſtory* of *Animals*; by *Edw. Tyſon.* M. D. *Lond.* 1681.

n. 239. p. 125. 21. *Opianus's Halienticks.* Gr. *Part of that Excellent* Poem, *Deſcribing the* Philoſtorgia *of* Fiſhes, *is Here Turned into* Engliſh Verſe.

n. 120. p. 481. 22 *Franciſci Willughbei* de *Middleton* Armigeri, è *Reg. Soc. Ornithologiæ* Libri Tres, in quibus *Aves* omnes hactenus Cognitæ, in Methodum Naturis ſuis convenientem Redactæ, accurate Deſcribuntur: Deſcriptiones *Iconibus* Elegantiſſimis, & *Vivarum Avium* Simillimis, Æri Inciſis Illuſtrantur. Totum Opus Recognovit, Digeſſit, Supplevit, *Joh.* n. 175. p. 1159. *Raius. Lond.* 1676, *in Fol. Some few Notes about* Birds *are here added by Dr.* M. Liſter.

n. 50. p. 1021. 23. *Th. Bartholini* Diſſertatio de *Cygni* Anatome; nunc aucta à *Caſp. Bartholino F. Hafniæ.* 1668. *in* 8°.

n. 202. p. 849. 24. Synopſis Methodica *Animalium Quadrupedum* & *Serpentini Generis.* Auth. *Joh Raio* S. R. S. *Lond.* 1693. *in* 8°.

n. 49. p. 991. n. 124. p. 591. n. 189. p. 371. 25. Memoires pour Servir à *l Hiſtoire Naturelle* des *Animaux.* a *Paris.* 1671. *in Fol.* The ſame in *Engliſh* containing the *Anatomical* Deſcriptions of ſeveral Creatures Diſſected by the *Royal Academie* of *Sciences* at *Paris*; by *Alex. Pitfield.* Eſqr. *Lond.* 1687. *in Fol.*

n. 263. p. 571. 26. *Godefredi Bidloo* Obſervatio de *Animalculis* in *Ovino* Aliorumque *Animantium* Hepate detectis. *Lugd Bat.* 1698. *in* 4°.

n. 8. p. 145. 27. The *Anatomy* of a *Lyon*; by S. *Redi.*

n. 39. p. 787. 28 *Elaphographia*; ſive *Cervi* Deſcriptio Phyſico Medico-Chymica. Auth. *Jo. Andrea Graba.* M. D. *Jenæ.* 1668 *in* 8°.

n. 51. p. 1034. 29 Diſcours de M. *Stenon*, ſur *l'Anatomie* du *Cerveau.* a *Paris.* 1669. *in* 12°.

n. 177. p. 1249. 30. *Caſtorologia*, à *Jo. Mario*; aucta à *Joh. Franco. Aug. Vindel.* 1685. *in* 8°.

n. 256. p. 338. 31. *Orang Outang*; ſive *Homo Sylveſtris*: Or the *Anatomy* of a *Pigmie*, Compared with that of a *Monkey*, an *Ape*, and a *Man*: To which is Added a Philological Eſſay concerning the *Pigmies*, the Cynocephali, the

the *Satyrs*, and *Sphinges*, of the *Ancients*; by *Edw. Tyson.* M. D. *Lond.* 1699. *in* 4.

32. *Marc. Malpighii*, Phil. & Med. *Bononienſis*, Diſſertatio Epiſtolica de *Formatione Pulli* in *Ovo. Lond.* 1672. *in* 4°. n. 87. p. 5079.

33. *Nicolai Stenonis* de *Muſculis* & *Glandulis* Obſervationum Specimen; cum Duabus *Epiſtolis Anatomicis.* n. 10. p. 176.

34. *Benjamini à Brookhuyſen Æconomia Animalis.* 1683. *in* 4°. n. 147. p. 194.

35. Explication Nouvelle & Mechanique des *Actions Animales*: ou il eſt Traite des *Fonctions* de l'*Ame*, *&c.* par M. *Duncan* M. D. a *Paris.* 1678. *in* 12°. n. 140. p. 1013.

36. *Joh. Alphonſi Borellii Neapol.* Math. Profeſs. Opus Poſthumum, De *Motu Animalium. Romæ.* 1680. & 1681. *Ph. Col.* n. 2. p. 35.

37. De *Anima Brutorum* Exercitationes duæ: Prior *Phyſiologica*, altera *Pathologica* Auth *Tho. Willis.* M D. *Oxon.* 1672 in 4°. n. 144. p. 62. n. 83. p. 4071.

38 Le Diſcernement du *Corps* & de l'*Ame*; par M. *de Cordemoy.* n. 17. p. 306.

39 Tractatus de *Natura Subſtantiæ Energetica*; ſeu de *Vita Naturæ*, ejuſque Tribus Primis Facultatibus, *Perceptiva*, *Appetitiva*, *Motiva*, *&c.* Auth. *Franc. Gliſſonio.* M. D. *Lond.* 1672 *in* 4°. n. 87. p. 5076.

40. Diſcours de la *Conoiſſance* des *Beſtes*; par le *Ignace Gaſton Pardies.* S J. a *Paris.* 1672. *in* 12°. n. 82. p. 4054.

41. *Antonii Le Grand* Diſſertatio de *Carentia Senſus* & *Cognitionis* in *Brutis. Lond.* 1671. n. 112. p. 282.

42. De *Mente Humana*, Libri 4, *&c.* Auth. *J. B. du Hamel. Paris.* 1672. *in* 12°. n. 87. p. 5081.

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