Pla. XV. *Vol. IX. part 3. pa. 264.*

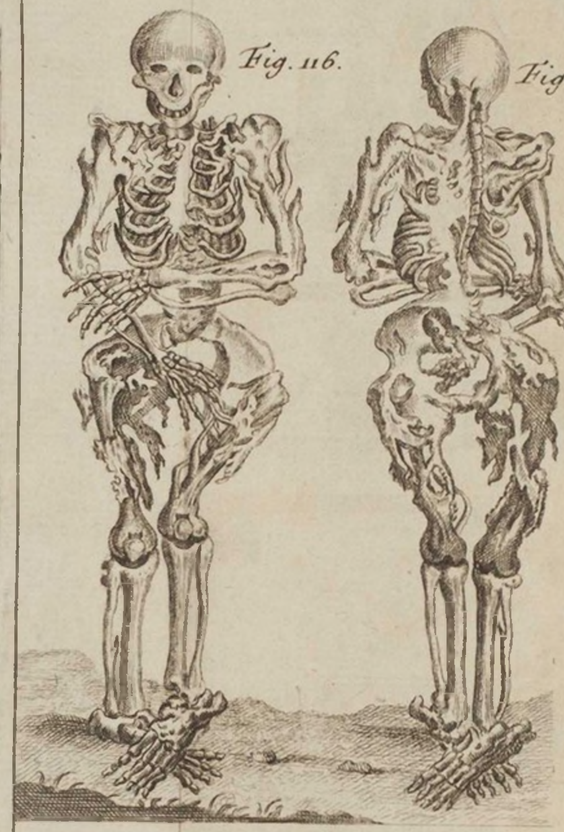


Fig. 116.

Fig. 117.

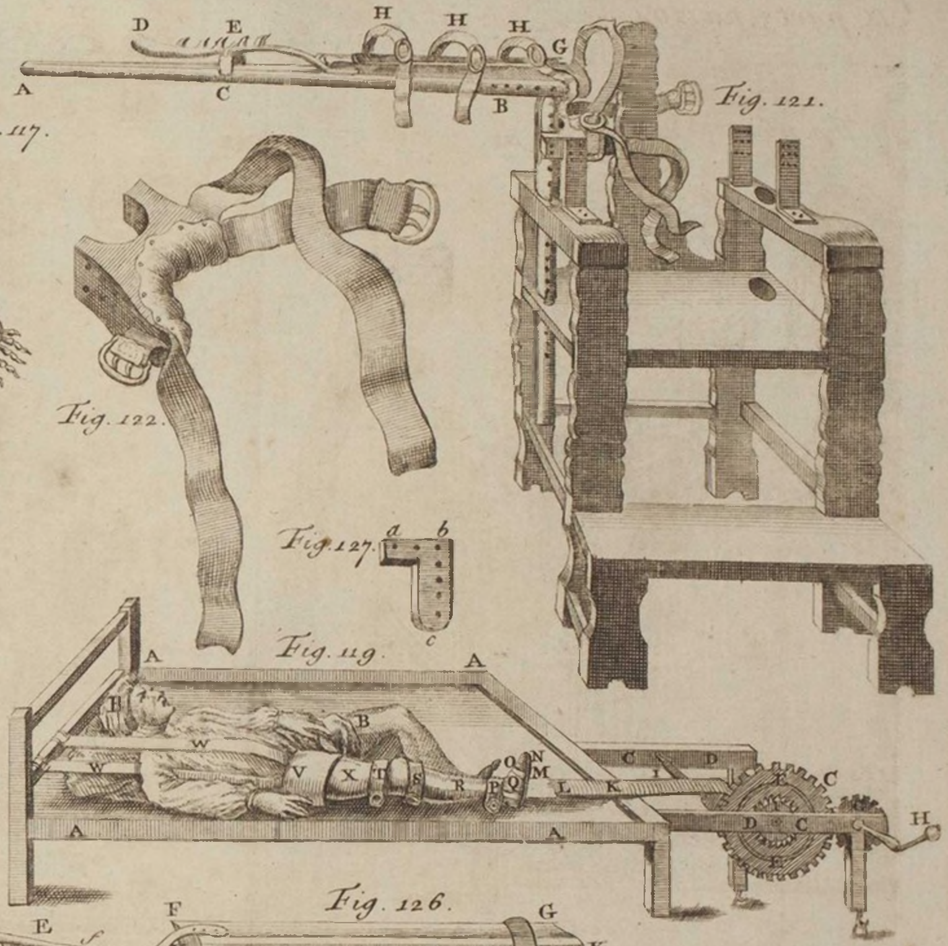


Fig. 121.

Fig. 122.

Fig. 127.

Fig. 119.

Fig. 126.

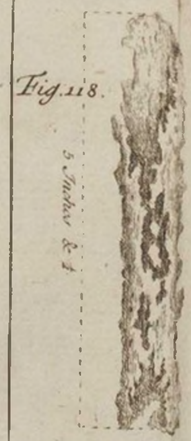


Fig. 120.

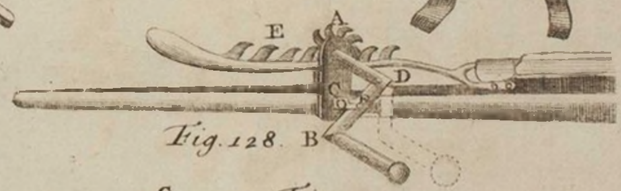


Fig. 128.

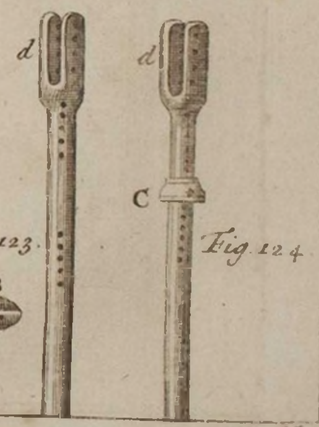


Fig. 123.

Fig. 124.

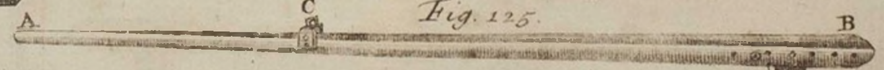
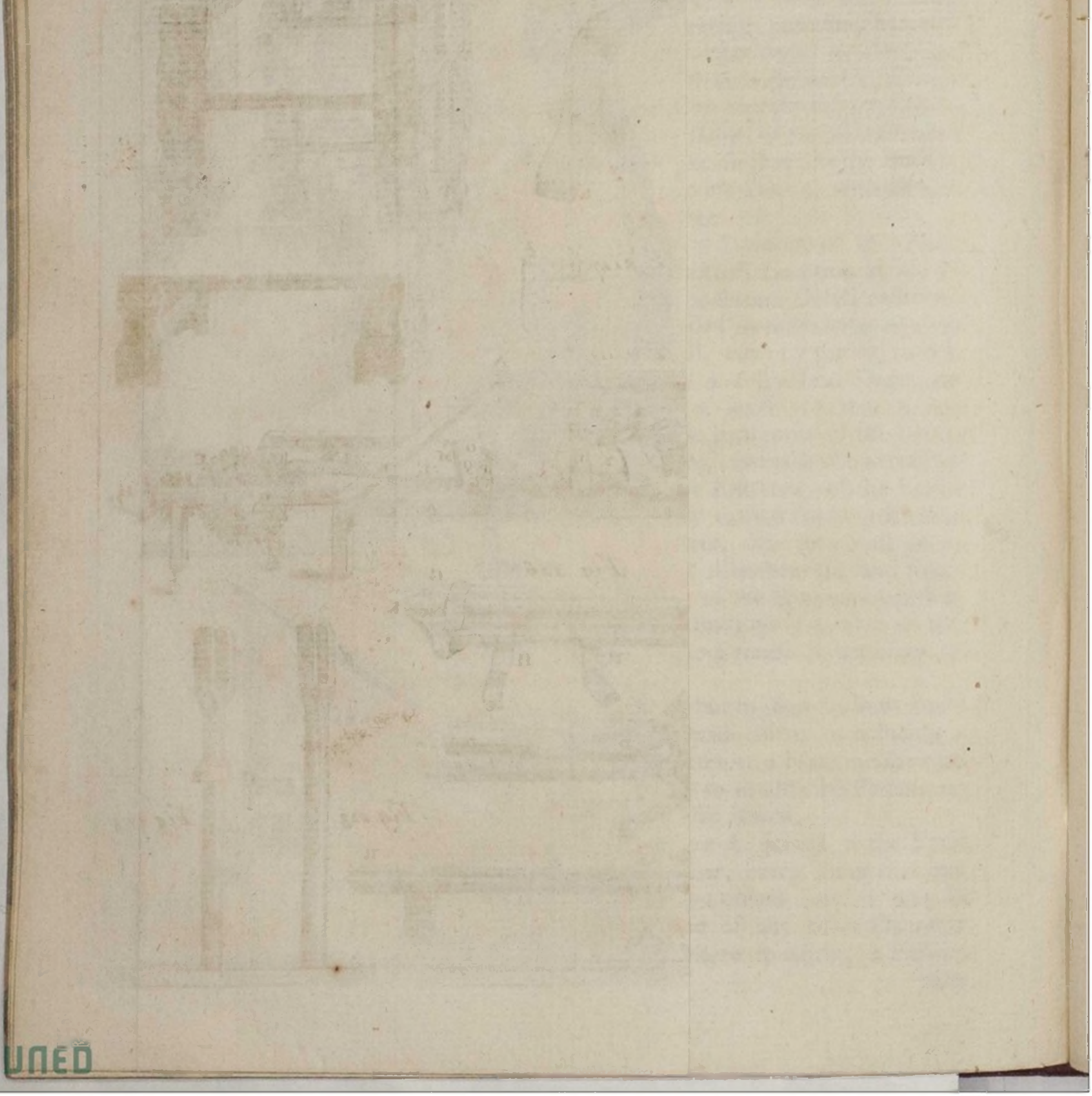


Fig. 125.

A Scale of Feet for Fig. 121.



may be ſet down, the Inſtrument applied, and the Shoulder reduced, in one Minute, ordinarily ſpeaking.

The Length of this Inſtrument, when ſhut up, is 1 Foot, 8 Inches, it's Breadth 9 Inches, and Thickneſs 3½ Inches. When it is opened, it is kept ſo by 2 Hooks fixed on the Backſide of it; and when one End of it ſtands on the Ground, the other ſtands high enough to become a *Fulcrum*, or Support of a Lever B B, which is fixed on a Roller *b*, by a large Wood Screw, which turning ſideways, as well as with the Roller, it obtains a circumrotatory Motion, ſo that it will ſerve to reduce a Luxation either backward, forward, or downward.

The Roller on which the Lever is fixed, is juſt the Diameter of the Depth of one of the Boxes, into which are driven 2 Iron Pins, the Ends of which are received by the 2 Sides of the Box, which are an Inch thick.

The Lever is 2 Foot 4 Inches, and is cut off and joined again by 2 Hinges C, to fold up ſo as to be contained in the Boxes. On the Backſide of it is a Hook, to keep it ſtrait; the other End of it is to hang over the Roller about an Inch and half, which is to be excavated and covered with Buff Leather, for the more eaſy Reception of the Head of the *Os Humeri*.

Two Iron Cheeks D D are ſkrewed on each Side of the Lever, to receive through them an Iron Roller E, which has two Holes through it, to receive 2 Cords coming from a Brace F, fixed on the lower Head of the *Os Humeri*: for on no other Part of the Arm above the Cubit can a Bandage for this Purpoſe be uſeful; for if the Surgeon applies it on the muſcular Part of the Arm, it never fails ſlipping down to the Joint, before you can extend the Limb.

The Iron Roller has a ſquare End, on which is fixed a Wheel G, within the Cheek, notched round, which works as a Rotchet on a Spring-Ketch underneath the Lever, by which it is ſtopped, as you wind it with a Winch; and may at Pleaſure be let looſe, as there ſhall be Occaſion for it, by diſcharging the Ketch.

I come now to deſcribe the Brace F, which, compared with common Bandages, is of more Conſequence than can eaſily be imagined by unexperienced Perſons. It conſiſts of a large Piece of Buff-Leather, big enough to embrace the Arm, ſewed on two Pieces of ſtrong Iron curved Plates, riveted together, one of them having an Eye at each End, to faſten 2 Cords in; the other is bent at the Ends into 2 Hooks, which are to receive the Cords, after they have croſſed over the Arm above.

In order to keep the Patient ſteady in his Chair from coming forward, or letting the *Scapula* riſe up, on depreſſing the Lever, after the Limb is drawn forward by the Winch, there muſt be fixed over the Shoulder a Girth with 2 Hooks at the Ends of it, long enough to reach to the Ground on the other Side, where it muſt be hooked into a Ring I, to be ſkrewed into the Floor, for that Purpoſe.

An Account of the Man *whoſe Arm with the Shoulder-blade was torn off by a* Mill, Aug. 15, 1737, *by Mr* John Belchier, *F.R.S. Surgeon to Guy's Hoſpital.* No. 449. p. 313. Aug. &c. 1738. *Dated* Nov. 17, 1737.

IX. *Samuel Wood*, about 26 Years of Age, Servant to Mr *Felton*, being at Work in one of the Mills near the *Iſle of Dogs*, over-againſt *Deptford*, and going to fetch a Sack of Corn from the further Part of the Mill, in order to convey it up into the Hopper, careleſsly took with him a Rope, at the End of which was a Slip-knot, which he had put round his Wriſt; and paſſing by one of the large Wheels, the Cogs of it caught hold of the Rope, and he not being able to diſengage his Hand inſtantly, was drawn towards the Wheel, and raiſed off the Ground, till his Body being checked by the Beam which ſupports the Axis of the Wheel, his Arm with the Shoulder-blade was ſeparated from it.

At the time the Accident happened, he ſays, he was not ſenſible of any Pain, but only felt a tingling about the Wound, and being a good deal ſurprized, did not know that his Arm was torn off, till he ſaw it in the Wheel: When he was a little recovered, he came down a narrow Ladder to the firſt Floor of the Mill, where his Brother was, who ſeeing his Condition, ran down Stairs immediately out of the Mill to a Houſe adjacent to the next Mill, which is about 100 Yards diſtant from the Place where the Accident happened, and alarmed the Inhabitants with what had happened to his Brother; but before they could get out of the Houſe to his Aſſiſtance, the poor Man had walked by himſelf to within about ten Yards of the Houſe, where, being quite ſpent by the great Effuſion of Blood, he fainted away, and lay on the Ground; they immediately took him up, and carried him into the Houſe, and ſtrewed a large Quantity of Loaf-Sugar powdered into the Wound, in order to choak the Blood, till they could have the Aſſiſtance of a Surgeon, whom they ſent inſtantly for to *Limehouſe*; but the Meſſenger being very much frighted, could not give the Surgeon a clear Idea of the Accident, ſo that when he came to ſee the Condition the Man was in, he had no Dreſſings with him for an Accident of that kind; but had brought with him an Apparatus for a broken Arm, which he underſtood by what he could learn from the Meſſenger to be the Caſe; however, he ſent home for proper Dreſſings, and when he came to examine particularly into the Wound, in order to ſecure the large Blood-Veſſels, there was not the leaſt Appearance of any, nor any Effuſion of Blood; ſo having firſt brought the fleſhy Parts of the Wound as near together as he could by means of a Needle and Ligature, he dreſſed him up with a warm Digeſtive, and applied a proper Bandage: The next Morning he opened the Wound again, in Company with two Surgeons more; and not perceiving any Effuſion of Blood at that time, he dreſſed him as before, and ſent him in the Afternoon to St *Thomas's Hoſpital*, where he was admitted a Patient under the Care of Mr *Ferne*; from which Time he was conſtantly attended, in Expectation of a Hemorrhage of Blood from the Subclavian Artery; but there being no Appearance of freſh Bleeding, it was not thought proper to remove the Dreſſings during the Space of 4 Days, when Mr *Ferne* opened the Wound, at which Time likewiſe there was not the leaſt Appearance of

any

any Blood-Vessels; so he dressed him up again, and in about 2 Months time the Cure was entirely completed.

Upon examining the Arm within a Day or 2 after it was separated from the Body, I found the *Scapula* fractured transversly, as were likewise the *Radius* and *Ulna* in two Places: But whether these Bones were fractured before the Arm was torn off, the Man cannot possibly judge.

The Muscles inserted into the *Scapula* were broken off near their Insertions, but the Muscles arising from the *Scapula* came away with it entire.

The *Latissimus Dorsi* and *Pectoralis*, were likewise broken off near their Insertions into the *Os Humeri*.

The Integuments of the *Scapula*, and upper Part of the Arm, were left on the Body, as also the Clavicle.

But what is very surprizing, the Subclavian Artery, which could never be got at to be secured by Art, did not bleed at all after the first Dressing; the Artery being separated so happily, and when the Coats of it were contracted, the fleshy Parts pressed against the Mouth of it, and prevented any Effusion of Blood.

As this Case is very singular, and so remarkable, that no History can furnish us with any Instance similar to it, in order to give a particular Account of it, besides visiting the Man frequently, from his first Admittance into the Hospital, and getting from him what Information he was capable of giving me, I went myself two Days ago to the Mill, where the Accident happened, and inquired into every particular Circumstance relating to the Fact, of Mr *Felton*, with whom the Man worked, the Woman of the House where the Man was carried into, and the Surgeon that dressed him, who all certified to me what is above related.

Of the Structure and Diseases of articulating Cartilages, by Mr Will. Hunter, Surgeon. No. 470. p. 514. *Read* June 2, 1743.

X. An articulating Cartilage is an elastic Substance uniformly compact, of a white Colour, and somewhat diaphanous, having a smooth polished Surface covered with a Membrane, harder and more brittle than a Ligament, softer and more pliable than a Bone.

When an articulating Cartilage is well prepared, it feels soft, yields to the Touch, but restores itself to it's former Equality of Surface when the Pressure is taken off. This Surface, when viewed through a Glass, appears like a Piece of Velvet. If we endeavour to peel the Cartilage off in *Lamellæ*, we find it impracticable; but, if we use a certain Degree of Force, it separates from the Bone in small Parcels; and we never find the Edge of the remaining Part oblique, but always perpendicular to the subjacent Surface of the Bone. If we view this Edge through a Glass, it appears like the Edge of Velvet; a Mass of short and nearly parallel Fibres rising from the Bone, and terminating at the external Surface of the Cartilage: And the Bone itself is planned out into small circular Dimples, where the little Bundles of the cartilaginous Fibres were fixed. Thus we may compare the Texture of a Cartilage to the Pile of Velvet, it's Fibres rising up from the Bone, as

the silky Threads of that rise from the woven Cloth or *Basis*. In both Substances the short Threads sink and bend in Waves upon being compressed; but, by the Power of Elasticity, recover their perpendicular Bearing, as soon as they are no longer subjected to a compressing Force. If another Comparison was necessary, we might instance the Flower of any corymbiferous Plant, where the *Flosculi* and *Stamina* represent the little Bundles of cartilaginous Fibres; and the *Calyx*, upon which they are planted, bears Analogy to the Bone.

Now these perpendicular Fibres make the greatest Part of the cartilaginous Substance; but without doubt, there are likewise transverse Fibrils which connect them, and make the whole a solid Body, though these last are not easily seen, because being very tender, they are destroyed in preparing the Cartilage.

We are told by Anatomists, that Cartilages are covered with a Membrane named *Perichondrium*. If they mean the Cartilages of the Ribs, *Larynx*, Ear, *&c.* there, indeed, such a Membrane is very conspicuous; but the *Perichondrium* of the smooth articulating Cartilages is so fine, and firmly braced upon the Surface, that there is room to doubt whether it has been often demonstrated, or rightly understood. This Membrane, however, I have raised in pretty large Pieces after macerating; and find it to be a Continuation of that fine, smooth Membrane that lines the capsular Ligament, folded over the End of the Bone from where that Ligament is inserted. On the Neck of the Bone, or between the Insertion of the Ligament, and Border of the Cartilage, it is very conspicuous, and may be pulled up with a Pair of Pincers; but where it covers the Cartilage, it coheres to it so closely, that it is not to be traced in the recent Subject without great Care and Delicacy. In this Particular it resembles that Membrane which is common to the Eye-lids and the Fore-part of the Eye-ball, and which is loosely connected with the *Albuginea*, but strongly attached to the *Cornea*.

From this Description it is plain, that every Joint is invested with a Membrane, which forms a complete Bag, and gives a Covering to every thing within the Articulation, in the same manner as the *Peritonæum* invests not only the *Parietes*, but the Contents of the *Abdomen*.

The Blood-Vessels are so small, that they do not admit the red Globules of the Blood; so that they remained in a great measure unknown till the Art of filling the vascular System with a liquid Wax brought them to Light. Nor even by this Method are we able, in adult Subjects, to demonstrate the Vessels of the true cartilaginous Substance; the Fat, Glands, and Ligaments, shall be red with injected Vessels, while not one coloured Speck appears upon the Cartilage itself. In very young Subjects, after a subtle Injection, they are very obvious; and I have found their Course to be as follows: All round the Neck of the Bone, there are a great Number of Arteries and Veins, which ramify into smaller Branches, and communicate with one another by frequent

Anasto-

Anastomoses, like those of the Mesentery. This might be called the *Circulus Articuli Vasculosus*, the vascular Border of the Joint. The small Branches divide into still smaller ones upon the adjoining Surface, in their Progress towards the Centre of the Cartilage. We are very seldom able to trace them into it's Substance, because they terminate abruptly at the Edge of the Cartilage, like the Vessels on the *Albuginea Oculi*, when they come to the *Cornea*. The larger Vessels, which compose the vascular Circle, plunge in by a great Number of small Holes, and disperse themselves into Branches between the Cartilage and Bone. From these again there arises a Crop of small short Twigs, that shoot towards the outer Surface; and whether they serve for nourishing only, or if they pour out a dewy Fluid, I shall not pretend to determine. However that be, I cannot help observing, that the Distribution of the Blood-Vessels to the articulating Cartilages is very peculiar, and seems calculated for obviating great Inconveniences. Had they run on the outer Surface, the Pressure and Motion of the two Cartilages must infallibly have occasioned frequent Obstructions, Inflammations, *&c.* which would soon have rendered our Motions painful, and at last entirely deprived us of them. But by creeping round the cartilaginous Brim, where there is little Friction, or under the Cartilage, where there is none, they are perfectly well defended from such Accidents.

It were to be wished, we could trace the Nerves of Cartilages: But, in relation to these Organs, here, as in many other Parts of the Body, we are under a Necessity, from the Imperfection of our Senses, of being satisfied with mere Conjecture. And though, from the great Insensibility of a Cartilage, some have doubted of it's being furnished with Nerves; yet, as it is generally allowed, that these are a *sine qua non* in the Growth and Nourishment of Animals, we have no sufficient Reason to deny their Existence in this particular Part. With regard to the manner of their Distribution, we may presume, from Analogy, that they follow the same Course with the Blood-Vessels.

The articulating Cartilages are most happily contrived to all Purposes of Motion in those Parts. By their uniform Surface, they move upon one another with Ease: By their soft, smooth, and slippery Surface, mutual Abrasion is prevented: By their Flexibility, the contiguous Surfaces are constantly adapted to each other, and the Friction diffused equally over the whole: By their Elasticy, the Violence of any Shock, which may happen in running, jumping, *&c.* is broken and gradually spent; which must have been extremely pernicious, if the hard Surfaces of Bones had been immediately contiguous. As the Course of the cartilaginous Fibres appears calculated chiefly for this last Advantage, to illustrate it, we need only reflect upon the soft undulatory Motion of Coaches, which Mechanics want to procure by Springs; or upon the Difference betwixt riding a Chamber-Horse and a real one. To conclude, the Insensibility of articulating Cartilages is wisely contrived,

trived, as by this means the necessary Motions of the Body are performed without Pain.

If we consult the standard Chirurgical Writers from *Hippocrates* down to the present Age, we shall find, that an ulcerated Cartilage is universally allowed to be a very troublesome Disease; that it admits of a Cure with more Difficulty than a carious Bone; and that, when destroyed, it is never recovered. *Hildanus*, in considering these Diseases, has observed, that when the Cartilages of a Joint were destroyed, the Bones commonly threw out a cementing *Callus*; and thus a bony *Anchylosis*, or immoveable Continuity, was formed where the moveable Joint had been. So far as I have had Opportunities of examining diseased Joints, either after Death or Amputation, I have found, according to the Nature and Stage of the Disease, the Cartilages in some Parts reddish and lax; or soft and spongy; or raised up in Blisters from the Bone; or quite eroded, and, perhaps, the Extremities of the Bones carious; or, lastly, a bony *Anchylosis* formed. But I could never see, nor indeed hear of, the least Appearance of an Exfoliation from the Surface of the Cartilage. Now, if we compare the Texture and morbid *Phænomena* of those Cartilages together, all the diseased Appearances will admit of as rational a Solution, as perhaps any other Part of the vitiated Oeconomy.

It appears from Maceration, that the transverse Fibrils are extremely tender and dissoluble; and that the Cohesion of the Parts of the strait Fibres is stronger than their Cohesion with the Bone. When a Cartilage therefore is inflamed, and soaked in purulent Matter, the transverse or connecting Fibres will the sooneſt give way, and the Cartilage becomes more or less red and soft, *&c.* If the Disorder goes on a little longer, the Cartilage does not throw off a Slough, but separates from the Bone, where the Force of Cohesion is least, and where the Disease soon arrives, by reason of the Thinness of the Cartilage. When the Bone is thus exposed, the Matter of the Ulcer, or Motion of the Joint, corrodes or abrades the bony Fibres. If the Constitution is good, these will shoot forth a *Callus*; which either cements the opposite Bones of the Articulation, or fills up the Cavity of the Joint, and for the future prevents Motion. But if, unfortunately the Patient labours under a bad Habit of Body, the Malignancy, having got Root in the Bone, will daily gain ground; the *Caries* will spread, and at last the unhappy Person must submit to Extirpation, a doubtful Remedy, or wear out a painful, though probably a short Life.

Explanation of the Figure. Figure 132. *represents a View of the* Patella *on the Backside, where it is covered with a smooth Cartilage. In this we may observe,* AAAA *the Surface of the Cartilage, appearing, when the* Perichondrium *is removed, like Velvet. Near the Middle, Part of the Cartilage is taken out, in order to shew* B *the subjacent Surface of the Bone: And* C *the Thickness of the Cartilage, where the perpendicular Fibres are seen very*

Fig. 129.

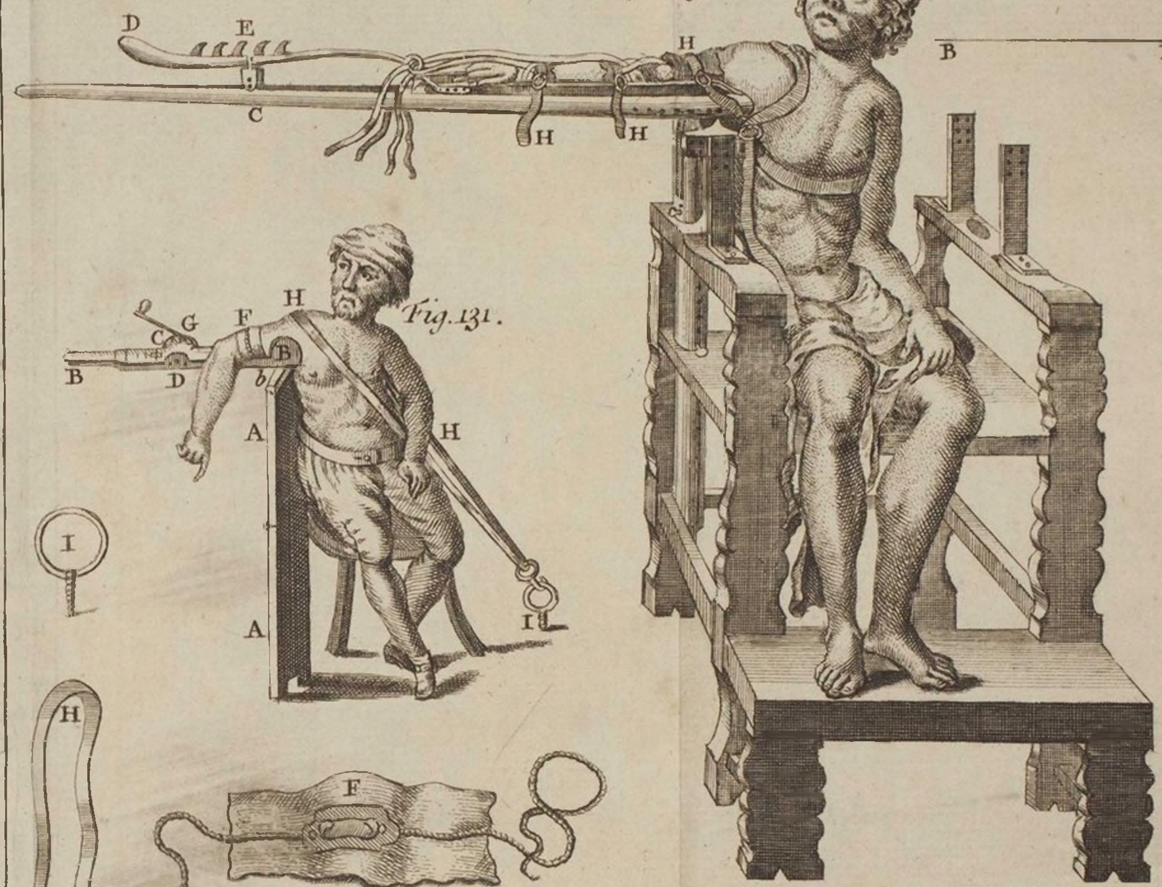
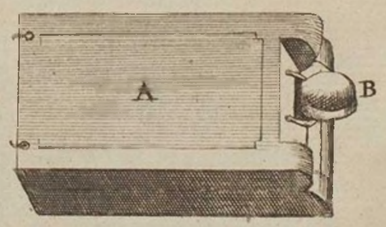


Fig. 131.



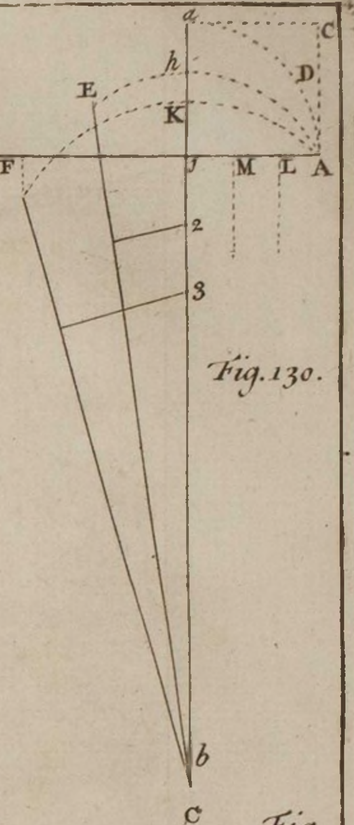
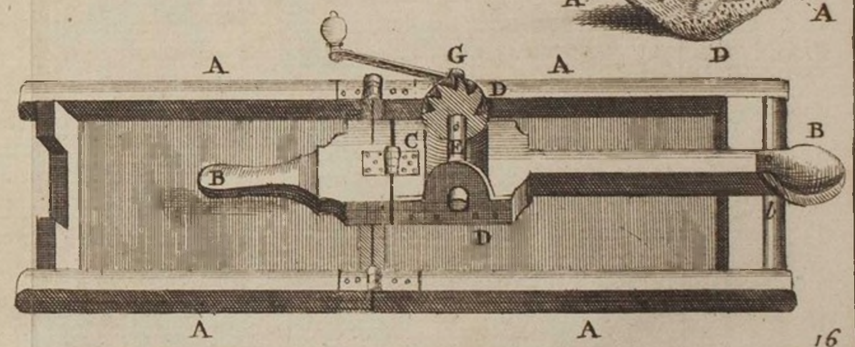


Fig. 130.

Fig. 132.



very distinctly. D. *The scabrous lower Point of this Bone, into which the Ligament is inserted that binds it to the* Tibia.

An Account of a very extraordinary Tumour *in the Knee of a Person, whose Leg was taken off by Mr* Jer. Peirce, *Surgeon at* Bath; No. 452. p. 56. Jan. *&c.* 1739. *dated, Bath, June* 11. 1737.

XI. *William Hedges* of *Stratton* in *Somersetshire*, a Farmer's Son, of 25 Years of Age, of a muscular healthy Habit, having never known any kind of Disease; about 8 Years since first observed a small Swelling on his Right Leg near the superior Epiphysis of the *Tibia*, which (to use his own Terms) he called a Splint, about the Bigness of a split Horse-bean. As he was not conscious of any Bruise on the Part, and as it was wholly free from Pain, so the only Reason he had to regard it, was from it's constant Increase, which during the 2 first Years was very slow; but afterwards it increased so fast (though without Pain) as to render him altogether incapable of Labour from the time of Hay-Harvest 1735.——

Upon taking off the Limb in *May* last, I found it weighed, with the Leg and Foot, 69 Pounds, which (to the best of my Remembrance) is 27 more than the Leg some Years since taken off at St *Bartholomew*'s Hospital by Mr *Gay*, for the like Disorder. The Operation itself afforded nothing uncommon, except the Quantity of recurrent Blood, which, however greater than usual, seemed proportional to the increased Bulk of the Part.

Upon examining this surprising Tumour, the adjacent Muscles were found destitute of their fibrous and fleshy Appearance (probably from the Pressure, and great Extension, which they had suffered, and the little Motion which for some Years they had employed upon the *Tarsus* and Toes); but the *Fascia* and common Membranes of the Muscles, being greatly thickened and callous, adhered to the subjacent Tumour; and upon removing this callous Integument, the Tumour appeared covered with great Quantities of Blood-Vessels, much distended, and of a Colour more intensely red than natural.

The Tumour itself was cartilaginous for the Space of ½ an Inch from it's external Surface; from whence it formed numberless bony Substances of various Forms, Colours, and Consistences, which (growing more and more numerous, as they lay deeper) at last formed a continual Substance completely ossified: In the Centre of this bony Substance we found about a Quart of mucilaginous Liquor, no ways fetid, (though it was then ten Days from the Operation) whose Colour and Consistence nearly resembled that of *Linseed Oil*; in which we observed many little bony Substances loose and floating, similar to many others adhering to the internal Surface of the Cavity, all which had nearly the Appearance of those irregular Incrustations, which in hollow Rocks are sometimes made by the dropping of petrifying Waters. After the Operation, every Circumstance of the Cure proceeded as I could wish, and the Stump is now healed.

It seems well worth observing, that the Parts above the Tumour were very little altered from their natural State. The Cartilaginous Extremity of the *Femur* was perfectly smooth; nor had the *Rotula* suffered

suffered any other Injury except the Ossification of the Ligament by which it is fixed to the *Tibia*; but the superior Extremity of the *Fibula* was wholly lost in the Tumour.

May we not justly admire the Goodness of a Constitution, which could bear such enormous Extensions in the Integuments, the tendinous *Fascia*, and even the Bone itself, without Pain and Inflammation? Or can we sufficiently wonder, that the Fluids should be so little disposed to putrify, as to bear so great a Diminution in their Motion, and for so long Time, without vitiating the Constitution, or tainting even the Parts affected. Fig. 133. represents the Limb immediately after the Operation: Fig. 134 shews the Tumour as opened.

Fig. 133.
Fig. 134.

Description of a Machine *for dressing and curing Patients, who are very unwieldy, and are under the Surgeon's Hands for some Ailment on the Back, the* Os Sacrum, *&c. or are apprehensive of it. By* M. le Cat, *F. R. S. Surgeon to the* Hôtel Dieu *at* Roüan, *and Royal Demonstrator in Anatomy and Surgery: Abstracted from the* French *by* P. H. Z. F. R. S. No. 468. p. 364. Jan. *&c.* 1743-4. *Read* Feb. 3. 1742-3.

XII. A Lusty Body labours, as it were, under the Richness of it's Constitution, which at the long-run turns to Misery: The Vessels of a plethoric Body are, even in the most vigorous State of it, hardly able to convey all the Juices; but when that Vigour is lost, they stagnate and corrupt, and produce numberless Distempers: If any critical and salutary Evacuations free it of Part of it's Burden, there remain flabby Bags and Cells ouzing Humours, which become Materials for Imposthumes, for want of a proper Supply of Animal Spirits, and laudable Humours, which are compressed and stopped by the Weight of the respective Parts. The increasing Weakness of the Patient hinders him from stirring, and putting himself into the Situation necessary for his Cure: His enormous Bulk makes it even impossible for his Attendants to assist him; the Number of Hands that are then employed, rather give him Torment than Ease, and the Apprehension of changing his Posture at so painful a Rate, will make him rather prefer an easy Situation, that will at last lead him to the Grave.

Since my practising Surgery, I have had several of those unhappy Persons under my Hands, and even some who were dearer to me than the rest of my Patients; and I have had the Grief to see them carried off in despite of all the Resources my Attachment furnished me with, and those my Profession suggested to me then, as generally used. Finding these latter insufficient by repeated Experience, my Imagination at last made me conceive a sort of *hanging Cradle* or *Hammock*. In *Jan.* 1741, I gave the Draught of this Machine to some Workmen, having then under my Hands the Abbé *de la Bucaille* of this City of *Roüan*, a Person of a vast Bulk, paralytic, and labouring under a Mortification about the *Os Sacrum*. The following Explanation of the Figures will shew the several Uses of the Machine.

Fig. 135. Fig. 135. represents the Patient's Bed-chamber with a Bed in it without the Bedding, in order the better to shew the Machine. Upon it lies a sort of Boat of *Turkey* Leather, full as long as the Bed, with very strong Hems all round, and Eylet-holes for receiving

ceiving Hooks, that serve to life up this *Hammock*. The Hooks are fastened to several Ropes, all which depend on as many Cross-beams of very solid Wood. The Cross-beams consist of one Beam of the Length of the whole Bed, running Lengthways over the Middle of it, and 4 transverse Beams, the 2 middlemost of which are somewhat longer than the others. The Ropes on which the *Hammock* hangs, are fastened to the Extremities of these Beams, which keep the *Hammock* displayed; and on the same Extremities are also fastened all the Ropes, which unite in one that passes through the Testern of the Bed, and above it hangs on a Pulley, that is fixed to the Cieling of the Bed-chamber. Another Rope that is run into the Pulley, passes into another Pulley corresponding to it, hanging at some Distance from the Bed, where a Man is placed to pull it, and raise the *Hammock*.

What we chiefly intend in dressing a Patient in Question, are,

1*st*, To dress and refresh him, that is to say, gently to place him in a proper Posture, easy both for himself, and those who attend him.

2*dly*, To put him into an easy Situation, that may also promote his Recovery: The making of his Bed often, is already of great Ease to him; but at the same time it is necessary, that his Wounds or Ailments may not bear upon any the least thing possible; and therefore his Bed ought to be composed of several small Matresses, or of Matresses of several Pieces, each with it's Tick over it; these Matresses ought besides to be supplied with Numbers of Pillows, each with it's Pillow-bier, so that he who waits on the Patient, may place them where it is proper, for the Ease of the Person, and of the Part affected. Nothing is more proper for this Purpose than our *Hammock*; the Patient may be lifted up from his Bed, and suspended just above those Pillows, and higher yet, if necessary.

Our *Hammock*, being of *Turkey* Leather, fits itself to those Pillows, and gathers them in as the lower Sheets would do; but the Inconveniency of Sheets we have supplied with those Ticks and Pillow-biers covering the Matresses and Pillows.

The *Turkey* Leather of the *Hammocks* is full wide, not only to cover the whole Bed, but even so as that the Hems or Borders of it may hang down round about it, and tuck in under the Matresses: The Bottom of it is pierced in those Places which answer to the *Anus*, or any Part affected, so that the Evacuations may find their Passage into Receptacles between the Pillows ranged accordingly.

When the Patient is to be dressed or refreshed, the Borders of the *Hammock* are taken up, and the several Hooks passed through, by which he is to be suspended, as appears in the Figure; and then a Man, being placed at the Rope that runs over the Pullies, lifts the Patient up to the Height necessary for the Surgeon to search and dress the Wound, and for the Assistants to make his Bed, which, even

for the greater Conveniency, may be pulled out from under the *Hammock*.

When all is done, the Bed is pushed back again to it's former Place, the Patient is gently let down upon it, the Cross-beams are lowered and detached both from the *Hammock* and the Block, and put out of the Way into a Corner of the Room; instead of it, a Rope is fixed to the Hook of the Block, tied into an Eylet at the End, coming down towards the Bed within the Patient's Reach, in order to help himself when he wants to stir a little.

The *Hammock* being displayed, and the Cross beams taken away, the Patient is wrapped up in Napkins as much as possible, to supply the Sheet he wants between his Body and the Leather of the *Hammock*; he is afterwards covered with an upper Sheet, and other necessary Bed-cloaths.

Fig. 136. Fig. 136. This Machine may be farther improved by Use. For Instance: Since I contrived this, I thought that instead of the Border or Hem of the *Hammock*, one might make strong cylindrical iron Rods, like Curtain-Rods, formed into a Square, somewhat larger than the Bedstead, to the Four Corners of which are fastened as many Ropes, which meet at the Pulley; in which Case the Cross-beams, and the Ropes depending on them, become useless; and instead of a *Hammock* all of one Piece, one might fix 4 broad Straps of *Turkey* Leather to Two Sides of the square Rod, which may be placed under such Parts of the Patient's Body as will be proper, and which leave a Space between each other where it is convenient. These Straps may be fastened to the iron Rods by several Buckles with Rings to slide along the Rods, by the Help of which the Straps may be pushed on to such Places where there is Occasion; they may also thereby be stretched or slackened, or even be taken off, or changed as is thought fit. After the Patient has been dressed, and the Bed made, the four Ropes may be taken off both from the Rod and from the Block, and the Rod be let drop with the Extremities of the Straps down upon the Floor round the Bedstead, which being narrower than the Square of the Rod, the latter will easily slip over it.

I have given these two Methods together, as there may be Occasions when one becomes preferable to the other.

An Account of a Book entituled, Osteographia, *or, the Anatomy of the* Bones, *by* William Cheselden, *Surgeon to Her* Majesty, *F. R. S. Sur-*

XIII. For the Frontispiece to the Book our Author has made choice of a Story very suitable to a Work of this Kind, which is a Description that *Galen*, in *Lib. i. Cap.* 2. *de Anatomicis Administrationibus*, relates of a Robber that was killed on a Mountain by a Traveller, whom he attacked, and whose Body no one cared to have buried, but were rather glad that so wicked a Man should become a Prey to the Vultures. Two Days after *Galen* went to see this Body, and found the Bones picked as clean as if prepared for the Instruction of Students.

This

This Opportunity he mentions as a Piece of good Fortune, because, in those Days, it was very rare to meet with a Skeleton, by what he observes to the young Physicians in the same Book, that he used to examine Bones which he found in Graves, and in the Ruins of Monuments; and once he met with a Body, which, by the over flowing of a River, was washed out of a Sepulchre that was slightly built on the Bank of the said River; the Flesh being destroyed, the Bones were left entire.

He likewise takes notice, that there was a Skeleton in the Physick-School at *Alexandria*, which he thought would amply compensate the Trouble of any one to go on Purpose to study.

The Figure representing *Galen* contemplating the Skeleton, is taken from a Philosopher of *Salvator Rosa*.

At the Bottom of the Title-Page he has given a Print of a *Camera Obscura*, which he mentions in his Preface to have contrived and drawn all his Bones by, and without which Assistance (notwithstanding he employed the greatest Artists in their way) he found it impossible to give a true and perfect Representation of them, there being so much Difficulty to express the Outlines of Bones in their different Attitudes.

This occasioned my looking into *Vesalius*'s Book of Anatomy more carefully than I had done before, whose Figures have hitherto been esteemed the most beautiful of their Kind, and are performed in so exquisite a Taste, that they have usually been taken for *Titian*'s, and always considered as a Study for Painters.

Yet whoever will give himself the Trouble to measure his Bones with real ones, will find many egregious Errors, which would take up too much room here to particularize; but upon the whole I find there is no kind of Proportion kept, and that his Bones in general are between $\frac{1}{3}$ and $\frac{1}{4}$ Parts too short for their Breadth: and tho' his 3 Skeletons have been so remarkably famous, that several Anatomical Writers have copied after them, yet when carefully examined, it will be very easy to discover many Imperfections in them, though, all together, they strike the Eye wonderfully.

This *Camera* he mentions not only as a great Help to him, by giving true Proportions and Outlines, but likewise for a more speedy Dispatch; doing more this way in one Day, than could possibly be done without in several.

It is a long square Tube set upon two Tressels (as represented in the Print before his Book) whose Inside is made black, to prevent the Reflection of Light; towards that End which is nearest the Object, is a Convex-Glass placed in a sliding Frame, through which the Rays passing from the Object, converge and meet in a Focus upon the Table-Glass placed near the other End, analagous to the Crystalline Humour and *Retina* in the Eye.

geon to St Thomas's Hospital, and Member of the Royal Academy of Surgery at Paris. By John Belchier, Surgeon, F. R. S. No. 430. p. 194. Nov. &c. 1733.

The Object here represented is the Trunk of a Skeleton fixed to a Painter's Ezel, which being inverted, appears upright to the Table-Glass, on the rough Side of which the Artist delineates with a Pencil, which afterwards he traces off on Paper. The Convex-Glass placed in the sliding Frame being moved backward or forward, makes the Object bigger or less, keeping it's due Proportions.

This *Camera* has several Advantages beyond the common one; for in this, Objects as big as the Life may be taken, or reduced gradually to any Scale; whereas the other only diminishes, and that in a very great Degree.

In this Work the gradual Increase of the Bones is described, even from the first Stages of Ossification, to that of an Adult, when every Bone is represented as large as the Life in different Attitudes; as likewise most of the Bones sawed through the Middle, to shew their internal Texture: And in order to shew how they are articulated to each other, there are several Plates wherein they are reduced to lesser Scales, and again reduced, to give a View of them all united together in Representations of six different Skeletons, where the Difference of the Growth of the Bones is very apparent, as likewise the different Shapes of the Male and Female Bones. There are likewise several Plates of Bones prepared on Purpose to shew the Ligaments which unite them together, as also the Cartilages at their Ends, besides a great Variety of most curious and remarkable diseased Bones.

And at the Front and Close of every Chapter, as likewise the Blank Pages, are Skeletons of the most remarkable Animals of their kind, which are not only very ornamental, but even very useful; most of them describing the Œconomy of the different Species of Animals.

The Author in his Treatise gives a general Description of the whole Work, though not so minutely as some might expect, he thinking it useless to give long Descriptions in a Work of this Kind, one View of such Prints shewing more than the fullest Description can possibly do; for which reason, in the several Chapters, the mechanical Contrivances of the Bones are rather treated of than their Shapes.

Each Book has a double Set of Prints, one before they are lettered, to shew them in their full Perfection; and the other with Letters, answering to their Descriptions.

The Advantage of a Set of Prints before they are lettered, will readily be perceived, when compared with the other: And how much these Figures excel any others of their kind, will appear at the first View, they being executed in so free and open a Stile, and expressed with so much Spirit, and (what is very rare) without the least kind of Exaggeration.

At the End of his Preface he takes notice, that when he began this Work, he proposed to go through the whole System of Anatomy, adorned with the Comparative, in three Volumes in this manner; the farther Prosecution of which Design he has now entirely laid aside,

it requiring so much Leisure, as renders him incapable of the Performance; and the vast Expence attending such a Work (besides other Inconveniences) will, I doubt, prevent the Execution of it by any Body else, especially in so grand a manner, this being undoubtedly the most magnificent Work of the kind now extant.

XIV. *EXPERIMENTS.*

Three Lectures on Muscular Motion, read before the R.S. in 1738. *by* Alex. Stuart, *M.D. F R.S. Supp. to the Year* 1738. Lecture I.

I. *The Elasticity of the Blood-Vessels, and Non-Elasticity of the Nerves, demonstrated on a Nerve, Artery, and Vein of a human Body cut out, and the Degree of the Elasticity measured.*

II. *The Distribution of the Nerves, Arteries, and Veins, to the Antagonist Muscles of the Arm of a human Body, shewn in an Anatomical Preparation; for demonstrating the Necessity of such a Distribution towards the Performance of Muscular Motion.*

III. *In the Air-Pump, on the jugular Vein of a Calf; to shew that there is Air in the Blood.*

This Experiment stands in the Minutes of the *Royal Society*, as first performed by me, about 17 or 18 Years ago; and is now only repeated on Occasion of these Lectures.

IV. *Upon a human Artery, and the* Rose of Jericho; *to shew that the Elasticity of Solids arises from the Fluids they imbibe or contain.*

V. *On a Frog; to shew the Existence of a Fluid in the Nerves, and that Muscular Motion is begun by an Impulse on it through the Nerves into the Muscles.*

Upon these Experiments, Anatomical Preparations, and Observations made upon them, the Doctrine of Elasticity, and of Muscular Motion, chiefly depends; and none of them have been made by any one before, nor are they extant in any Author, that I know of.

VI. *On Water, Oil, and Mercury, in the Air-Pump; to prove the Elasticity of Fluids.*

This Experiment, if it ever was made before, was at least never yet applied to prove the Elasticity of Fluids, and shew the immediate Cause of Elasticity, and Cohesion in Solids.

The Manner, Explanation, and Use of Exp. I.

1. The Elasticity of the Blood-Vessels, and Non-Elasticity of the Nerves, will appear to any, who are disposed to make this Experiment, as I have done, by laying a Piece of Twine, about 4 Inches in Length, parallel to the Nerve, Artery, and Vein of the Inside of the Thigh, in a human Subject; which being tied together above and below, as soon as they are cut out of the Body, and laid on a Board, the Artery and Vein will be seen to contract equally, to the loss of $\frac{2}{8}$ of the Length, which they had in the Body before Excision; as appears in those in Fig 137, the Nerve continuing of the same Length with the Twine, as in the Body. Fig. 137.

In

2. In Dogs the Elasticity is greater, to the loss of $\frac{1}{8}$ of the Length they had before Excision; and as this Elasticity seems to differ in different Species of Animals, so it may vary in the Individuals of the same Species, and in the same Individual in different Stages of Life, or Degrees of Health.

3. The Use of this Experiment is not barely to shew, that the Blood-Vessels are elastic; for every one who knows, that the Artery is dilated in it's Diastole, and contracted in it's Systole, knows it therefore to be elastic in that Sense; and every one, who has performed the Ligature on the Artery after Amputation, knows that it shrinks or shortens it's Axis, and therefore is also elastic in that Sense. But though this be known, yet the Measure or Degree of the Elasticity of an Artery has not, that I know of, been taken Notice of by any body. And, *2dly*, As the Vein has no Pulsation, and is never designedly tied in an Amputation, it's Elasticity has been overlooked; though it be equal to that of an Artery in Degree, but not in *momentum*, it's Coats being thinner than those of the Artery. *3dly*, The Non-Elasticity of the Nerves has not been so much as once named by any Author, as I remember, before the Publication of my Inaugural *Theses* at *Leyden*, 1711, where it is remarked, and since that Time by Dr *Boerhaave* only, in the subsequent Edition of his *Institutions Ann.* 1713, and the two following Editions. But, on the contrary, all the Authors on Muscular Motion, that have come to my Hands, as well as those who have written of the Theory and Practice of Physic, have supposed and ascribed Elasticity to the Nerves.

4. The Experiment therefore is so far useful, as it discovers some essential Properties of these essential Parts, which were not known before; and clears up some Mistakes, that passed for fundamental Truths, relating to the Nerves and Veins, in explaining most Parts of the animal Œconomy, as well as Muscular Motion in general.

5. And it is further very remarkable, that though the Elasticity of the Artery has always been known, and indeed obvious in the Pulsation: yet Authors have been constantly so full of the Elasticity of the Nerves, in explaining not only Muscular Motion, but also several other Parts of the animal Œconomy, and even in accounting for the Symptoms of various Diseases; that they have taken no other Notice of the Elasticity of the Arteries, than solely as it propels the Blood in the Circulation through them: and even in that, by their Doctrine it has been allowed but a very small Share; and by most of them no Share at all.

6. And it may not be amiss to observe, that this Experiment was never made by any, that I know of, till 1711; and afterwards, in 1735, when I first shewed it to this Society. And further, tho' it appears simple and easy to be made, yet it is of the utmost Consequence in all Parts of the animal Œconomy: For as all Parts of the animal body are entirely composed of Nerves, Arteries, and Veins, (excepting the hardest Fibres of the Bones, which also are nourished by them) it is certain

that all the animal Functions depend upon the Qualities, and Contents of these three Parts. Therefore this Experiment, as it demonstrates the Qualities, and Degrees of the Qualities, of each of these, gives us the Qualities of the Solids in all Parts of the Body; and therefore opens at least one Door towards the Explanation of all the animal Functions, as far as they depend upon the Solids.

Explanation and Uses of Exp. II.

1. The next thing which we are to take Notice of, is the Form or Manner of the Distribution of these 3 essential Parts to the various Organs at their Extremities; for upon this Distribution, and the Structure of the Organs, which they lead to, depends the whole Variety of the Functions, whether natural, vital, or animal.

2. The Cause, Manner, and Effect, of voluntary Muscular Motion, being a Point that the Founder of these Lectures had chiefly in View, it was necessary to observe the Manner or Order of Distribution of these essential Parts to the Organs of voluntary Motion, the Muscles.

3. For this Purpose therefore I exhibited this Anatomical Preparation, not extant before in any Author, and, so far as I know, not hitherto attempted by any one; namely, the Antagonist Muscles of a human Arm, with all the Nerves, Arteries, and Veins leading to them, entire, as they appear in the Subject itself; and likewise laid before you a very accurate Draught of them, wherein the Arteries are marked red, the Veins blue, and the Nerves white, as in Fig. 140. Fig. 140.

4. The Uses of this Preparation are various. *1st.* As it shews that there is no Communication between the Antagonist Muscles by their Nerves, each having a peculiar Trunk, or Trunks, and Branches of Nerves distributed to it, distinct from those of it's Antagonist; by which the Mind has a distinct Power over each, and may at Pleasure act upon either, without acting upon the other: for if both were equally acted upon at the same Time, no Motion, but a Rigidity and Immobility, would ensue. *2dly*, This Preparation shews that the Antagonist Muscles have a Communication with one another, by the Intervention of their Blood-Vessels, as there appears to be one Trunk of an Artery, and one Trunk of a Vein, common to both.

5. This seems also to be absolutely necessary towards voluntary Motion, and the Power and Energy of it; to wit, that the acting Muscle may have a greater derivation of Blood into it from the common Trunk of the Artery, than it's Antagonist, which is at that Time to remain passive.

6. Both these very essential Parts of voluntary Muscular Motion must have remained in the Dark, without such an Anatomical Preparation. The mechanical Cause and Manner of this Derivation of an accessory quantity of Blood to the acting Muscles, depends upon this Distribution of the Vessels, and the Mechanism of the muscular Structure, which shall be shewn in the Course of the following Lectures; wherein it will appear,

appear, that the Antagoniſt Muſcles of voluntary Motion are like two Antagoniſt Scales of a Balance; and that it is in the Power of the Mind, by Means of this, and other Parts of the Muſcular Mechaniſm, not only to throw in a greater Weight at Pleaſure into either Scale, but further to throw the Weight taken from the one into the oppoſite Scale, by which the *Momentum* is doubled on the Side, on which the Mind determines to act.

The Manner, Explanation, and Uſe of Exp. III.

1. This Experiment is performed by laying bare the jugular Vein of a Calf, before it be killed, and ſeparating it carefully from Adheſions; which is then to be tied with a cloſe Ligature, firſt below near the *Thorax*, and then in the ſame Manner near the Head, at the Diſtance of 3 or 4 Inches from the former Ligature, ſo as that the intermediate Segment of the Vein full of Blood between the Ligatures may be cut off beyond the Ligatures.

2. This Segment of the Vein, turgid with Blood, ſhould be immediately put into a Veſſel full of luke-warm or blood-warm Water, to keep the Blood from coagulating within it, which would happen in a few Minutes, if it was expoſed to the cold Air.

3. The Vein being taken out of the warm Water, is to be tied to a ſmall ſquare paſte-board Frame, and made faſt over the Mouth of a Wine or Gelly-Glaſs, or any ſuch Veſſel tapering towards the Bottom, and put into the Recipient of an Air-Pump, which being exhauſted, the Vein is to be opened with a Lancet, fixed at the End of a Wire, paſſing through a Collar of Leathers.

4. The Conſequence of this is, that the Blood, which runs out of the Vein into the Veſſel ſet underneath, will be immediately and totally raiſed up in Air-Bubbles, and thrown out of the Veſſel upon the Plate of the Pump, by the Force of the Air which it contained, equally diſtributed through the whole Maſs.

5. By which it appears, that the Blood is greatly ſtored with Air, as was to be ſhewn.

Remarks on this Experiment.

Obſ. I. §. 1. It is remarkable in the *Apparatus* to this Experiment, that the Heat of luke-warm Water, which is nearly the ſame with the Heat of Incubation, keeps the Blood in the Vein in a State of Fluidity for ſome Hours; and I believe it might be kept in that State much longer, which deſerves a Trial; this being, as I imagine, the ſtandard Degree of Heat in all ſuch outward Applications, as are intended to diſſolve, attenuate, and diſcuſs ſtagnating animal Fluids, or diſobſtruct the Veſſels: Intentions which are rather hindered than promoted by too hot Baths or Fomentations, in which the miſtaken ſtandard Degree is as hot as the Patient can bear it, inſtead of what he could call a comfortable Warmth, and would be the uſeful Meaſure for him. This Degree of Heat would indeed be different to different Perſons; but every one would have the due Degree ſuited to his Temperament, Conſtitution, and

Feeling

Feeling, in which he could not be deceived, being himself the best Judge. Nay even in Mortifications or Sphacelations, though neither this nor any other Degree of Heat can restore Motion in the sphacelated Part, yet this Degree is most likely to promote the Circulation remaining in the Confines of the mortified Part; which is the only Intention of Fomentations and Poultises in such Cases, in order to a Separation of the sphacelated Stuff.

§. 2. This Doctrine is confirmed by Observations, that all 'Animal Fluids are thickened by any great Degree of Heat, or Cold. Thus,

§. 3. The White of an Egg becomes as hard in a Night's time under the Snow in frosty Weather, as if it had been roasted by the Fire, or boiled in Water; though the Yolk, being more oily, is not so much hardened in the same Time; whereas it is known, that all Parts within the Shell are made more fluid by the Heat of Incubation.

§. 4. And hence it is, that the same Kinds of inflammatory Distempers appear in the Summer Heats, as in the greatest Colds of Winter: Whereas the temperate Warmth of the Spring and Autumn is generally healthier, or at least freer from these Kinds of inflammatory Distempers.

Obs. II. §. 1. Though the Vein contains such a Quantity of Air, yet it is no way tumified or expanded by exhausting the Receiver; which shews, that the real Elasticity of the muscular Fibres of the Vein is superior to the expansive Force of the inclosed Air, in which it's Elasticity is imagined to consist.

§. 2. This elastic Power of the Vessels therefore would make a Rupture of them impossible in an exhausted Receiver of an Air-Pump, or at the Top of a very high Mountain, such as *Teneriff*; did not the Force of the Circulation, at least in this last Case, contribute to that Rupture of the capillary Vessels; which appears by spitting of Blood in such Eminences.

Obs. III. The Manner of this Experiment upon Blood, which has never had any Communication with the external Air, obviates an Objection against an Experiment of this Kind, upon Blood received into a Porringer, or other Vessel, from the Arm by Venæsection, which might be supposed to have imbibed or received Air in it's Passage, and Exposition of the external Air, before the Experiment.

Obs. IV. §. 1. As the Blood circulating in the Vessels appears to have such a Quantity of Air intimately mixed with every Molecule, Globule, or Particle of it, the whole Compound, according to the common Doctrine of Elasticity, ought to be looked upon as an elastic Fluid: Even if these Globules themselves were not elastic, as I formerly endeavoured to prove them to be, in an Essay on the Structure and Motion of the Heart, read some Years ago in this illustrious Society, and in a Dissertation *de Struct. & Mot. Musc.* lately published.

§. 2. In the mean Time it may be necessary here to obviate an Objection against the Elasticity of all Fluids, which arises from the Incompressibility, and therefore, as is alleged, the Non-Elasticity of Water, the Basis of all the rest; even though it be known to contain a great Quantity of Air. For this Purpose the *Florentine* Experiment of filling a spherical Vessel of Gold full of Water, closely shut up in it, and exposed to the Strokes of an Hammer on an Anvil, or to any other strong Compression, is offered in Proof. Because in that Experiment it appears, that some Part of the Water will make it's Way through the Pores of the Gold; which plainly shews, that it cannot be compressed into less Room than it had in the spherical Vessel, which is more capacious than the Cavity of an oblate Spheroid, to which the Strokes of the Hammer, or other Compression, may have reduced it.

§. 3. The solving of this Difficulty will give a Handle for clearing up some Mistakes, relating to the imagined Non-Elasticity of Fluids, for which Reason it may not be improper in this Place to give some account of the Nature of Elasticity.

Of Elasticity. Elasticity being one of the Principles of Muscular Motion, it is necessary to shew where it resides, and how it acts. In order to this, I shall offer the following Propositions, some of which are so evident as to want no Proof, and to the rest the proper Proofs shall be subjoined.

Prop. I. The *Minima* of all Bodies are perfectly hard; that is, their Parts are neither separable, nor capable of changing their relative Situation, by any Power in Nature. This is supported by the incomparable Sir *Isaac Newton*, in his Treatise of Optics, by irrefutable Arguments which I need not here repeat.

Prop. II. Therefore, as the *Minima* of Bodies, cannot be singly elastic, Elasticity must be a Property of compound Bodies only, whose component Parts are capable of changing their relative Situations, and can be drawn to various relative Distances with regard to one another.

Prop. III. §. 1. This Property appears to be greater or less in all compound Bodies, whether solid or fluid; but the Question is chiefly about the Elasticity of Fluids, which has been positively denied in Water (the Basis of all the animal and vegetable Fluids) upon the Score of it's Incompressibility, observed in the *Florentine* Experiment mentioned above. But notwithstanding that Experiment, I believe it may be made to appear, that Water, Oil, and Mercury, are not only elastic themselves, but also the Causes of Elasticity in all compound solid Bodies.

§. 2. In order to this, we are to consider: That the natural State of all elastic Bodies, whether solid or fluid, is Contraction of all the Parts of the Compound towards one another, and to the common Centre of the Mass. This appears in a Bow, and after the same Manner in a Drop of Water, Dew, or Mercury, whose Particles are all equally attracted towards the common Centre of the Mass, even in *Vacuo*, ac-

cording to Exp. VI. and therefore towards one another, so as to form the exactest Sphere about that Centre, where they remain in *Æquilibrio*, and immoveable by any Power or Force of their own; and if disturbed by any external Force (short of what will dissipate them into lesser Spheres) so as to be reduced to oblate or oblong Spheroids, or to any other Figure different from that of a Sphere, they will immediately upon removal of that Force resume their former spherical Figure, Situation of Parts, and *Æquilibrium* about their common Centre, as before: And in their Progress towards Restitution, they will either repel or constantly endeavour to repel, the incumbent or impelling Force.

Corollary. Thus Fluids appear to be elastic, as they are capable of Extension or Expansion by any external Force applied; and of Restitution to their pristine Figure by their own natural Force, by which they repel, or endeavour to repel, every Thing that stands in the way of their Restitution. Which is the whole Characteristic of elastic Bodies.

Scholium. Repulse therefore (in this Case at least) appears to be no Principle of Action, but the Effect of that Principle, which is rightly called Contraction or centripetal Force; which I have endeavoured to shew elsewhere. [See *Diss. de Str. & Motu Musc. Introd.*]

§. 3. As to the *Florentine* Experiment, which is offered in Contradiction to this Quality in Water, we are to consider, that cold Water is before the Experiment, in the State of it's ultimate Condensation or Contraction which it can have at that Time or Season in which the Experiment is made, with an immediate Contact, or the nearest possible Vicinity of all Parts of the Compound, whose *Minima* are perfectly hard, as has been already proved; and also perfectly round, which it's Fluidity shews to be very probable. Such a Body, I say, in it's natural State of Contraction cannot be brought into a nearer Contact of Parts, nor into a lesser Compass than that of a Sphere, which is the most capacious of all Figures, under the same Surface; and therefore cold Water, or any other Fluid, shut up in a Vessel of that Figure, would either constantly resist the Compression, or escape it even through the Pores of Gold: which no way invalidates the Arguments offered above in Proof of it's Elasticity. For though an elastic Body extended, distended, expanded, or rarified, may be contracted or condensed, either by it's own natural Power, or by an external Force superior to that by which it was extended or rarified; yet it does not from thence follow, that after it's full natural Condensation or Contraction, it can be still further condensed or contracted, by any Force whatsoever: which does not at all imply a want of Elasticity, such as has been above described.

§ 4. It may be further added, that if it was possible to condense any pure elastic solid Body, beyond the ultimate Degree of it's natural Contraction and Condensation, when all extraneous or heteroge-

neous Bodies are removed ; then we should be able to alter the specific Gravity of Bodies, and so far the Transmutation of Metals would be no longer a Mystery. But there is no known Power in Art or Nature, by which pure Gold, Silver, Mercury, or any other pure homegeneous Metal, can be made denser, or it's specific Gravity increased. It is true, that in impure Metals, by removing the impure or less weighty Particles out of the way of the mutual Contact of their purer Parts, the remaining pure Parts become heavier and denser, than an equal Bulk of the original Mass ; but this is only a Purification, not a Condensation of the primary essential component Particles ; which, was it possible, would alter the specific Gravity, and therefore the Species of the Metal, and so introduce a new Species of pure Metal. Which, I believe, is beyond the Power of Art, or any known Power of Nature.

§. 5. The second Thing to be considered in elastic Bodies, whether solid or fluid, is a Capacity of being extended, distended, expanded, or rarified ; the Effect of which is also to repel any incumbent or impinging Force ; which is sometimes done with very great Violence and Impetuosity in a Direction exactly contrary to the centripetal Force above described, and therefore has been called, though, I think, erroneously, the centrifugal Power of elastic Bodies, observed in various Experiments on the Air, whence it is denominated the most elastic of all Bodies. Of which more hereafter.

§. 6. But I must observe, that the same expansive Power, and even a greater Force of Repulsion, appears in Water, rarified in the Æolipile and Fire-Engine; though it be not allowed to be elastic.

§. 7. But the Truth is, that this Expansion, and Repulse which attends it, do not seem to be natural Powers either of Air or Water ; but Effects produced in them by the Force of Fire, the Rays of the Sun, or Heat, in a Direction contrary to the elastic centripetal natural Powers of these two Fluids : So that Rarifaction or Expansion in them is not a natural Action of their own, but a forced Effect ; and therefore the Repulse arising from it must also be the same.

§. 8. And this is equally observable in all elastic solid Bodies. For example, a Bow, that lies unbent, cannot be bent by any Force of it's own Elasticity, but by the Impulse of some adventitious external Power, which really extends it, or draws it to a greater Length in the Bending : Therefore the Bow is not then said to act, but to be acted upon, in order to it's subsequent Action of Restitution ; and the Man's Hands and Arms in acting upon it repel whatever stands in the Way of their Action. But this Action and Repulse is never ascribed to the Bow, whose Action is Restitution, or a centripetal Motion only, by which the Arrow is projected by Repulse, or Reaction of the Bow upon it in it's Restitution or Contraction.

§. 9. It

§. 9. It is in the ſame Manner, that the Rays of the Sun, Fire, or Heat, expand and rarify condenſed Air, or Water, and repel whatever ſtands in the Way of their Action, and that *Undequaque* in the manner of all other Fluids; in which Action the Velocity of the Particles of Fire, communicated to the Particles of a weightier Fluid than itſelf, increaſes the *Momentum* of the Expanſion and Repulſe, in Proportion to the different Weights of the Fluid acted upon: Therefore the Force of this Expanſion and Repulſe is found to be far greater in rarified Water or Steam, than in rarified Air; as is evident in the Æolipile and Fire-Engine.

§. 10. Thus it appears, that this Expanſion and Repulſe is not owing to the natural Elaſticity of the Air, but to a foreign Power, to wit, that of Fire or Heat acting upon it.

§. 11. And this is confirmed by obſerving, that Air long ſhut up from the Rays of the Sun, and from all Communication with the external Air, which conveys them: I ſay ſuch impriſoned Air at laſt totally loſes this expanſive Power, ſo as to become unfit for Reſpiration, and will extinguiſh a Flame, or kill an Animal, as quickly as if they were ſtifled in *Vacuo*. Which indeed is the Caſe. Whence it is commonly, but I think, wrongly ſaid, that ſuch Air has loſt it's Elaſticity. As if we ſhould ſay, that a Bow has loſt it's Elaſticity, becauſe we ſee it lie ſtill, contracted, or unbent, and no Hand employed to extend, that is, to bend it; without conſidering, that no elaſtic Body can act until it be firſt acted upon.

I ſhall proceed to conſider theſe Inſtances a little further, in the next Lecture, together with ſome other ſenſible Properties of Fluids; that by comparing them we may be able to draw ſuch general Concluſions for our Purpoſe, as ſhall appear to flow neceſſarily from them, in Confirmation of what has been already ſaid, and for a further Illuſtration of this Subject.

Section 1. There appears to be only 4 kinds of Fluids, viſible and obvious to the Touch, namely Water or watery Fluids, Oil, Mercury, and Fire; the laſt of which, though the moſt univerſal and moſt powerful of all, we are certainly the leaſt acquainted with. Lecture II.

§. 2. The Air as it is not a viſible Fluid, and is known to be an heterogeneous Mixture of almoſt all ſorts of Fluids; until we are at ſome Certainty about the Properties of the other more ſimple and more ſenſible Fluids, of which it is compoſed, it is not likely that we can come to any ſolid Concluſions concerning it: Therefore this may more uſefully be the Subject of ſome following Lectures.

§. 3. The firſt Property that I have already touched upon in Water, is, that the minuteſt, viſible, diſtinct Drops of it, and even pretty large ones, as well *in Vacuo* as in the open Air, (according to Exp. VI. made) form themſelves into exact Spheres; in each of which the Centre of Magnitude appears to be the Centre of Gravity, Attraction, and

and Æquilibration, as also of Vibration or Elasticity. And in such small Drops it continues to be so, as long as the Attraction of each Particle of the Fluid within that Sphere is greater towards it's own Centre, than towards the Centre of the Earth: That is, until the Drop is so increased, that the Gravity of the extreme Particles of it's Surface exceeds their Attraction towards the Centre of the Drop, as placed at too great a Distance from it, to be sensibly or sufficiently affected by it. In which Case, though they do not lose their mutual Attraction towards each other, and therefore retain a proportional Attraction towards their common Centre; yet they are forced to yeild to the superior Power of Gravity, by which they form themselves into a small Part or Section of a larger Sphere, about that more powerful Centre of the Earth. This is most remarkable in the Ocean, where the Water affects and obtains the same spherical Figure about the Centre of the Earth, as the least Drops do about their own peculiar Centres.

§. 4. And this Attraction of it's Particles in *Æquilibrio* towards the common Centre of each small Drop, is distinct from, and independent of, the Action of the Specific Gravity of the whole Drop towards the Centre of the Earth, the one being no ways hindred or promoted by the Action of the other; which appears by the constant Sphericity of their Figure, whether they ascend in Steam or Vapour, descend in Rain or Dew, are suspended in a Fog, or lie or hang on the Leaves of Grass; either in the open Air, or *in Vacuo*.

Corollary. Therefore the same hydrostatical Laws, which take Place in the Ocean, or any other considerable Collection of Water, whose Surface forms itself to a Convexity about the Centre of the Earth, must equally take Place in every distinct Drop of Water, whose Surface forms itself to a Convexity about it's own peculiar Centre. And such of these Laws, as may serve for our present Purpose, shall be taken notice of in the Sequel.

§. 5. The second Property that I would take Notice of in Water, is, that it is very plentifully attracted into the Pores, Vessels, Interstices, and innermost Recesses of all Solid, Animal, Vegetable, and Terrestreous Substances, where it diffuses itself equally, and uniformly, *quaquaversum*; and constitutes in some one half, but in the greatest Number more than half of their Bulk or Weight: to say nothing of Tin, Antimony, Sulphur, and some other mineral Substances, where it is also found; for which the Chymists may be consulted, and particularly Dr *Boerhaave*, in his Treatise of the Elements of Chymistry.

§. 6. I shall only offer one remarkable Instance of this in Exp. IV. made on a Species of *Thlaspi*, commonly called the *Rose of Jericho*, *Rosa Hierichontea*, which in it's vegetating State spreads it's Branches all round, almost horizontally, from the Top of the Root, near the Ground, as from a Centre: When it has perfected it's Seeds, it appears

Fig. 138.

of

of a hard woody Contexture; and as it grows dry, the Branches contract and curl themſelves up towards their Centre, ſo as to form a ſpherical Figure: in which State this Plant weighed 7 Drachms and a few Grains; but after having been ſteeped 2 Hours in luke-warm Water, it expanded it's Branches as you ſee; and it weighs now 13 Drachms, which is but one Drachm leſs than the double of it's former Weight in it's dry State: How much more Water then, or watery Juice, muſt it have contained in it's green and growing State? Fig. 139. Fig. 133.

§. 7. Some green Plants indeed contain more Juice than others, but almoſt in all of them, when pounded and ſqueezed, the Juice is found greatly to exceed the huſky or dry Part. This Exceſs of the Fluids in Vegetables is exceedingly remarkable in all the Succulent kinds, and is little or nothing leſs in living Animals, and recent Animal Subſtances; Experiments having ſhewn, that after Waſte or Expulſion of all the Fluids by Deſiccation, or Diſtillation, the remaining ſolid Parts appear to bear a very ſmall Proportion to the Fluids.

Corollary. Therefore the few rigid and leſs moveable Solids in all Animal and Vegetable Subſtances muſt in Action yield to, and be governed by, the Hydroſtatical and Hydraulic Laws of the Fluids, ſo plentifully contained in them; as that which has the greateſt *Momentum*, ariſing from it's Weight and Celerity, will in all Motions overpower what has leſs.

§. 8. This is in a good Meaſure remarkable in the *Heath Roſe* juſt now ſhewn, where the Force of the Fluids, tho' urged on by no other Power than the Attraction of it's ſmall Pores and capillary Tubes, was ſufficient to expand and extend the Branches, and Veſſels of which they are compoſed, from being Segments of leſſer to form Segments of much larger Circumferences of Circles, or other Curves; which no external Force can do, without breaking them to Pieces.

§. 9. This Experiment ſerves alſo to prove and illuſtrate, what I have advanced elſewhere, concerning the Power of the Blood propelled alternately by the Force of the Heart and Arteries into the Branches of the Blood-Veſſels, inveſting the Cavities of the Inteſtines and Veſicles of the Lungs, for forwarding the Diaſtole or Expanſion of theſe Cavities in the periſtaltic Motion and Inſpiration; to wit, by a Force in the Direction of the Tangents of the Arches of theſe Veſſels and Cavities, which is a Direction perpendicular to their centripetal elaſtic Contractions; as they appear in Draughts of the Inteſtines and Veſicles of the Lungs. See *Diſſ. de. Struct. & Motu Muſc.* Tab. II. Fig. 1, 2, 3. and Tab. V. Fig. 5.

§. 10. The third Property obſervable in Water is, that it is the Cement of Union of the ſolid Parts in all Animal, Vegetable, and Terreſtreous Subſtances. A Paradox, which nothing but Experience could render probable; to wit, that a fluctuating Body, whoſe Parts may be ſo eaſily diſturbed, diſplaced, or ſeparated, ſhould give Firmneſs, Hardneſs, Rigidity, and Stability, and prove a *Copula* of Union

to

to other Particles of a Mass, which could never unite among themselves without it. Yet this is obvious in making of Bricks, Mortar, and Figures in Plaister of *Paris*, and also in the Distillation and Calcination of all Vegetable and Animal Substances; where, after the total Expulsion of all the Fluids, nothing remains but incoherent loose Dust or Ashes, incapable of uniting again without a new Recruit of Moisture.

§. 11. The fourth Property of Water is, it's being the universal Dissolvent of all these very Substances, of which in the preceding Section it is observed to be the Cement. Which also at first Sight seems another Paradox; because to unite, and divide, are evidently two contrary Actions. I shall therefore in the Sequel endeavour to shew, how consistently they flow from one and the same Principle, acting by the same Instrument.

§. 12. The fifth very remarkable Property of Water and other Fluids is, that they are capable not only of an Alteration of Figure, or different Position of Parts, without the loss of Contiguity, as has been said already; but are also liable to have their Parts separated to small Distances by Expansion or Rarifaction, or to greater Distances by Evaporation or Dissipation; which is evident in Water, Spirit of Wine, Oil, Mercury, and all other kinds of Fluids exposed to the Fire, or Heat, of any sort. In which Circumstances they very forcibly, and in some Cases almost irresistibly, repel every moveable thing, that stands in the way of their Expansion or Evaporation, even to the Pitch of Explosion at the Places of least Resistance: as appears in the Æolipile and Fire-Engine.

§. 13. The Principles from whence this expansive Power and Repulse arise have been mentioned already. I shall now apply what has been said in this, and the former Lecture, towards a further Explanation of the universal Elasticity both of Fluids and Solids.

§. 14. 1*st*. It has been generally supposed, that when the solid Particles of an elastic Body are drawn out of Contact to some very small Distance by Extension, they have a Power of restoring themseles to their former Contacts again by their mutual Attraction; in which the Elasticity of compound solid Bodies has been said to consist. But if we may depend upon what is visible, we shall never see the dry solid Fibres or Particles of any solid Body, once divided or drawn out of Contact, coalesce or unite again, or recover the close Contacts they had before; without some fluid Medium superadded. And therefore if the least Fibre of a Bow, or other elastic solid dead Body, be once cracked or broken, the Rupture will always continue the same; and notwithstanding the Elasticity remaining in the other Parts of the Bow, by which the broken or divided Parts are brought again within the same Bounds of Vicinity through which this attractive Power is said to extend, nevertheless they do not again coalesce or cohere.

§. 15. It

§. 15. It is further observable, that if a Drop of Water, Oil, or Mercury, be divided into many lesser Drops, and placed at the least imaginable Distance from mutual Contact, they always remain distinct and disunited; but upon Contact they are absorbed into each other with a visible Rapidity, and become one as before.

Corollary. Therefore there is some Reason to conclude, That the Power of Attraction does not reach much, if at all, beyond Contact, either mediate or immediate; and that it takes Effect in Solids only by the Mediation of Fluids. Again, it is apparent, that within the Limits of Contact it is very sensibly strong in Fluids.

§. 16. This Quality in Fluids with their Capacity of Change of Figure, or Disposition of Parts in the Mass, to every imaginable Shape, without a Solution of Continuity or Contiguity; and with a Power of returning to their pristine Figure, or Disposition of Parts, within their former Surface again, when left to themselves; these Qualities, I say, are sufficient to establish Elasticity as a natural and essential Property of Fluids, not discoverable in pure or simple Solids, without their Mediation or Assistance.

§. 17. For by what has been said of solid Bodies, when destitute of all Humidity, or deprived of all their Fluids, it appears evidently, that none of the aforesaid Qualities can belong to them; and therefore as Solids they can have no Elasticity of their own, nor any Degree of it, but what is borrowed from the Fluids they contain. An Instance of this is in the Artery before you, whose Elasticity while recent and moist was shewn before in the first Experiment; but being now dried is neither capable of Extension or Distention, but remains rigid and contracted, until it be steeped again some Hours in Water, by which it will recover it's former Elasticity.

§. 18. If Elasticity therefore resides solely in Fluids, and only by their Intervention in Solids, we are now to consider how, and with what Force, or *Momentum*, it acts there.

§. 19. Elasticity then, at least in Animal and Vegetable Substances, being an essential Property of their Fluids, and of them only, the Laws of Elasticity and Hydrostatics must be the same, these last arising from the Nature of Fluids, as well as the first; and there can be no Incongruity, Contradiction, or Inconsistency in the same Nature or Essence: therefore the known Hydrostatical Laws will give us the Laws of Elasticity, which must take place equally *in minimis ut in maximis*, in a Drop of Water as in the Ocean.

§. 20. It is a general Law in Hydrostatics, that the Pressure of Fluids is in Proportion to their Altitude or Height, and the Surface against which they press; and not in Proportion to their Breadth.

§. 21. Another general Law is, that in the same Altitude they press equally in all Directions, or *quaquaversum*.

§. 22. From these 2 general Laws arises another special one, which is commonly called an Hydrostatical Paradox: to wit, that a Cylinder

of Water of any given Height, communicating with a Veſſel ſet under it of any given Diameter larger than it's own, and full of the ſame Fluid, preſſes upon the Bottom, Sides, and Cover of that Veſſel, with a Force equal to the Weight of a Cylinder of Water of the Height of that Cylinder, and of the Diameter of the underſet Veſſel; and, if the Veſſel be diſtenſile, it will diſtend it, or inlarge it's Cavity by all that Force; which may be indefinitely greater than the Weight of the whole Water, contained both in the Veſſel and in the Cylinder: which mechanical Diſpoſition of the Fluid produces a great Multiplication of Power, in Proportion to the Height of the Cylinder, and Breadth or Diameter of the communicating underſet Veſſel.

§. 23. Let us then only for the preſent ſuppoſe, what ſeems highly probable, that the Pores and Interſtices, at leaſt, of Solid, Animal, and Vegetable Bodies are round, as their Veſſels are known to be cylindrical; and that the Water every Drop of which tends naturally to Sphericity, being attracted into them, is lodged there in ſmall *Spherules* or *Cylinders*; this being the contracted Shape, which they naturally take, as comprehending moſt Matter within the leaſt Surface. Now if the ſolid Body, containing them in it's Pores or Veſſels, be drawn, bent, or extended to a larger Surface, containing the ſame quantity of Matter, the Fluids in it muſt yield to that Force; and therefore each Drop muſt take ſome Figure different from that of a Sphere, or become a Cylinder of a leſſer Diameter; that is, it's Surface muſt be extended or expanded, ſo as to become an oblate or oblong Spheroid; or it muſt take ſome other Figure different from that of a Sphere, and adapted to the Figure, which the Pores and Interſtices of the Solids or the Veſſels themſelves are reduced to by the Extenſion. But ſo ſoon as the bending or extending Force ceaſes, and the whole ſolid Body is left to itſelf, the Particles of each Drop will endeavour to recover their *Æquilibrium* about their peculiar Centres, whereby they recover their Sphericity, or Contraction, again into the leaſt poſſible ſpherical or cylindrical Space; by which the Reſtitution in every Part, and therefore of the whole, is performed, the contiguous Solids yielding to, and conſpiring with, the *Momentum* of the Fluids in this Action.

§. 24. But for the ſake of Illuſtration only, let us again ſuppoſe a thing leſs probable: to wit, that by the Extenſion of the containing Solid a Part of each diſtinct Drop ſhould be raiſed beyond the Surface, in the ſhape of a ſmall Cylinder, by which the Diameter of the Drop would be leſſened; this ſmall Cylinder then would preſs towards the Centre, and all Sides of the Drop, with the ſame Force mentioned in *Section* 22; and in the Reſtitution the Diameter of the Drop would increaſe proportionally, as the Length of the Cylinder in it's Deſcent or Acceſſion towards the Centre of the Drop decreaſed: therefore it would deſcend or accede to that Centre by a Motion uniformly accelerated; as in Gravity. And in this view we have Gravity and Elaſticity ariſing from one and the ſame Principle.

§. 25. But

§. 25. But the ſame Argument will hold, and the ſame Concluſion will follow, upon the other more probable Suppoſition: to wit, if by the Extenſion of the ſolid containing Body, mentioned before, each diſtinct Drop be ſuppoſed to be drawn from it's Sphericity into an oblong Spheroid, or preſſed to the Form of an oblate one; for the Reſtitution in both Caſes will produce the ſame Effect from the ſame Hydroſtatical Principles, ſince whatever Part of the Fluid is extended beyond the Bounds of it's former ſpherical Surface, will thereby have an increaſed Preſſure towards the Centre, ſuch as the Cylinder has been ſaid to have, or in ſuch a *Ratio*: becauſe the Rays terminating in the uncompreſſed Parts of the Surface of the oblong or oblate Spheroids of Fluids, are lengthened by the new Acceſſion of Particles from the compreſſed Sides, by which the Preſſure towards the Centre in ſuch lengthened Lines will be increaſed, in Proportion to their Lengths; and the ſhorter Diameters of each *Spheroid* will be proportionally lengthened, as theſe Lines in acceding to the Centre are ſhortened: that is, the Particles, which lie in the Direction of the longer Diameters of the *Spheroid*, in the Reſtitution will accede towards the Centre, with a Motion uniformly accelerated, as in Gravity. The ſame will be true of a Cylinder, whoſe Diameter is ſhortened, and it's Axis lengthened, by the Compreſſion or Extenſion.

Corollary. Therefore the Laws of Gravity, Hydroſtatics, and Elaſticity, are probably the ſame, and ariſe from the ſame Principle of central Attraction, only diverſified in almoſt an Infinity of *Phænomena* both natural and artificial, by the Diverſity of Centres, Circumſtances, and different Qualities of the Bodies acted upon.

§. 26. And this Concluſion ſeems to be corroborated by the VIth Experiment made at laſt Meeting, on Water, Oil, and Mercury, in which it was apparent, that the centripetal Force of theſe diſtinct Fluids differed one from another in the Proportion of their ſpecific Gravities. The Drop of Mercury, as the heavieſt, formed the moſt perfect Sphere about it's own Centre, and the leaſt; the Drop of Water, though ſpherical, touched the Plain in more Points; and the Oil, though it's upper Surface was ſpherical, lay much flatter on the Plain, forming as it were a Section of a ſmall Sphere. Therefore the centripetal Force in each was proportional to it's ſpecific Gravity; which ſeems to ſhew, that it flows from the ſame Principle, acting on the ſame Subject always with the ſame Degree of Force, only on each Species to a different Centre with a different Degree of Force or *Momentum*; whereas, if the centripetal Force in each of theſe Drops did ariſe from ſome other Principle than that of Gravity, it might be ſtronger in the lighteſt than in the heavier Fluids. For as Gravity is a Power which acts equally on all Bodies in the *Ratio* of their Contents, if this centripetal Power, being equal in all Bodies, was in ſome other *Ratio* or Proportion, than that of their Contents; then it would act moſt ſtrongly and ſenſibly on the lighteſt Fluid, whoſe Gravity

and Contents could least resist it's Force: And therefore the Drop of Oil would form a perfecter Sphere, than the Mercury; the Reverse of which appeared in the Experiment.

§. 27. Another Thing that I would suggest from the Experiment is, that if a Drop of each of these 3 Fluids could be taken equal one to another in Weight, the Cubes of the Diameters of the Spheres formed by them would be one to another reciprocally as their specific Gravities; in the same Manner as the Spaces they take up in the same cylindrical Vessel are reciprocally as their specific Gravities. Which confirms the former Conclusion, that this centripetal Power in Fluids, and therefore their Elasticity arising from it, does not differ from Gravity, and is governed by the same Laws; producing a Motion uniformly accelerated, as in the Descent of heavy Bodies.

Corollary. Therefore the Laws of Gravity, Elasticity, and Hydrostatics, are the same; and arise from the same Principle.

Having thus endeavoured to prove, that Water and watery Fluids are not only elastic themselves, but also the immediate Cause of the Elasticity of all Animal, Vegetable, and Terrestrial solid Substances, of whose Composition they make a very considerable Part; it is now incumbent to shew, how it's other seemingly contrary Properties, formerly mentioned, are reconcileable one with another, and also with this essential Property of Elasticity: Particularly how Water and watery Fluids can prove the Cement, and likewise the Dissolvents of Animal and Vegetable, and also of many Terrene Bodies: Or can become the Causes of so very different and even contrary Effects, as to unite and divide the Parts of the same Subject; and this by that single Property of central Attraction.

In order to the easier Illustration of this, I would offer the following Propositions, which are either evident of themselves, and universally acknowledged, or founded upon Experiments, or proved in this and the preceding Lecture.

Prop. I. There is a natural centripetal Power in Water, and indeed in all other Fluids, by which every distinct Drop, or certain small Quantity, left to itself, gains and retains an exact Sphericity. This I hope has sufficiently appeared by the Observations and Experiments already made.

Prop. II. The Degrees of the Intensity of Powers propagated in Rays from a Centre, or impelled in a contrary Direction towards the Centre, are found to be reciprocally, as the Squares of the Distances from the Centres of the respective Spheres of their Activity.

Cor. Therefore as Water appears to have such a centripetal Power, it follows, that the extreme or superficial Particles of the smallest Drop of Water press towards one another, and towards their common Centre, more strongly, than the superficial Particles of a larger Drop, or of the same Drop, augmented to a larger Size by the Accession of more Water.

Prop. III.

Prop. III. There is an univerſal Impenetrability in Matter, ſo that one Quantity cannot take place, without diſlodging another of equal Bulk or Surface.

Prop. IV. And in this Action, that which has the greater *Momentum* will overcome or diſplace that which has leſs.

Prop. V. The Quantity and Celerity, or *Momentum*, of a Fluid in Motion may be ſuch, as to overcome the Reſiſtance of Solids at Reſt.

Prop. VI. Water and other Fluids in Contact with Solids, acquire a Degree of Motion by Attraction into their Pores, capillary Tubes, and Interſtices, even to their innermoſt Receſſes, ſo as to ſwell, extend, or expand them. Inſtances of this were ſhewn in the *Roſe of Jericho*, and in a human Artery.

Prop. VII. And the Degree of Attraction of the ſame Species of Fluids into the ſame Kind of Solid being always equally the ſame, the Celerity of the Motion ariſing from it will alſo be always the ſame. Therefore the Increaſe of the *Momentum* of the Fluid in this Action muſt ariſe from the Increaſe of the Quantity of the Fluid ſo abſorbed; which may therefore be accumulated not only to the Pitch of Extenſion, Expanſion, and Softneſs, but even to a perfect Solution. Which all Obſervations confirm.

§. 28. Theſe Propoſitions being admitted, it will appear, that the Coheſion of Solids in their various degrees of Hardneſs, Solidity, Rigidity, or leſs ſenſible Elaſticity, manifeſt Elaſticity and Softneſs; and alſo their perfect Solution, even to the State of Fluidity, do all ariſe purely from the different Quantity of Water, or other Fluids, lodged in their Pores, or between their ſolid Particles.

§. 29. Thus the incoherent Duſt of dry Clay, and fine Gravel, by a conſiderable Quantity of Water added in making of Bricks, become a ſoft ductile kind of Paſte, *Prop.* VII. but by loſing a great deal of this Moiſture in drying, or baking, becomes a hard ſolid Maſs. In which nevertheleſs a conſiderable Quantity of Water ſtill remains in diſtinct Drops, leſſened in their Size by the Evaporation, and therefore having their remaining Particles more ſtrongly attracted to their reſpective Centres, and one to another; and conſequently producing a ſtronger Adheſion of the contiguous ſolid Particles to the Pitch of Hardneſs, Rigidity, and a leſs ſenſible Degree of Elaſticity. As in *Cor. Prop.* II.

§. 30. This alſo appears for the ſame Reaſon in dried Lime-Mortar, and Plaſter of *Paris*; and muſt be the ſame in the natural Concretions of common Stones, Marble, *&c.* in all which the Moiſture has been by Degrees evaporated to their ſpecific Pitch of Hardneſs. And hence it is that all Quarry Stones, by being expoſed to the open Air for ſome Time, become gradually harder, than when they were cut out of the Quarry.

§. 31.

§. 31. But when the remaining Moisture is farther or totally expelled by the Force of Fire, they return to their original incoherent Dust, dry Powder, or Lime.

§. 32. So that the Cohesion of Parts in Solids of this Kind to the Pitch of Hardness, Rigidity, or less sensible Elasticity, arises from the Smallness of the Spherules or Drops of Water interspersed in their Pores; which makes them less capable of Extension, Dilatation, or sensible Elasticity. See *Cor. Prop.* II.

§. 33. The same appears in dry Wood, and other vegetable solid Substances; and in the dry Bones, Horns, and Nails of Animals; whose Hardness or Rigidity is owing to their Deficcation, or to the Evaporation of a certain Proportion of their Moisture; the remaining small Portion making the Solids in them cohere more strongly, for the Reasons mentioned in the same *Prop.* II.

§. 34. And when this Remainder is also expelled by the Force of Fire, having lost the *Copula* of Union, they fall to Dust and Ashes.

§. 35. Or if the Proportion of Water be greatly increased by Infusion, Maceration, or Decoction, they are brought to a Softness or Solution by the *Momentum* of the increased Fluid. As in *Prop.* VII.

§. 36. This is farther evident in the making Glue of the dry Skins of Beasts, and of Fishes; and Paste of Starch; whose agglutinating Quality is owing solely to the Proportions of Water absorbed, or intermixed by Infusion, Maceration, or Decoction.

§. 37. Again, a certain greater Proportion of Water or watery Fluids, than is found in these dry Substances mentioned above (observable in the green Twigs and Branches of Trees, and other Vegetables; and in the fresh Arteries, Veins, and other recent Parts of Animals) produces a sensible Elasticity, easily to be brought into Action; because the larger Molecules or Drops of the interspersed Fluids by a lesser or weaker *Nisus* of their extreme Particles one to another, and to their respective Centres, admit an easier Change of Figure in the Bending or Extension, and thereby gain a more sensible Motion in their Restitution. That is, by this greater Proportion of Fluids in their Pores and Vessels, they become more sensibly elastic. As in *Cor. Prop.* II.

§. 38. But if this Proportion of Fluids be farther increased, all these Substances become soft and pulpy, and thereby lose their Elasticity; because the interspersed Molecules of the Fluids are now so large, that the Particles of their extreme Surfaces, contiguous to the solid Parts of the Compound, are less attracted towards their Centres, and therefore upon Change of Figure are incapable of restoring themselves. That is, by a redundant Moisture their Elasticity is lost, and they become soft; they fall into a degree of Solution, or the lowest degree of Fluidity. See *Prop.* VI. and VII.

§. 39. And if this Proportion of Fluids be yet more or greatly increased, the Solid is completely dissolved, (See *Prop.* III. V. and VII.)

VII.) it's ſolid Particles being repelled, or driven aſunder by the Interpoſition of a copious Fluid, as by ſo many Wedges ſucceeding one another, increaſing in Bulk, and impelled by Attraction, the prime Spring of Motion in all Solutions, Fermentations, and Putrefactions; but as this opens a very large Field of Diſquiſition, which would lead us too far from the Purpoſe of theſe Lectures, it muſt therefore be left to ſome other Opportunity.

§. 40. Thus the ſeemingly contrary or repugnant Properties of Water and other Fluids in cementing and diſſolving, hardening and ſoftening, as well as communicating Elaſticity to Solids, are reconciled; as ariſing from the ſame Principle of central Attraction, producing different and even contrary Effects, by it's different Degrees of Force, in different Proportions of the Fluid.

§. 41. By which it alſo appears, that there is no ſuch Principle in Nature, as a centrifugal Power: But that Repulſe (at leaſt in all theſe *Phænomena*) ariſeth from the Principle of central Attraction in the Reſtitution to Equilibration; and from the Impenetrability of Matter; and the ſuperior *Momentum* of an increaſed Fluid, forced into Action by the ſame Attraction: And therefore that it is no natural Principle, but a forced Effect, which was to be proved. See *Prop.* III. IV. V. VI. VII.

Lecture III.

This Lecture, which is to be the laſt for this Seaſon, contains an Explanation of Exp. V. and a ſhort Abſtract of a general Scheme of Muſcular Motion, which may lead us, without wandering from the Purpoſe of theſe Lectures, through the whole Animal Œconomy: In which the Principle of Elaſticity, which I have been endeavouring to explain in the former Lectures, bears ſo great a Share, as it does indeed in other innumerable and ſurprizing *Phænomena* of Nature; the centripetal Power, from whence it ariſeth, ſeeming to be, next to immaterial Impulſe, the inexhauſtible Source of all Motion in the Univerſe.

The Manner, Explanation, and Uſe of Exp. V. Fig. 143.

1*ſt*, This Experiment is performed by ſuſpending a live Frog by the fore Legs in a Frame, or in any other commodious Manner, Fig. 143. when having cut off the Head from the firſt Vertebre of the Neck with a Pair of Sciſſars, a ſmall Probe, the Button at it's Extremity being firſt filed flat, is to be puſhed very gently down upon the upper Extremity of the *Medulla Spinalis*, in the firſt Vertebre of the Neck; upon which the inferior Limbs, which hung down looſe, will be immediately contracted, as they appear in Fig. 144. The ſame Probe puſhed gently through the Hole of the Occiput of the Skull on the *Medulla Oblongata*, will make the Eyes move, and ſometimes the Mouth to open.

Fig. 144.

2*dly*, The ſame being repeated at ſome ſmall Interval of a few Seconds, ſucceeds for ſeveral Times in the ſame Manner; until the Extremity of the ſpinal Marrow be either puſhed down too far out of the reach of the Probe, or contuſed by it, which laſt Effect appears

soonest on the *Medulla Oblongata*: But after this the Experiment will not farther succeed, the Compression then ceasing to be equal or uniform.

Observations on this Experiment

Obs. 1. It must be observed, that this Experiment succeeds better in the Summer Months some Time after the Frogs have spawned, than it does early in the Spring, or in Winter when those Creatures are almost dead by Cold, and want of Food.

Obs. 2. The Interval of a few Seconds in repeating this Experiment on the same Frog, seems to be necessary for recovering the Equality of the Circulation, which was disturbed by the immediate preceding Convulsion, as it throws the Blood violently out of the Muscles in the Time of their Contraction, or Systole, which cannot be restored immediately in such a languid State of Circulation, as this Experiment must bring on; and as the Assistance of the Blood will appear by the following Scheme to be necessary to Muscular Motion, where it is deficient, the Motion must also be defective or imperfect, as it appears in repeating the Pushes too quick.

Obs. 3. As the inferior Process of the Brain, called the *Medulla Oblongata*, and it's Continuation called the spinal Marrow, are only a continued or prolonged Collection of the Nerves arising from the Brain and *Cerebellum*; by this Experiment it appears, that the Nerves contribute remarkably to Muscular Motion; and that their Assistance in it is owing to the Fluid they contain, I have endeavoured to prove, by shewing the Non-Elasticity of the Nerves in the first Experiment.

Obs. 4. The Motion here excited is in the Muscles of voluntary or spontaneous Motion, which are under the command of the Will.

Obs. 5. The Effect of the Impulse by the Probe is the same, which is or may be produced in these Muscles by the Mind or Will; or is the very same in it's Manner as voluntary or spontaneous Motion, and performed by Mediation of the same Instruments, to wit, the Animal Spirits, or Fluid of the Nerves, and the Muscles of voluntary Motion.

Obs. 6. The Extremity of the Probe applied in this Experiment being flat, cannot produce this Effect by Irritation, but by Compression; and the Compression of the pliable Extremities of Tubes full of any Fluid, must depress or propel the contained Fluid towards the lower or opposite Extremities, with an increased Degree of Velocity. Therefore at least the Beginning of this Motion may be justly ascribed to a Propulsion of a small Quantity of the contained Fluid, through these slender Canals into the Muscles, in which they terminate, with some greater Degree of Velocity, and in some greater Quantity than usual. Whence we may conclude, that voluntary Muscular Motion in a living Animal is begun in the same Manner, by an Impulse of the Mind or Will on the Animal Spirits through the Nerves, into the Muscles.

Cor. And

Cor. And as the Quantity of Animal Spirits propelled into the Muſcles in this Experiment muſt be ſuppoſed very ſmall; it follows, that the Waſte of this Fluid, by moderate voluntary Motion in Life, is very inconſiderable, or little more than what ariſes from the common Courſe of the Circulation, moderately promoted by eaſy Exerciſe, and uſeful for Health.

Obſ. 7. In the following ſhort Abſtract of a general Scheme of Muſcular Motion, the Structure of a Muſcular Fibre is ſuppoſed veſicular, with a reticular *Plexus* of Blood-Veſſels inveſting each Veſicle; which is confirmed by an univerſal Analogy in the Structure of all the moving Parts in the Animal Œconomy, viſible in the Heart, Lungs, Stomach, Inteſtines, urinary Bladder, *&c.* whoſe Motions conſiſt in an alternate Syſtole and Diaſtole. Therefore the Nature and Manner of the Muſcular Motion produced in this Experiment muſt be the ſame, while the Heart continues to beat, and the Blood to circulate in the Limbs, in the ſame Manner, though not with the ſame Force, as before the Experiment. Which will be farther explained in the following Scheme.

An Abſtract of a general Scheme of Muſcular Motion. See Diſſ. de Struct. & Mot. Muſc.

The Order of accounting for Muſcular Motion conſiſts in aſſigning, 1. The Principles. 2. The immediate Cauſe or Cauſes. 3. The Inſtruments. 4. The manner of Action, or *Modus*. 5. The Effects of it.

1. The Principles or Sources of all Motion whether Natural or Artificial, are only two; Impulſe, and centripetal Power.

2. Original Impulſe, and therefore every new Motion, muſt ariſe from ſome immaterial Being, as it's immediate Cauſe. *Diſſ. de Struct. & Motu Muſc. Cap.* 1.

3. Impulſe, as the Beginning of every new Muſcular Motion, is in the Power of the Mind or Will, which muſt therefore be an immaterial Being. *Diſſ. de Struct. & Motu Muſc. Cap.* 2. 5.

4. Centripetal Power, or the Power of Contraction, is the moſt univerſal Principle in Nature, producing Repulſe; and is properly the Elaſticity of the Inſtruments in Muſcular Motion.

Schol. 1. Inquiries into the intermediate Cauſe or Cauſes of this univerſal centripetal Power, of which Elaſticity is only one Branch, are not to be dropt, or neglected; but after all our Reſearches and Diſcoveries we ſhall be forced at laſt to acknowledge, that at the Origin of the Chain of Natural Cauſes, in all it's real or imaginary Length, there muſt be an omnipreſent and immaterial Agent as the prime Cauſe.

Schol. 2. In the mean Time, in many *Phænomena* of Nature it is much to be doubted, whether that Chain be ſo long as is generally imagined; and whether God himſelf be not the immediate, acting, ubiquitary Cauſe of centripetal Power; which ſeems to be the immediate Cauſe of all the *Phænomena* of Nature; the indefinite Variety of them appearing to ariſe only from the different Structure of the Ma-

chines or Inſtruments, and other Circumſtances of Action. And it is evident, that all thoſe *Phænomena*, which by ſome of the ancient Philoſophers have been attributed to a *Fuga Vacui*, ariſe from a perpetual *Niſus* to Equilibration, the ultimate Aim of Nature, and the immediate Effect of this centripetal Power.

And though this univerſal centripetal Power was to be admitted as the *ne plus ultra* in the Line of Cauſes or Principles, (which I do no ways pretend to determine) and was to be reſolved into the immediate and ubiquitary Agency of God as the prime Mover; this would nevertheleſs be far from putting an end to all further Diſquiſitions, or Inquiries in Natural Philoſophy; as ſome may have inadvertently apprehended: For there would be ſtill an almoſt infinite Work behind, for exerciſing all the Faculties of the Mind, in explaining the innumerable Varieties of the *Phænomena* or Effects ariſing from this Principle. We ſhould ſtill be far from knowing all it's Laws of Motion, all the Degrees of it's Force, and the indefinite Variety of it's Directions in the innumerable Productions of Nature, with all their various Structures; which would ſtill remain the inexhauſtible Subjects of Inquiry in Natural Philoſophy; by unfolding of which, ſhe would not only nominally, but really, become the Miſtreſs of all Arts and Sciences; the former being only Imitations of the Works and Deſigns of Nature, and the latter the Doctrine or Explanations of the ſame Works, whether Phyſical or Moral. But to return from this Digreſſion.

5. The univerſal Inſtrument of all Animal Motion is a Muſcle. *Diſſ. Cap.* 3.

6. No other Veſſels are obſerved to enter into, or to make a Part of the Compoſition of a Muſcle, but Nerves and Blood-Veſſels; therefore a Muſcle, or the compound Inſtrument of all Animal Motion, muſt be made up of theſe only. *Diſſ. Cap.* 4. *& Concluſ.*

7. The Nerves are not elaſtic, but ſerve to convey an aqueous Fluid, called the Animal Spirits, from the Brain, *Cerebellum* or ſpinal Marrow, to the Muſcles. *Diſſ. Cap.* 5, 6. Which Fluid is the immediate Subject of Impulſe, or the immediate Inſtrument of the Mind for beginning Muſcular Motion. As appeared by Experiment V. made on a Frog.

8. The Blood-Veſſels and Blood are elaſtic; whence the centripetal Power, or Contraction and Repulſe in Muſcular Motion. *Diſſ. Cap.* 6.

Fig. 140. 9. The external Diſtribution of the Nerves and Blood-Veſſels to the antagoniſt Muſcles formerly exhibited ſhews, that each Antagoniſt has it's diſtinct Nerve or Nerves without Communication; but the antagoniſt Muſcles communicate one with another by one common Trunk of an Artery, and one common Trunk of a Vein: So that they are like two antagoniſt Scales *in Æquilibrio*, over which the Mind has a diſtinct Power by diſtinct Nerves for determining the Animal Spirits, and thereby the Blood, to either ſide at pleaſure, without affecting the other.

10. The

10. The internal Diſpoſition of theſe Veſſels in the Compoſition of this Inſtrument is taken from the univerſal Analogy, viſible in all the moving Parts of the animal Machine: To wit, the Heart, Lungs, Inteſtines, Urinary Bladder, *&c.* wherein ſuch a Structure appears to the naked Eye, as gives us the following Idea of the ſmalleſt Muſcular Fibre, deſcribed in *Diſſ. Cap.* 8. that is, *a nervous Fibre produced from it's Entrance into the Muſcle along or in the Axis of each carnous Fibre, in the Form of a Chain of diſtenſile Veſicles, whoſe Sides are covered with a Net-Work of elaſtic longitudinal and tranſverſe Blood-Veſſels; the Extremities of all theſe Nerves compacted forming the Tendon, which being ſpread out or expanded again, forms the* Perioſteum. See Fig. 2. and 3. Tab. 2.

11. By the naked Eye, or with the help of a Microſcope, this ſmalleſt Muſcular Fibre appears of the ſame blood-red Colour, and of the ſame Shape or Figure with the whole Muſcle, whence it is taken; and the whole Muſcle of voluntary Motion is no more than a Faſcicle or Bundle of ſuch ſmall Muſcular Fibres: Therefore it's Action can be nothing elſe, than the joint Action of all theſe. *Introd. to Diſſ. Page* 1, 2.

12. But the Action of the whole Muſcle by Dr *Gliſſon*'s Experiment, appears to be only an alternate Diaſtole and Syſtole: And therefore, by what has been ſaid in the laſt Paragraph, there muſt be ſuch a Diaſtole and Syſtole alternately in each of theſe ſmall carnous Fibres of which it is compoſed. *Diſſ. Exp.* 1. *Cap.* XI.

13. And by Exp. V. already mentioned on a Frog, it appears, that a very ſtrong Muſcular Motion may be eaſily excited by a very ſlight Impulſe through the Nerves.

14. But ſuch an eaſy Production of Motion is not conceiveable, without the niceſt Equilibration of all Parts of the Machine moved.

15. Therefore a Statical Equilibration of the Antagoniſt Muſcles of each Limb is deſcribed, and delineated in *Diſſ. Tab.* 4. ſhewing the Equilibration of their Elaſticity.

16. And a Hydroſtatical Equilibration of the Fluid of the Nerves is deſcribed and figured in *Diſſ. Tab.* 5.

17. Now Equilibrated Bodies may be eaſily moved, by adding or diminiſhing the leaſt imaginable Force of either Side; but if what is taken from one be added to the other, the *Momentum* of the Motion will be doubled, without the Loſs or Expence of what is taken away, *Diſſ. Theor.* 19, 20. which is the Caſe in Muſcular Motion, in it's Progreſs from utmoſt Extenſion to final Contraction; as will appear in the Sequel.

18. We are now to ſhew how eaſily a very ſtrong Motion may be excited, and carried on in a Machine of this Fabrick, whoſe Parts are in ſo juſt and accurate an Equilibration.

19. Previous to which it may be neceſſary to remove the following Objection or Difficulty, which occurs in *Diſſ. Cap.* 10. where it appears,

that the Power of abſolute Elaſticity in the Muſcles greatly exceeds the utmoſt Force of Impulſe in the Power of the Mind. But the Statical Equilibration of that Elaſticity, and the Hydroſtatical Equilibration of the nervous Fluid mentioned before, take off all Reſiſtances, that would elſe be in the Way of that Impulſe, by which it becomes ſufficient for the Purpoſe, ſo as to be able to begin Muſcular Motion; which is carried on in the following Manner.

20. The whole Progreſs of Muſcular Motion is from the State of utmoſt Extenſion, through the States of Relaxation, Equilibrium, complete Inflation or Diaſtole, to the State of ultimate Contraction or Syſtole. In all which Courſes from the firſt Term to the laſt each veſicular Fibre ſhortens it's Axis; and therefore draws the Limb affixed into Flexion, or Extenſion, at the Pleaſure of the Mind. *Diſſ. Tab.* 4.

21. The Mind can act upon the Muſcular Fibres in any State, but that of ultimate Contraction, which is the Termination of the Progreſs of Muſcular Motion; as the beginning of it is from the State of utmoſt Extenſion. *Diſſ. Cap.* 10.

22. In the State of utmoſt Extenſion then, the longitudinal capillary Blood-Veſſels on the Surface of each Veſicle in the Fibres muſt be extended, and therefore their tranſverſe Diameters muſt be leſſened: That is, theſe Veſſels thereby become ſtraiter, and the Circulation in them therefore more difficult; and in this State alſo the tranſverſe Blood-Veſſels of each Veſicle will be forced into ſerpentine Flexures, which muſt render the Paſſage of the Blood through them ſtill more difficult. *Diſſ. Cap.* 9.

23. In this, and all other States of the Antagoniſt Muſcles, both the Statical and Hydroſtatical Equilibration, mentioned above, take place to ſuch a Degree, as to remove all Reſiſtances, that would elſe be in the Way of any ſupervening Impulſe. *Diſſ. Cap.* 10.

24. Therefore if the Mind impels but a very little more of the nervous Fluid than uſual, through the ſlender Tubes of the Nerves, into theſe extended Veſicles, they will be uniformly dilated as in the known Experiment of the Water-bellows. *Diſſ. Cap.* 9. and *Th.* 22.

25. By this Diſtenſion of the Veſicles their Axes being ſhortened, and their Diameters lengthened, the longitudinal capillary Veſſels on their Surface muſt be ſhortened, and thereby their Diameters enlarged; and the ſerpentine Flexures of the tranſverſe Veſſels will be extended; which in both Kinds will leſſen the Reſiſtance they gave to the tranſit of the Blood, which both by the Diaſtole and Syſtole of the Arteries is continually urged on to it's Paſſage through them; and being thus facilitated, every globule of Blood in it's Progreſs, by endeavouring to fly off by the Tangents of theſe Veſſels and Veſicles, tends to expand them more, and thereby opens the Way for the further and eaſier influx of the nervous Fluid; to which the Blood-Veſſels contribute as ſo many elaſtic Levers acted upon by the Blood in it's Progreſs. Thus by the aſſiſtance of theſe three Powers, of the nervous Fluid, the Blood, and

and Blood-Veſſels, the Progreſs from Extenſion to Inflation or Diaſtole of the Veſicles is made, with ſuch a Degree of Celerity as the Will commands. *Diſſ. Cap.* 9.

26. The Muſcle is at that Time tumid and enlarged by the Afflux of the nervous Fluid and Blood, which increaſes it's Bulk.

27. The Mind may keep up this Inflation, as long as it pleaſes, only by impelling conſtantly ſuch a ſmall Quantity of the nervous Fluid into the diſtended Veſicles, as is ſufficient to ſupply the uſual Expence of them in their common Courſe.

28. But if the Mind deſiſts to ſend in this Recruit, or ſuſpends it, then theſe Circular or arched elaſtic Veſſels now turgid with elaſtic Blood, whoſe Areas have been thus forcibly enlarged, endeavour to contract themſelves every way towards the Centres of their Areas, which are the Centres of the Veſicles; and, the Mind giving no reſiſtance, this *Niſus* takes place to the complete Contraction of each Fibre; by which the Limb affixed is brought into complete Flexion or Extenſion, according as this or the other Antagoniſt has been acted upon. *Diſſ. Cap.* 9.

29. In this State the whole Muſcle becomes ſhorter, and leſs in all it's Dimenſions; harder and paler by Expulſion of a great part of it's Fluids through the Veins towards the Heart, and through the Extremities of the Nerves into the Tendon and *Perioſteum*. And ſuch are the viſible *Phænomena* of this and all other moving Parts of the Animal Machine.

30. It may be imagined, that ſuch Interruptions of the Courſe of the Blood in the Capillaries of the Arteries and Veins, and ſuch uncertain ſubſultory Changes in the Figure of the Parts as have been deſcribed, might interrupt the regular Circulation of the Blood, and thereby diſturb the Motion of the Heart; which is not obſerved to happen by moderate Exerciſe. But this Difficulty is removed by conſidering, that the whole is carried on in extenſile and diſtenſile Blood-Veſſels, communicating one with another, and therefore what cannot be received into one is immediately communicated to, and eaſily received by the other, and by it forwarded in it's return to the Heart, in the ſame Time and Quantity, as if the Paſſages through all the Veſſels were equally open, and paſſable. Therefore though an Acceleration does ariſe in all Exerciſes, yet an Irregularity of the Circulation in a healthy Perſon is not obſerved to happen by any Degree of Exerciſe. Fig. 140.

What I have here briefly recited, I have at large endeavoured to explain in a *Diſſertation* on this Subject lately publiſhed, with ſeveral Figures annexed for Illuſtration of the Whole; by which, I hope, the Principles, Cauſes, Inſtruments, manner of Action, and Effects, in which the *Ratio* of Muſcular Motion conſiſts, have been pointed out from Anatomy, Mechanics, Hydroſtatics, Obſervations, and Experiments.

periments. To which, for the sake of Brevity, I have every-where referred.

The Proof and Illustration of this general Scheme will appear in the Application of it, for explaining the various Functions of the Animal Œconomy; which may naturally become the Subjects of some future Inquiries towards answering the Intention of the worthy Founder * of these Lectures.

Explanation of the Figures.

Fig. 137. Contains a Nerve, Artery, and Vein, of a human Subject, which before Excision were all of equal Length with a piece of Twine applied to measure them. *A.* The Nerve after Excision, continuing of the same Length as it was in the Body; to wit, equal to the Twine *B. B.* The Twine or common Measure of all the Vessels before Excision. *C.* The Artery, which in the Body was of the same Length with the Nerve and Twine; but being cut out and left to itself shrinks, or contracts, to the Loss of $\frac{2}{8}$ of it's Length; as those of Dogs lose about $\frac{1}{8}$. *D.* The Vein, which was equal to the Nerve and Twine in the Body; but being cut out and left to itself shrinks, or contracts as much as the Artery, though not with the same Degree of Force. Hence it appears that the Arteries and Veins are evidently elastic, and that the Nerves have not the least apparent Elasticity. See *Exp.* I. Lect. I.

Fig. 138. Fig. 138. *A.* The *Rose of Jericho*, expanded by being steeped two Hours in Water, weighing 13 Drachms, and resembling it's State of Growth in the Ground.

Fig. 139. Fig. 139. The same dry and contracted, weighing 7 Drachms and a few Grains.

Fig. 140. Fig. 140. Contains the antagonist Muscles of a human Arm, placed at a little more than their natural Distance, with the Nerves, Arteries, and Veins, distributed to them in their natural Situation and Order. *A. A. A.* The Muscle *Biceps*, one of the Flexors or Benders of the Cubit or Fore-Arm. *B. B. B.* The internal brachial Muscle, another Flexor or Bender of the Fore-Arm. *C. C. C. C.* The external brachial Muscle called *Triceps*, an Extensor of the Fore-Arm. The Muscle called *Anconaeus*, another Extensor of the Fore-Arm, is hid here. *D.* The common Trunk of the branchial Artery, distributing the Blood by it's Branches to all these antagonist Muscles on each Side of the Arm; red, expressed by the Lines thus ||| as in Heraldry. *E.* The common Trunk of the Vein, through which the Blood brought back from the Muscles on each Side returns towards the Heart; blue, expressed as in Heraldry thus ≡. *F.* The Trunk of the Nerve peculiar to the Flexors of the Fore-Arm, whose Branches are peculiarly distributed to these Flexors only, but not to the Extensors; white. *G. G.* Two Trunks of the Nerves peculiar to the Extensor Muscles of the Fore-Arm, whose Branches are peculiarly distributed to these

* *Dr* Croone.

Muscles

Muſcles only, but not to their Antagoniſts the Flexors; white. The number of the Branches of theſe ſeveral Veſſels, and the manner of their Diſtribution and Inſertion into theſe Muſcles, appear in the Figure. I need only to obſerve, that the antagoniſt Muſcles, that is, the Muſcles of each Side communicate one with another by their Blood-Veſſels, but not by their Nerves.

By the help of this Figure the mechanical manner of Muſcular Motion deliver'd in Lecture III, will be eaſily underſtood.

Fig. 141. *A.* Repreſents a Muſcular Faſcicle, or ſmall part of a Muſcle, macerated in Water, and carefully ſeparated longitudinally from the reſt of the Muſcle, with it's tendinous Extremities; expreſſing together the Figure of the entire Muſcle, as mentioned §. 11. Lect. III. and at greater Length in *Cap.* VII §. 5. *Diſſ. de Struct. & Mot. Muſc.* and *Introd.* §. 2. and 18. *B, B, B. &c.* The carnous red Fibres drawn aſunder, that the nervous white *Fibrillæ* or Filaments diſtributed to them may better appear. *C. C. C.* The nervous white Filaments, entering into the carnous Fibres at Angles more or leſs acute. *D. D.* The tendinous Extremities of the Muſcular Faſcicle; being the Nerves and nervous Membranes of each Muſcle or part of a Muſcle collected, and compacted to the Firmneſs of a Tendon; whence being again expanded, it is juſtly called the *Aponeuroſis*; and being farther continued over and into Bones, is called the *Perioſteum. F. H. G.* Shew the Directions and Diſtributions of theſe Proceſſes of the Nerve, Artery, and Vein, to the Muſcular Faſcicle, ſimilar to their Directions and Diſtributions to the whole Muſcle. This Figure is the ſame with the next following; excepting that in this the ſmall nervous Veſicles in each carnous Fibre are ſuppoſed to be covered by the Blood-Veſſels. Fig. 141.

Fig. 142. *A.* Shews the angle of Inſertion of the Nerve into this Faſcicle, as into the whole Muſcle, with the Direction and Diſtribution of it's Branches into the Muſcular Veſicles. *B. B. B.* The Chains of the Muſcular Veſicles, ſuppoſed to lie in the Direction of the Axis of each carnous Fibre, and to be inflated or diſtended by the Influx of the nervous Fluid, at the command of the Will in the Diaſtole of the Muſcle. See *Diſſ. de Struct. & Motu. Muſc. Cap.* VIII. §. 2, 4, 5, 7, 8. and *Abſtr.* in Lect. III. Fig. 142.

This verſicular Structure of the ſmalleſt Muſcular Fibre, pointed out and confirmed by a ſimilar Structure in all the viſible moving Parts of the animal Œconomy, may be juſtly inferred from the plain Analogy of Nature, which is always ſimilar to itſelf; by which it will be eaſy to underſtand what is ſaid of the general Muſcular Structure in *Diſſ. Cap.* VIII. and of the Manner of Muſcular Motion *Cap.* IX. and more compendiouſly in the *Abſtract* of that general Scheme in Lect. III.

Fig. 143. *A.* A live Frog, the Head being cut off, hanging by the Fore-Legs without Motion. Fig. 143.

Fig. 144.

Fig. 144. Fig. 144. *B.* The ſame Frog, whoſe inferior Limbs, which hung looſe and free, are brought into a ſtrong and complete Confraction by a very ſlight Impulſe with the button end of a Probe, on the upper Extremity of the ſpinal Marrow; the end of the Probe being filed flat and ſmooth for that Purpoſe. See *Exp.* V.

CHAP. VIII.

MONSTERS.

Some Reflections on Generation, *and on* Monſters; *with a Deſcription of ſome particular* Monſters: *By* Daniel de Superville, *Privy-Counſellor and chief Phyſician to the Margrave of* Brandenburg-Bareith. *Tranſlated from the* French *by* Phil. Hen. Zollman, *F. R. S.* No. 456. p. 294. Jan. &c. 1740.

I. IT cannot be denied, that ſince the middle of laſt Century to this Time, very important Diſcoveries have been made in Natural Hiſtory: However, thoſe Diſcoveries are very inſignificant, in compariſon to what is ſtill concealed from us. We have ſome Knowledge of the coarſer Sort of Nature's Operations, but the Niceties, the Particulars of them, eſcape us. If we endeavour to puſh our Knowledge ſo far, we find ourſelves ſurrounded with Clouds, we grope in the dark, and it is very difficult, if not impoſſible, to catch Nature in the Fact. It even ſeems, we have had better Succeſs in determining what Nature does not do, or cannot do, than in ſpecifying what ſhe actually does.

The Human Body is a Compound of Springs, which produce very regular Motions: Yet theſe Springs themſelves we do not know but very ſuperficially, and are far from knowing how thoſe Motions are produced. We know, that we are born, that we exiſt; but how came we to this Exiſtence? How were we produced? The Generation of Mankind and of the Animals is one of thoſe *Phænomena*, where innumerable Experiments have not been of ſo great Uſe, as they are elſe in other *Phænomena* of Natural Philoſophy, for diſcovering their moſt ſecret Springs.

It is ſtill a Diſpute, whether the Male or the Female contributes moſt towards Generation. It is certain, that for the Generation of Mankind there muſt be a Male and a Female, and it is the ſame thing with regard to that of Brutes. There is all the Reaſon in the World to believe, that what is written about Hermaphrodites, and about thoſe Animals which, being endued with the Advantage of the two Sexes, produce alone their Like, has not been examined with all the neceſſary Attention and Exactneſs.

The *Semen* of Man, which is certainly a moſt neceſſary Agent for Generation, becauſe it has been obſerved, that thoſe who have none, or do not eject it according to certain requiſite Conditions, are not fit for multiplying their own Species: This *Semen*, I ſay, is a Liquid full of ſmall Worms. It would be abſurd to deny it: All exact Obſervators

Pla. XVII. *Vol. IX. part 3. page 304.*

Fig. 133.

Fig. 134.

A Scale of Inches for Fig^s 133 & 134.

7 14 21 28

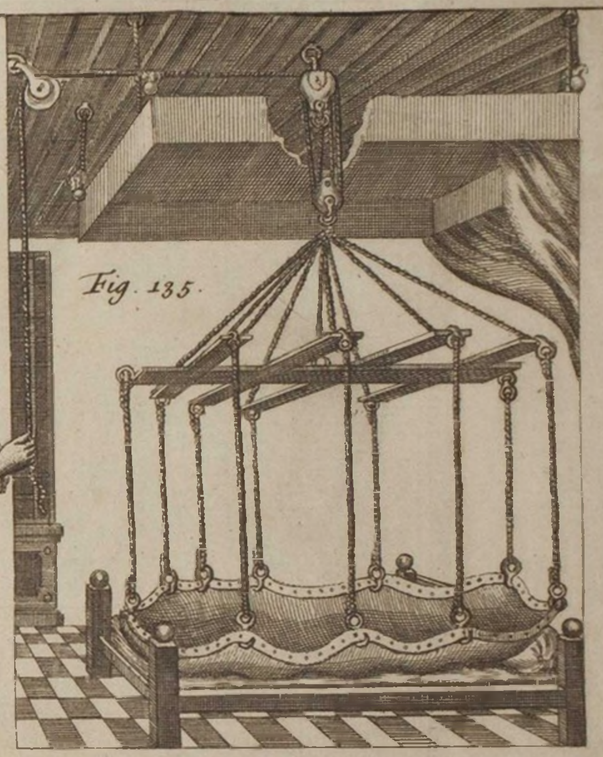


Fig. 135.

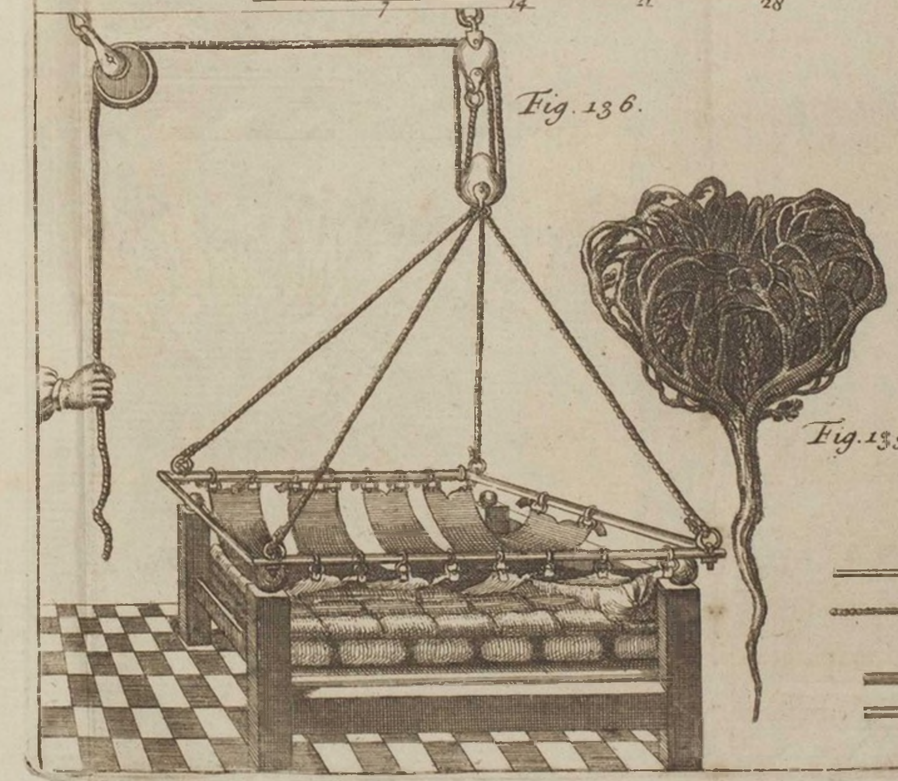


Fig. 136.

Fig. 139.

Fig. 138.

Fig. 137.

A

B

C

D

Pla. XVIII. *Vol. IX. part 3. page 304.*

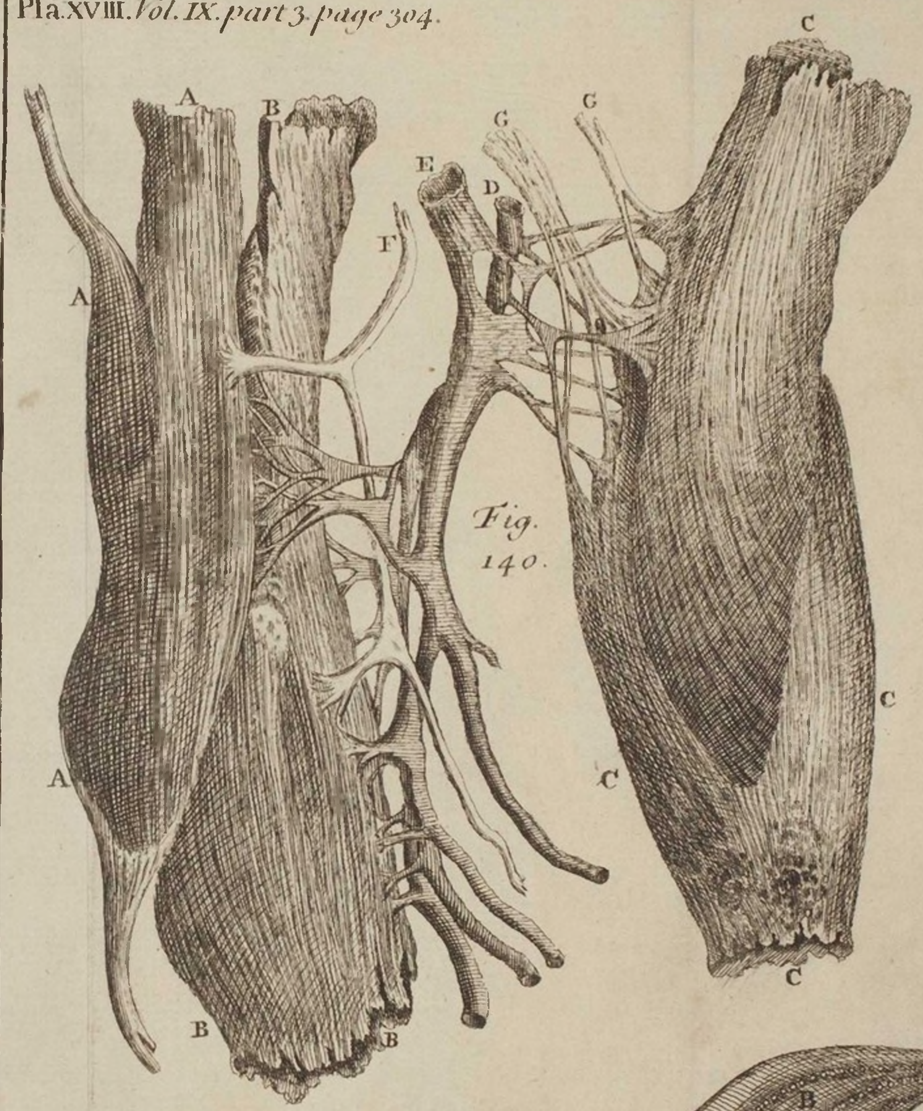


Fig. 140.

Fig. 143.

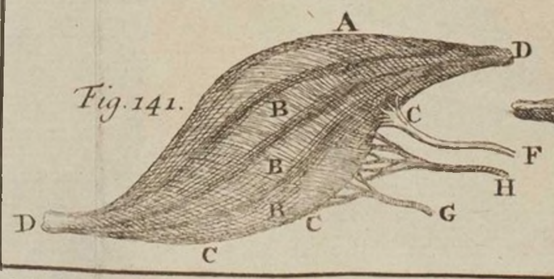


Fig. 141.

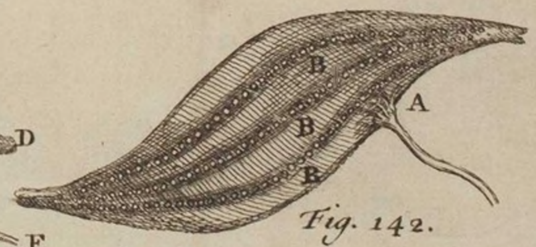


Fig. 142.

Fig. 144.

Obſervators have taken Notice of them, and offered to ſhew them to the incredulous. I have obſerved theſe *Animalcula* in human *Semen*, in that of ſeveral Quadrupedes, and in that of ſome Birds. I have obſerved, that the Figure of theſe *Animalcula*, as to Birds, was different from that of other Animals, I have preſerved *Animalcula* in a proportionable Warmth alive for ſeveral Hours; I have obſerved their Strength and Livelineſs to leſſen by Degrees, and at laſt entirely to ceaſe; and I have obſerved them dead, not ſwimming any longer, but always ſinking to the Bottom. I have obſerved in the *Semen* of Men, who had a virulent *Gonorrhœa* upon them, thoſe *Animalcula* to be without Motion, and like dead. I might enlarge upon the Particulars of a greater Number of Obſervations; they all prove the real and conſtant Exiſtence of *Animalcula* in the *Semen* of Males.

Theſe Worms, according to ſome Natural Philoſophers, are true *Embryoes*. As ſoon as an *Animalculum* has entered into an Egg, the Female who carries the Egg in her Body, has conceived; ſhe harbours it, nouriſhes it, and contributes towards the ſhaping of it, until it becomes an Animal, too big to be any longer contained in ſo ſmall a Place, and ſtrong enough to bear the Air.

According to other Natural Philoſophers, the Eggs that are in the *Ovaria* of the Females, contain the Image, the Type, the Picture of the *Embryo*; and the ſubtile Vapour of the Male *Semen*, or rather the occult Quality of that Seed, impregnating one of thoſe Eggs, immediately fixes that Image, and makes a real *Embryo* of it.

Theſe latter entirely deny the Exiſtence of *Animalcula* in the Seed, becauſe they have not ſeen them; and if they are ſhewn them, they maintain that they are foreign Beings; or, that they are a particular ſort of Worms, which form a ſeparate Claſs among thoſe Inſects: That God created them to exiſt in the ſeminal Liquid, that they keep in it as in their Element, that they multiply there, and that they continue there and die, ſuch as we obſerve them by the Microſcope.

I do not pretend to decide, that the former are entirely in the Right; they maintain an Hypotheſis founded on ſome Probabilities. Alas! who can hope upon ſo dark and hidden a Subject to find a demonſtrated Syſtem? The ſecond Opinion ſeems to me unwarrantable: It is founded upon Words which have no Reality. How can one form to himſelf the Idea of a Vapour extremely ſubtile and active, that ſhall have the Faculty of giving Life and Motion to an Image, to a Type, in ſhort, to a thing that was not real? The Pre-exiſtence of the *Embryo* in the Egg can by no means be demonſtrated: Even by the Help of the beſt Microſcopes, there is never any thing found in thoſe Eggs, but a clear and limpid Liquid.

I keep among my Curioſities ſix oſſified Eggs, which I found in the *Ovaria* of a Woman who died at the Age of 60. They are not all of the ſame Bigneſs. I broke two of them, and examined their internal Structure with all the Attention imaginable; but found no-

thing there except oſſeous Fibres, iſſuing from the Centre towards the Superficies; there was not the leaſt Appearance of an *Embryo*, norof it's Image.

One muſt have an Imagination extremely prepoſſeſſed to perſuade one's ſelf, that there is an organized Body in the Liquid contained in thoſe Eggs: Or, it requires a very particular Natural Philoſophy, to pretend to demonſtrate, that a bare Vapour (more ſubtile than any the moſt ſpirituous Vapours we know of) could, by it's ſimple Touch or Friction, produce an organized Body, where there was none.

The Generation of Mankind, as well as of Brutes, by the means of the *Animalcula*, which are obſerved in the *Semen* of Males, ſeems more analogous to all that we ſee Nature do for the Production and Multiplication of the Vegetables. There needs no Imagination for forming to one's ſelf an Idea of it. Each *Animalculum* is an *Embryo*, is a ſmall Animal of the ſame Species with that which harbours it: As ſoon as it finds itſelf diſengaged from the Confinement in which it was, and in a Place where it meets with a Humour proper for it's Vegetation and Expanſion, it takes Root there, it ſwells like a Corn newly put into the Earth, it ſpreads itſelf, it's Members ſhape themſelves, and by degrees take more Strength and Conſiſtence, it's Parts grow longer, and diſentangle themſelves, as it were, from all thoſe Plaits and Folds in which they were confined before, and the *Embryo* becomes a *Fœtus*.

I own, that the immenſe Number of *Animalcula*, which are obſerved in the ſeminal Liquid of Man, ſeems to oblige one to reject this Hypotheſis, and particularly this Opinion, that every *Animalculum* is an *Embryo*. For it is certain, that in every Man there would be enough of them to people a vaſt Country, and of all that immenſe Quantity there are but a few that come to any thing. And ſo, there you have Millions of little Men, created never to exiſt; which ſeems directly contrary to the wiſe Intentions of the Creator, who, in all Likelihood, made nothing in vain. But *Teleology* is one of thoſe Parts of Philoſophy, in which there has been but little Progreſs made, wherein one reaſons only by Conjecture, nor can demonſtrate any thing otherwiſe than *à poſteriori*. Who dares preſume ſo far as to pretend to penetrate into all the Deſigns of the Almighty, and into the divers Ends he has propoſed to Himſelf in the Creation of the Univerſe? Beſides, it is certain, that half of Mankind periſh, before they come to the Age of one Year, that is to ſay, before they can know themſelves, before they can anſwer the Ends God propoſed to Himſelf when He created them. Would one ſay therefore, that their Exiſtence was uſeleſs? But moreover, this ſeemingly uſeleſs Quantity of *Animalcula* equally affords an Argument againſt the Hypotheſis of thoſe, who believe the *Embryo* is in the Egg. One cannot maintain, that all the Eggs in the *Ovaria* are fruitful. And ſo there we have equally an immenſe Quantity of Types of *Embryo's* created

for nothing, and abſolutely uſeleſs; and it will follow from both Hypotheſes, that God might have ſaved Himſelf the Trouble of creating ſo prodigious a Quantity of Creatures in order to precipitate them into nothing. But who dares ſay, that the creating ſo many Millions of Creatures more has coſt Him any more Pains? And by what could one prove, that all thoſe *Animalcula*, which do not come to the State of a *Fœtus*, are annihilated?

The Hypotheſis of the Generation by *Animalcula* in the ſeminal Liquid of Man, appears ſupported and confirmed by ſeveral Experiments. *Leeuwenhoek* has already obſerved, that a wild Male Rabbet, and a tame and white Female, produce young ones entirely reſembling the Father; and that it is a Cheat very common in *Holland* to ſell that ſort of Rabbets, for wild ones, and that it is only by the Taſte one can find out the Truth. There is among domeſtic Animals a ſort of Poultry without Tails, and another ſort with the Feathers turned upwards; if a Cock without a Tail is put among ordinary Hens, or a Cock with the Feathers upwards, all the Chicks will prove like the Cock *. The ſame Experiment may be made with Pigeons, with Canary-Birds, *&c.*—— A Mule ſprung from an Aſs and a Mare, reſembles more the Aſs than the Mare, whereas a Mule coming from a Horſe and a She-Aſs, has more of the Horſe's Nature. All this proves in ſome meaſure, that the Male furniſhes the moſt eſſential Part in the Generation, *viz.* the *Embryo*.

By the ſame Hypotheſis ſome *Phænomena* obſerved in Generation, may be more eaſily accounted for, *Hippocrates* believed that the Difference of the Sexes depended on certain Diſpoſitions in the Seeds of the Male and the Female; that when the Male was the moſt vigorous in the Copulation, they begot Males; but if the Seed of the Female prevailed, they produced only Females. This Opinion, abſurd as it is, has been followed and maintained by ſeveral celebrated Phyſicians. How can one believe, that a little more of I do not know what, (for they do not determine wherein the more or leſs of the Virtue in the Seed muſt conſiſt) a little more Activity, a little more Spirituouſneſs, ſhould compoſe, ſhould determine any Organization? It is more natural to believe, that every *Animalculum* has already the Sex it is to have when it comes into the World. It has been diſputed Tooth and Nail, to determine the Time when the *Fœtus* becomes animated, and to know from whence and how it's Soul enters into it's Body. According to the moſt general Opinion, there muſt be at every Conception a new Creation of a Soul: Or, according to others,

* This Obſervation is not true: I have kept theſe Cocks without Tails among other Poultry, with ſome Hens alſo of the ſame Kind; and yet the Chicks were ſo far from being all like the Cock, that, though I was ſollicitous to preſerve the Breed, yet I could ſeldom breed any without Tails. I had one Hen, with the Feathers upwards; and though I had no Cock of the ſame Sort; yet I had more Chicks like this one Hen, than like any Cock in my Yard. *J. M.*

there is always a Legion of created Souls fluttering about in the Air, and watching the Minute for entering into a fruitful Egg as ſoon as it is impregnated. What an Extravagance is this! Would it be as abſurd to believe, that every *Animalculum* has already it's Soul, which waits only for the little Machines unfolding itſelf in order to exert it's Function?

According the Hypotheſis of *Animalcula*, one may eaſily account for thoſe monſtrous Births, when two *Fœtuſes* are joined together, or Children and Animals are double, in the Whole or in Part. I keep in my Collection a Pig, that has 8 Feet; the two Bodies, that are ſeparated, reunite themſelves by the *Spina Dorſi* below the *Diaphragma*, and have but one viſible Neck ſupporting a Head, bigger than it ſhould be, on which there appear 4 Ears, 3 Eyes, and the Snout ſeems double. I have alſo the Head of a Foal, which is double, and has 3 Eyes. I have a *Turkiſh* Duck, which is double, the 2 Bodies are joined by the Breaſt; each Body has 2 Wings, and 2 Legs; but they have only one Neck with one Head. I keep a Chicken, which has a ſecond Rump fixed to it's Breaſt, with the 2 Legs, and 2 Paws. I even have a Frog, which beſides it's 4 Paws, has a Fifth as well formed as the others, which comes out at the Right Shoulder. The Production of all theſe Monſters that are double, or have ſuperfluous Members, may very well be occaſioned by two *Animalcula* entring into the ſame Egg; they touch, they cloſe, they unite, they crowd each other: The Parts of the weakeſt, being too much crowded, cannot extend nor diſplay themſelves; ſo they vaniſh, as it were, ſo much the eaſier as they are extremely tender, and without any ſenſible Conſiſtency.

It is not more difficult to find plauſible Reaſons for imperfect Monſters, or that have an odd Conformity, as to the Whole, or as to ſome of the Members. I have the *Fœtus* of a Sheep which has no Noſe; the Part where the Noſtrils ſhould be, ſeems to be flayed, and the two Eyes are there one by the Side of the other. On the Forehead there is a ſmall Trunk of about an Inch and a half long, and pierced at the End by two Noſtrils. I have another, which has but one Eye in the Middle of the Forehead. I have a human *Fœtus* of about 7 Months, which has no Mark of the Sex, and inſtead of the Legs there is a Bag that runs to a Point, the Extremity of which is cartilaginous: In that Bag there is a Bone 3 Inches long, covered with a muſcular Fleſh; it is articulated with the *Os Sacrum*; the *Oſſa innominata* are wanting, and below the *Anus*, which is upon the Middle of the *Os Sacrum*, there is a ſmall Tail like that of a Pig.

When I was at *Stetin* in *Pomerania*, about 12 or 14 Years ago, a Midwife came to tell me, that a Sergeant's Wife was delivered of 3 dead Children, one of which had no Head. I immediately went, and obſerved, that theſe *Fœtuſes* had died at different Times. One began already to corrupt, and the *Epidermis* ſevered itſelf at the leaſt Touch.

The

The Monſter without a Head was alſo already quite flabby, and the third ſeemed to have died but a few Hours before. I examined the Monſter; there was no Appearance of any Head, and inſtead of the Navel there was a ſmall Lump of ſpungy Fleſh of the Bigneſs of a large Strawberry. About the *Secundines* I found but 2 *Placentas*, and 2 Coats? ſo that this Monſter muſt abſolutely have been in one of thoſe Coats with another *Fœtus*. The Midwife was not ſkilful enough to give me an Account of the Delivery: I put Queſtions to the Mother, who aſſured me ſhe felt one Child dying 3 Weeks before, and that the laſt died the Evening before. I offered a good Sum of Money to have all ſhe was delivered of, but they would not let me have it. I ſtill offered Money to have only Permiſſion to diſſect the Monſter, but the impertinent Superſtition of the Parents deprived me of that Satisfaction.

I ſtill preſerve in my Collection a monſtrous *Fœtus*, which deſerves particular Attention. It is of 8 Months, without Head or Arms: The Figure outwardly ſeems to be nothing elſe but the *Abdomen* with the Legs; theſe are well-ſhaped and proportioned, with the Toes, and the Beginning of the Nails; the Right Foot however is, as it were, crooked, and bending inwards. Having opened it, I found indeed but one Cavity, which in the upper Part contains a ſmall Bladder. There is not in all the Cavity any thing beſides a Bit of Inteſtine, the two Kidnies, the Bladder, and the Right Teſticle, which lay upon the Ring. The Fleſh was hard, and, as it were, *carcinomatoſe*. The Navel-ſtring went in a little higher than naturally, and a little towards the Right Side, entering into the Inteſtine. There is a ſlender Inteſtine of about 14 Lines in Length, proceeding from the ſame Place, where the Navel entered into the Cavity; next comes the *Cæcum* with it's vermicular Appendix, the *Colon* and the *Rectum*, the whole together of the Length of about two Feet. Theſe Inteſtines go from above to below in *Zic-Zac*, and are attached to the *Spina Dorſi*. There is no Footſtep of the Heart, the Lungs, the Stomach, the Liver, the Spleen, the Pancreas, the Meſentery; all that is wanting. The ſmall Bladder I mentioned was fleſhy, and contained ſome Seroſity; it is attached to the firſt of the *Vertebras* of the Neck. This Beginning of the *Spina* is bent forwards like a Bow, and forms the Monſter's Roundneſs from above. The bended Extremity kept the little Bladder, as it were, under, and ſhut up in the Cavity cloſed up by the Ribs. This Cavity was to form the *Thorax*, but the *Sternum* was wanting as well as the *Diaphragm*. Fig. 145.

Des Cartes and *Lanciſci* would in vain have looked out here for the Seat of the Soul, and the *Punctum Saliens* would prove very hard to be determined in this *Fœtus*. But I do not now intend to enlarge upon it. The Buſineſs is to find ſome plauſible Reaſons about the Origin of thoſe ſorts of Monſters I have now deſcribed.

The

The Opinions of moſt of the Natural Philoſophers on this Head may, upon the Main, be reduced to theſe two Hypotheſes: 1. That Monſters are original, that is to ſay, that even in Conception the Monſter is conceived. 2. That they are not produced but by Accident. One may conclude from what I have ſaid about double Monſters, that I believed them accidental; and I believe, rigorouſly ſpeaking, they are ſo, whatever they be: For ſuppoſing every *Animalculum* to be an *Embryo* created, I cannot imagine them to be created imperfect. Their Imperfection, their Deformity, may proceed from a thouſand Accidents, either in the *Reſervoirs* where they are contained, or in the different Routs they are obliged to take going from Father to Son. In this Caſe it may eaſily happen, that they are Monſters, even in the Moment of Conception, though they be ſuch by Accident. To how many Accidents are they not ſubject afterwards in the Venter of the Females? A Fall of the Mother, a ſtrong Preſſure, a Contuſion, *&c.* may diſorder the nice and tender Structure of that little Creature ſo far, that a great many of it's Parts do not unfold themſelves any longer, are deſtroyed, or have their Order and natural Situation entirely changed.

The diſturbed and diſordered Imagination of the Females ought alſo to be ranged among the accidental Cauſes of Monſters. I have ſeen in a Sow juſt ſlaughtered 7 Pigs, which all had the bloody Mark of the Knife about their Necks. About ſome 20 Years ago, a Clothſhearer in *Holland* had the Misfortune to fall into the Hands of ſome drunken young Fellows, who murdered him, and ſtabbed him with more than 20 Wounds with their Swords. He was to be married that very Week: His Sweat-heart ſaw his Corpſe naked with all thoſe Wounds, and was 2 Days after delivered of a dead Child, which had the Marks of the Wounds in the ſame Places of it's Body, where the Mother had obſerved them on her dead Lover.

I very well know, that theſe ſorts of Inſtances, of which one might alledge ſome Hundreds, will not go down with certain People, who deny the Effect of the Mother's Imagination on the *Fœtus*. They lay Streſs on two principal Reaſons: 1*ſt*, It is pretended, that the *Fœtus* has no immediate Connexion with the Mother who carries it. But this is ridiculous; for one cannot deny, that the *Secundines* are cloſely united to the *Matrix*, and receive from the Mother a Humour, or a Liquid, which by the Navel-ſtring it remits to the *Fœtus*. It is by that way it receives it's Nouriſhment, that is to ſay, the Matter neceſſary for it's Increaſe. Accordingly one may ſay, that the *Fœtus* owes part of it's Being to the Mother; and that the Liquid which runs in the Veſſels of the Mother, runs likewiſe in the Veſſels of the *Fœtus*. 2*dly*, It is ſaid, that it is incomprehenſible how the Soul of the Mother can have an Effect on the Child. I own I do not comprehend it neither. It does not follow from thence, that we ought to reject as falſe all that our Reaſon cannot penetrate into. When once the Exiſtence and the Nature of the

Soul

Soul has been demonstrated, when once we have a perfect Knowledge of the Manner how an immaterial Being acts upon Matter, we shall then reason in Consequence about what the Soul can do, and cannot do. Daily Observations demonstrate to us, that the disordered and disturbed Imagination of Women often hurts the Infants. And this is a Reason which I add to all the others, to think I have good Grounds to conjecture, that all Monsters are accidental; and to believe, that by the Hypothesis of *Animalcula* one may better explain the *Phænomena* which are observed in Generation, than by any other Hypothesis known as yet.

A Bregma of a Gigantic Magnitude, by Ja. Theod. Klein, *Secr. to the Republick of* Dantzick, *F. R. S.* No. 456. p. 308. Jan. *&c.* 1740. Fig. 146, 147.

II. Having obtained from the famous *Museum* of *Wittsen* at *Amsterdam*, a Bregma of a Gigantic Size, in Height 9 *English* Inches, and in Breadth 7, with a Description, and Figure by *Ruysch*, representing the Height of the Head from the Chin to the Crown 20 Inches, and the Breadth at the Temples 12 Inches, and also another Bone of the same Sort, in 1728, the Height of which was $5\frac{5}{8}$ Inches, and the Breadth 5 Inches, but without any Figure or Reference to the Head, I could easily find, by taking 8 Lengths of the Head, according to the Rules of Painting, that the Stature of the Giant was 13 Feet 4 Inches. But being desirous also to know the just Proportion of the other *Bregma*, according to Mathematical Rules. I proposed the following Problem to Dr *Henry Kühn*, Professor of Mathematicks at *Dantzick*.

If in two human Bodies of different Stature, the Height of the *Bregma* in the former, shall be 9 Inches, the Breadth 7, the Height of the whole Head 20, the Breadth 12; and in the latter, the Height of the *Bregma* $5\frac{5}{8}$ or $\frac{45}{8}$, the Breadth 5, and the Height and Breadth of the whole Head unknown: To determine the unknown, and to settle the Proportion of the Stature of the former to that of the latter.

This may be resolved 3 ways,

If the Bodies were similar, the Question may easily be answered by inferring, that, as in the former Body the Height of the *Bregma* is to the Height of the whole Head, or even of the whole Body (which is it's Octuple) so in the latter Body the Height or Breadth of the *Bregma*, to the Height of the whole Head, or even of the whole Body; but because 9 to 7, and $\frac{45}{8}$ to 5 are dissimilar Proportions, those Bodies are not similar. Therefore we must consider both the Heights and Breadths of the Bones in question, as will appear from the 3 following Methods.

The first Method.

(α) $9'' : 20'' = \frac{46''}{8} : \left\{ \begin{array}{l} \text{the Height of the Head desired.} \\ \frac{20.\ 46''}{9.\ 8} \end{array} \right.$

The Octuple of this will be $= \frac{8.\ 20.\ 46''}{9.\ 8} = \frac{20.\ 46''}{9} = \frac{920''}{9}$

$= 102$

$= 102\frac{2}{9}$ { = 8 Feet $6\frac{2}{9}$ Inches
= the Stature of the ſecond Body.

(β) $7'' : 20'' = 5'' :$ { the Height of the Head deſired
$\frac{100''}{7}$

The Octuple of this will be $= \frac{800}{7} = 114\frac{2}{7} = 9$ Feet $6\frac{2}{7}$ Inches

= the Stature of the ſecond Body.

(γ) The Addition of the Statures found, and the Biſection of the Sum to obtain the Arithmetical Mean, will be $\frac{8', 6''\frac{2}{9} + 9', 6''\frac{2}{7}}{2}$

$= \frac{17', 12''\frac{1}{2}}{2}$ nearly $= \frac{18' + \frac{1}{2}''}{2}$ { = 9 Feet $\frac{1}{4}$ Inch
= the Structure of the ſecond Body very nearly.

The ſecond Method.

$9'' + 7'' : \frac{46''}{8} + 5'' = 20'' :$ The Height of the latter Head.

That is, $16 : \frac{46 + 40}{8} = 20'' :$

That is, $16 : \frac{86}{8} = 20'' :$ { Height of the latter Head $\frac{20 . 86''}{16 . 8}$
$= \frac{5 . 86''}{4 . 8} = \frac{430''}{32} = \frac{215''}{16}$.

The Octuple of this will be $= \frac{8 . 215''}{16} = \frac{215''}{2} = 107'' \frac{1}{2}$

{ = 8 Feet $11\frac{1}{2}$ Inches
= the Stature of the ſecond Body nearly.

This does not differ from the former Calculation more than $\frac{3}{4}$ of an Inch.

The third Method.

Since in the ſame Parts of different Bodies (for Example, in 2 *Oſſa Bregmatis*) the Surfaces of the Parts are to one another, as the Squares of the Heights of the whole Bodies; and thoſe Surfaces are alſo to one another, as the Products of the Heights of the Parts into the Breadths; thoſe Products alſo will be to one another as the Squares of the whole Bodies. Wherefore, ſince the Height of the former Body is $20''$, and ſo it's Octuple, or Height of the whole Body is $160''$, the Square of which is 25600, ſay

The

9 • 7 : $\frac{46}{8}$ • 5 = 25600'' : . . . . .

(The Height of the former *Bregma* into it's Breadth. The Height of the latter *Bregma* into it's Breadth. The Square of the Height of the whole former Body. The Square of the Height of the whole latter Body.)

That is, $63 : \frac{230}{8} = 25600'' : \frac{230 \cdot 25600}{63 \cdot 8} = \frac{230 \cdot 3200''}{63}$

Since therefore $\frac{230 \cdot 3200''}{63} = \frac{736000''}{63} = 11682''.\frac{1}{2}$ very nearly;

= the Square of the Stature of the ſecond Body; the Stature of the ſecond Body (extracting the Square Root of 11682) will be very nearly = 108 = 9 Feet, *Engliſh* Meaſure. This Stature, being a mean between thoſe found already, may be accounted the moſt accurate.

Laſtly, as 8 Heights of the Head may very well be aſſumed for the Height of the whole human Body, and as the Height of the former Gigantick Head is 20 Inches, the Stature of the former Giant will be equal $8.20'' = 160'' = 13$ Feet 4 Inches. Conſequently the Stature of the former Giant is to the Stature of the latter, as 13 Feet 4 Inches to 9 Feet, *Engliſh* Meaſure, or as $160''$ to $108''$, or as 40 to 27.

Concerning a Monſtrous Child born of a Woman under Sentence of Tranſportation; by Mr Timothy Sheldrake, *ibid* p. 341, *dated* Norwich, Jan. 8. 1734-5. Fig. 148.

III. *Elizabeth Spencer*, being tried at our Aſſizes for the City and County of *Norwich*, for Shop-lifting, and being found guilty of the Crime, received Sentence for Tranſportation; for reſpiting of which Sentence ſhe pleaded her Belly, which Plea, as ſhe was a married Woman, appearing what was very probable, ſhe was favoured by the Mayor and the other Magiſtrates, by being allowed the full Time that ſhe ſaid ſhe had to go; at the Expiration of which ſhe was delivered of a Child, which I ſaw a few Hours after it was born. The Head had a Riſing on the Top of it, and the Noſe was as if one Noſe was on the Top of another, but only two Noſtrils, and thoſe at the Bottom of the lower Noſe. The Arms were without the Elbow-Joint; the two Bones, which make the lower Joint of the Arm, in common, were in this extended to the Shoulder. Juſt under the Ribs, and above the Hips, was a deep Place, as if a Cord had been tied very ſtraight, ſo as to ſink down below the Reach of the Eye: This girding-in of the Body, I believe might go almoſt round: I did not turn it, to ſee whether it did or not, but it was continued as far about the Body as I could ſee, without turning it. By this girding-in of the Body, the lower Part of it was almoſt round, it being without either Legs or Thighs; but had two Feet joined unto the lower Part of the Body, the Heels inward, the Toes (of which it had not the full Number) pointing towards the Sides. As to Sex, this Creature was a Female,

male, and born alive, it was the Opinion of the Women about her, that the Midwife had injured the Head in the Birth, by which the Rising in the Head was produced; and this surprising Creature that was born alive, was thereby soon deprived thereof. This Woman, who had been the Mother of several Children, before this strange Production, and all in perfect Form, was by some free speaking Persons charged with having been guilty of some Practices both unnatural and unlawful, which she very positively always denied; and said that she knew nothing that could give any Change to the natural Form of this Creature, but the strange Apprehensions that her Sentence had put her under, from the uncommon Creatures the Country to which she was sentenced might bring in her Sight. These odd Ideas that she had formed to herself, were all and the only Thing, that had occasioned so great a Change from the natural Form the Child might otherwise have had, as she often asserted.

An Account of a monstrous Boy; by Andrew Cantwell, *M. D.* Monspel; *translated from the* French, *by* T. S *M. D. Dated at* Montpelier, Dec. 27. 1731. *N. S.* No. 453. p. 137. Apr. &c. 1739.

IV. There is actually in this Town, a Lad of 13 Years of Age, born at *Cremona*, who bears the lower Parts of another Boy, which seem to issue from his Epigastric Region, between the *Cartilago ensiformis* and the Navel. The Fore-part of the one faces that of the other. The Head and Trunk seem buried in the Lad's *Abdomen*, down to the Hips, where the Connection is plainly to be seen. This Portion of the prominent Body has a well-formed *Anus* and *Penis*. The *Scrotum* has a fine Down on it, but is void of Testicles, and seems to be filled with the Intestines. Nothing passes through these two Outlets. I have perfectly well distinguished the two *Ossa Ilium* in their natural State, but could not feel the *Os Sacrum*. The Articulation of the *Femur* is somewhat discernible on each Side: And I have perceived the Pulsation of the anterior crural Arteries. The Lad is very sensible when these additional Feet, Legs, or Buttocks, are pinched, or overmuch pressed. He has lately had the Small-pox, and these have suffered by it equally with him. At his Navel I found a considerable Rupture, which is covered by this Portion of a Body. This Rupture grows monstrously big in wet Weather, and diminishes again in dry. It has a circular Hole in it, which runs through the *Peritonæum*. The Lad is of a thin Habit of Body, but otherwise enjoys good Health. His Father, *Michael Martinetti*, a Tinker, told me, that this is the 7 Child his Wife *Nunciada* bore him. She was 30 Years of Age at his Birth, and bore him 2 more since. All the rest were of the natural Shape.

An Account of a monstrous Fœtus, resembling a hooded Monkey: *Communicated by Mr* William Gregory *of* Rochester. No.

V. A Woman, aged 44, of an athletic Body, conceived with Child a little before *Christmas* 1730. upon which ensued all the usual Symptoms of Pregnancy. Soon after Conception, some Fellows who travel the Country, with a *Bear* and a *Monkey*, placed themselves before the Woman's Door, in order to make Diversion for the Populace. The *Monkey* had a Hood on, which reached to his Shoulders, of which the Woman took prodigious Notice; and all the time the *Monkey* was playing his Tricks, in turning over a Stick, *&c.* The Woman

Woman could not keep her Eyes off from him. Some ſmall time after, the Woman met a Man of a thin, pale, diſmal Aſpect, upon whom ſhe looked very earneſtly, and thought his Face to be (to a Tittle) like the *Monkey*'s Face. When the Woman was quick with Child, and the *Fœtus* began to move, the Woman felt it turn over and over, many times ſucceſſively, juſt as the *Monkey* turned over the Stick; and as often as it moved, it was in the ſame Manner. In the 7 Month of her Pregnancy, ſhe was taken ill, with a Vomiting, Gripes, and Looſeneſs, which ſoon ceaſed without the Help of Medicine; upon which the Woman's Belly began to grow leſs, and the *Fœtus* did not move ſo often, nor ſo ſtrong, as before. The Woman began to be very uneaſy, thought her Caſe dangerous, and that ſhe was not with Child; upon which ſhe conſulted me. I examined how ſhe was from the Beginning, and found her Caſe as above related: I then gave it as my Opinion, that ſhe was with Child, and begged ſhe would not take any Medicine, until her Time of Reckoning was expired, which (with much Difficulty) I prevailed upon her to conſent to. I was ſent for in a Month after, and was deſired to give her ſomething to bring down her great Belly, ſhe believing herſelf not with Child. I was ſtill of Opinion ſhe was with Child, and told her, that what ſhe felt move in her Belly, was in all Probability a Child; and the Fulneſs of her Breaſts, and other Symptoms, were ſtrong Proofs of her being with Child. I endeavoured to convince her, that there was no Danger in her Caſe, as far as I could apprehend; ſhe being then in tolerable good Health, and able to attend the Affairs of her Family. I again prevailed upon her to deſiſt from taking Medicines for a Month longer: The Month elapſed, and no great Alteration. She felt ſomething move faintly about the Expiration of the 9th Month, when I viſited her, and was then in tolerable good Health, though very uneaſy at her great Belly: I told her, that ſhe might be miſtaken in her Reckoning, and that ſhe would go a Month longer: She was poſitive ſhe was not miſtaken, for that ſhe had miſſed her *Menſtrua* ſome time before *Chriſtmas*, which ſhe never uſed to miſs, but when with Child; and now ſhe could not believe herſelf with Child, by reaſon her full Time of Pregnancy was expired. I told her the Danger of taking purging Medicines, whilſt ſhe was with Child; and gave her Inſtances in the Neighbourhood, of the fatal Conſequences of ſome Mens Practice in the like Caſe; by which I again prevailed upon her to tarry another Month, at the Expiration of which I gave my Patient a Viſit, and found her much as ſhe was when I ſaw her before. Now Ten *Lunar* Months were elapſed, and my Patient felt nothing move in her Belly for 6 Weeks paſt: I then confeſſed I had miſtaken her Caſe, but gave her Hopes there was ſtill a Probability of removing her Diſtemper, and reſtoring her to Health; in order to which I immediately ſent her an Infuſion of *Sena*, *Rhubarb*, *Sal. Tartar. &c. cum Syr. de Rhamno*, which ſhe did not

461. p. 764. Aug. &c. 1741.

take for two Days after, being the 5th of *September* 1731. My Patient took the Potion about 5 in the Morning, and before 6 ſhe was taken with the moſt exquiſite Travail-pains: A Meſſenger was diſpatched for me, but, before I could come to her Aſſiſtance, ſhe was delivered; the *Fœtus* came, with the *Placenta*, *Membranes*, and Humours, all whole, which were preſerved until I came, which was ſoon after; and, to my great Surprize, found the *Fœtus* as before-mentioned. I took out my Inciſion-knife, and divided the *Membranes*; ſo took out the *Fœtus*, with the Twiſt in the Navel-ſtring, as it now appears; the *Membranes* were very ſtrong, but the Humours were very foul, and but ſmall in Quantity, though not fetid. My Patient, who is a Woman of Probity and good Underſtanding, declared, from ſtrong Reaſons, that ſhe conceived at the Time above-mentioned, and was deliVered as mentioned before; the Twiſts in the Navel-ſtring are Demonſtration, that the *Fœtus* moved in the *Matrix*, in the Manner my Patient deſcribed. I need not here mention the exact Reſemblance of the *Fœtus* to a hooded *Monkey*: The *Fœtus* itſelf will ſhew it more particularly than I can relate it.

A remarkable Conformation, or Luſus Naturæ, *in a Child; by* C. Warwick, *Surgeon, in* Truro, Cornwall, No. 464 p. 152. *Read* July 1. 1742.

VI. About *April* 1741. one *Sarah Allen*, of the Pariſh of *St Blazy*, near *Truro*, having been married near 4 Years, and Mother of 2 Children, well-formed and living, was brought to-bed of my preſent Subject, but of ſo remarkable and preternatural a Conſtitution, as muſt render it's whole Life inevitably miſerable, the Particulars whereof, from my repeated Obſervations, are as follows:

The *Umbilicus* is nearly in it's natural Site, but ſomewhat large and prominent, having more the Appearance of a Tumour, that the ordinary irregular Shape of that Organ.

Immediately below this *Umbilicus*, is a large fungous Excreſcence, nearly the Size of a ſmall Egg, but ſomewhat depreſſed, of a fiery Aſpect, and exquiſitely ſenſible. The Surface is irregular, being compoſed of divers Granulations or ſmall Lobes of Fleſh; and the Baſis of it I could not well diſcover, my Endeavours being attended with much Pain and Difficulty; however, from the branchy Top of it, I am inclined to think it ſomewhat pendulous.

Beneath, adjoining to this *Fungus*, is another pretty large Excreſcence, neither ſenſible nor ſpongy, as the former, but of a ſolid uniform Contexture. It's Projection from the *Abdomen* is about $\frac{1}{3}$ of an Inch, and, was there a Section made parallel to it's Baſis, it would be of an Elliptical Figure. In Shape and Dimenſions it ſomewhat reſembles the *Glans Penis*, it's Surface being covered with the ſame fine *Membrane*, and has a ſmall Indenture in the Top of it, but it is not ſo large, and has no Aperture in it.

Suſpended to this *Glans*, like the *Omentum* to the *Ventricule*, is a large *Membrane* of a ſemilunar Figure, looſe, flexible, and when turned up, capable of covering ſome Part of it. It's Texture nearly reſembles

bles that of the *Præputium*, or is ſomewhat thicker. There is likewiſe a ſmall Cord or *Frænum*, which ariſing from the Circumference of this *Membrane*, and biſecting the above *Glans*, terminates under the *Fungus*. About half an Inch below this *Membrane*, is a wrinkled Extuberance reſembling a *Scrotum*, but of an uncertain Magnitude, great or ſmall, as the Deſcent of the Infant's *Inteſtines*, which having broken their natural Confines, form an unſeemly Roll from one *Inguen* to the other. It's Situation is about the upper Edge of the *Os Pubis*, which, in examining this Part, I found greatly deficient, and I am apt to believe, from the great Chaſm which I perceived there, it muſt be entirely wanting.

The next Thing to be obſerved is the *Anus*. I found the Situation of this Part more forward than uſual, at leaſt by 2 Inches; and, if my Conjectures be right, the *Rectum*, from this Poſition, muſt take it's Courſe nearly through the Chaſm of the *Os Pubis*.

Beſides all theſe Inconveniences, to complete the Child's Miſery, there is a perpetual Diſtillation of Urine from ſome unſeen Paſſages under the *Fungus*, exciting by it's Acrimony, every Moment, Pains and Excoriations.

To conclude: It's Sex is ſo imperfect, and obſcurely repreſented, that it received no Baptiſm till 4 Months after it was born; when it's Parents, flattering themſelves that Nature might take a Turn ſome time or other for the Child's Advantage, gave it an Appellation applicable to either Sex, as Time and Circumſtances ſhould require.

A. Umbilicus. B. Fungus. C C. Prolapſus. D. Glans. E. Membrana. F. Scrotum. G. Anus. H. Frænum.

Explanation of the Figure: Fig. 149. *A* Child *of a monſtrous Size, by* M. Geoffroy, F. R. S. *and Member of the R. Acad. of Sciences at* Paris, No. 471. p. 627. *Read* Dec. 22. 1743.

VII. *Normandy* furniſhed us ſome Years ago with a Child, monſtrous by it's Size, and a Strength which it's Age could not naturally afford. It was born at *Roüan*, and is a Prodigy of Virility, of 3 Years and 2 Months of Age, perhaps one Month older, and is now in the Hoſpital at *Roüan*. It has a very large Neck, the Breaſt very broad, and the Belly bigger than in it's natural State. The upper Part of the Thighs is a little thickiſh, the reſt is conformable to it's Age. He has Hair only about the Privy Parts; the *Penis* is 3 Inches long when there is no Erection, but of 6 when there is any. They have found him to have Emiſſions. The Fact is very true, and M. *Le Cat*, F. R. S. a Surgeon at *Roüan* has fully traced it out.

VIII. In order, to give you, in ſome Meaſure, a View of the Deſign of this little Book, I am to inform you, that the general Opinion of the World is, that there are *Hermaphrodites* in human Nature. In this Treatiſe I am to ſhew it cannot be; which I have endeavoured to do in the following Method, *viz.*

Account of a Book intitled a Mechanical critical Inquiry into the Nature of

1. The Introduction, which is chiefly hiſtorical, lays down the Manner of this Error's being propagated amongſt *Jews*, *Pagans*, and *Chriſtian*, at all Times; with an Account of *Jewiſh*, Civil, and Canon

Hermaphrodites; by James Parsons M. D. F. R. S. *given by the Author.* No. 459. p. 650. Jan. &c. 1741.

non Laws made againſt ſuch as were reputed *Hermaphrodites*, as well as thoſe that were always in Force at *Rome*, by which great Numbers of People were deſtroyed from Time to Time.

2. The Firſt Chapter exhibits many Reaſons againſt a Poſſibility of their Exiſtence in human Nature; with a true Diſcovery of ſuch Diſeaſes as have been the Cauſe of Men and Womens being called *Hermaphrodites*.

3. The Second Chapter is a critical Account of the Cauſes Authors have aſſigned for the Produce of *Hermaphrodites*; wherein it is proved, that no ſuch Effects could ariſe from thoſe Cauſes; and ſeveral Abſurdities are expoſed in the Arguments advanced for the Support of this Error.

4. The Third Chapter is a critical View of the Hiſtories of *Hermaphrodites* given by ſeveral Authors; ſhewing that thoſe ſo reputed were either perfect Men or Women, having only ſome Deformity or Diſeaſe in the Parts of Generation.

5. The Concluſion deſcribes the State of all Female *Fœtuſes*, with ſome Obſervations, which prove that every Female *Fœtus* may as well be thought an *Hermaphrodite*, as any that were ever called ſo.

CHAP. IX.

Period of Human Life.

I.

The Bills of Mortality *for the Town of* Dreſden, *for a whole Century*, viz. *from the Year* 1617 *to* 1717, *containing the Numbers of Marriages, Births, Burials, and Communicants. Communicated by Sir* Conrad Sprengell, *M. D. F. R. S.* No. 428. p. 89. Apr. *&c.* 1733.

The Year	Couples married.	Chriſtned.	Buried.	Communicants.	Who received Holy Orders.
1617	126	478	639	21507 among whom were	37
1618	175	466	400	22567	31
1619	148	530	332	23221	34
1620	119	546	472	22850	36
1621	146	546	491	23988	18
1622	144	521	381	24032	16
1623	127	541	421	25864	20
1624	146	576	411	25899	15
1625	141	543	481	26319	21
1626	151	580	407 beſides 333 who died of the Plague.	29201	27
1627	162	548	412	26677	29
1628	124	543	469	27085	17

Pla. XIX. *Vol. IX. part 3. page 318.*

Fig. 146.

Fig. 149.

Fig. 147.

Fig. 145.

Fig. 148.

The Year	Couples married.	Chriſtned.	Buried.	Communicants.	Who received Holy Orders.
1629	136	599	398	28525 among whom were ?	18
1630	115	599	480	28446	28
1631	163	599	844	30241	23
1632	161	515	3129 during the Troubles of the War and Plague.	32416	46
1633	412	425	4585 the Troubles of War and the Plague ſtill continuing.	27688	57
1634	346	531	721	23165	47
1635	205	523	597	24942	24
1636	153	531	594	23904	26
1637	156	613	1897 the Plague breaking out again.	28888	19
1638	205	550	531	26744	43
1639	122	602	1845	28702	24
1640	192	451	935	26032	30
1641	144	509	525	25662	22
1642	155	514	601	27247	20
1643	137	623	1041	28720	30
1644	128	561	489	27677	28
1645	118	497	532	27602	22
1646	134	512	481	27996	9
1647	148	655	471	36619	21
			In which Year they began to deliver in the Number of Communicants at *Old Dreſden.*		
1648	190	714	606	37097	23
1649	179	664	597	39198	21
1650	197	752	494	39588	26
1651	199	713	511	39773	19
1652	206	732	450	40389	24
1653	193	673	535	40924	20
1654	194	691	558	41789	28
1655	180	725	525	40253	26
1656	212	708	560	43086	15
1657	163	610	663	44783	30
1658	186	707	518	43117	16
1659	193	703	599	43297	29
1660	219	738	542	45111	23
1661	196	709	649	45137	28

The

The Year	Couples married.	Christned.	Buried	Communicants.	Who receiv'd Holy Orders.
1662	180	733	637	45313 among whom were	27
1663	193	640	620	45640	31
1664	176	682	662	46115	42
1665	228	734	699	46667	33
1666	188	699	824	47194	32
1667	247	754	823	47325	20
1668	237	739	703	48403	17
1669	215	833	794	48765	27
1670	251	802	776	50121	22
1671	262	844	743	51500	26
1672	275	856	909	51650	32
1673	252	891	909	52483	26
1674	256	887	846	52636	19
1675	257	920	947	53179	25
1676	260	895	1284	51164	28
1677	322	988	887	53079	31
1678	204	1028	1020	53510	22
1679	308	1063	975	55296	30
1680	247	883	1311 besides 5103 who died of the Plague	56116	18
1681	531	791	753	45244	18
1682	386	1137, among whom two Blackmoors Children.	1023	51512	21
1683	256	1201	1200	52493	29
1684	270	1039	1154	48855	21
1685	273	984	937	50931	32
1686	244	1020	1199	53754	31
1687	285	1078, among whom a *Turkish* Woman.	927	49040	35
1688	274	1062, among whom 1 *Turkish* Woman. 3 *Turkish* Girls, and 1 *Turkish* Man.	1011	54868	23
1689	244	1022	1163	55284	21
1690	370	1002, among whom 1 *Turk.*	1200	57130	26

The

The Year	Couples married.	Chriſtened.	Buried	Communicants.	Who received Holy Orders.
1691	306	1119, among whom 4 *Turkiſh* Women, 2 *Turkiſh* Boys, and 1 Black Woman.	1166	56629	among whom were 33
1692	323	1003, among whom 1 *Jew.*	999	58995	18
1693	309	1096, among whom 1 *Turkiſh* Man.	1071	59921	29
1694	366	1014, among whom 2 *Turkiſh* Boys.	1426	61288	23
1695	329	1225	1227	62230	35
1696	293	1162, among whom one Black Man.	1055	64491	23
1697	480	1206	1070	61171	30
1698	332	1007	919	59030	25
1699	295	963, among them one Black Woman and a *Lapland* Man 80 Years old.	1139	59662	38
1700	292	975, among them 1 *Turkiſh* Woman, 2 *Turkiſh* Men and a *Jew*,	1198	59369	28
1701	324	991	992	61176	27
1702	210	1086, among whom a *Jeweſs.*	946	60225	27
1703	288	1049, among whom a *Turkiſh* Woman.	1078	62636	31
1704	279	1111, among whom a Black Woman.	964	62971	39
1705	354	1044, among whom a *Jew.*	1346	64262	30
1706	313	1104	1098	63894	19
1707	296	1034	1523	63120	24
1708	350	1256	1119	66519	30
1709	348	1141, among whom a *Jew* and his Wife.	1340	67021	41
1710	337	1141, among them 2 *Jews*, who apoſtatized afterwards.	1214	69197	24
1711	313	1181	1222	70123	29
1712	354	1227	1140	72432	22

The Year	Couples married.	Chriſtened.	Buried	Communicants.	Who received Holy Orders.
1713	353	1112, among whom one *Turkiſh* Man, and one *Jew*.	1383	71600	among whom are 22
1714	306	1312, among whom a *Jew*.	1250	75547	33
1715	349	1249, among whom a *Jew*.	1353	76155	23
1716	361	1339, among whom one Black Man, one *Jew*, and one *Jewiſh* Girl.	1274	77146	27
1717	397	1443, among whom a *Jew*.	1908	78019	19

Sum Total from 1617 to 1717 inclusive.

Married 24294 Couples, Chriſtened 83412, Buried 98611. Communicants 4654064, among whom 1686 who received Holy Orders.

II.

N. B. *The Years marked* †, *denote the Time of Plague, or Contagious Diſtempers.*

The Bills of Mortality for the Imperial City of Augſburg, *from the Year* 1501 *to* 1720 *inclusive, containing the Number of Births, Marriages, and Burials Communicated by the ſame Ibid.* p. 94.

	The Year	Born	Couples married	Died		The Year	Born	Couples married	Died
	1501	1764	643	1982		1517	1890	419	1893
	1502	1984	440	1543		1518	1980	418	1872
	1503	1764	542	1646		1519	1760	419	1893
†	1504	3048	985	4765		1520	1542	320	1760
†	1505	2464	648	3564	†	1521	2970	322	3895
	1506	1974	764	1950		1522	1765	372	1980
	1507	1876	665	1754		1523	1822	382	1970
	1508	1764	444	1844		1524	1824	392	1989
	1509	1878	347	1764		1525	1827	435	1515
	1510	1976	765	1979		1526	1829	436	1418
†	1511	2897	896	4870		1527	1833	438	1522
†	1512	1768	786	2980		1528	1763	439	1632
	1513	1875	760	1960		1529	1783	440	1733
	1514	1985	645	1740		1530	1973	442	1893
	1515	1895	692	1622		1531	1853	445	1763
	1516	1470	410	1732		1532	1640	562	1543

The

	The Year	Born	Couples married	Died
	1533	1765	573	1172
	1534	1985	583	1282
+	1535	1410	593	13000
+	1536	1515	770	1492
	1537	1519	784	1462
	1538	1518	636	1565
	1539	1922	639	1575
	1540	1842	645	1585
	1541	1283	496	1208
	1542	1439	507	1472
	1543	1282	660	1283
	1544	1473	887	1179
	1545	1483	440	1065
	1546	1603	370	1356
+	1547	1646	630	3480
	1548	1705	492	1227
	1549	2038	819	1757
	1550	1205	411	1490
	1551	1867	360	1455
	1552	1567	417	1477
	1553	1677	498	1665
	1554	1270	445	1464
	1555	1497	526	1340
	1556	1587	447	1239
	1557	1520	417	1310
	1558	1670	488	1485
	1559	1763	467	1555
	1560	1297	613	1990
	1561	1150	488	1310
	1562	1717	454	1744
+	1563	1869	460	2680
+	1564	1872	536	2542
	1565	1779	538	1488
	1566	1861	418	1518
	1567	1723	424	1718
	1568	1757	440	1703
	1569	1838	446	1396
	1570	1884	334	1640
+	1571	1521	318	3071
+	1572	1634	650	3306
	1573	1629	549	1371
	1574	1488	382	1520
	1575	1563	384	1595
	1576	1647	442	1245
	1577	1721	386	1427
	1578	1687	403	1410
	1579	1629	388	1520
	1580	1635	416	1522
	1581	1477	456	1185
	1582	1627	414	1536
	1583	1497	452	1245
	1584	1614	311	1167
+	1585	1568	435	2497
+	1586	1583	526	3136
	1587	1541	578	1545
	1588	1583	420	1468
	1589	1664	426	1372
	1590	1592	405	1678
+	1591	1520	410	1352
+	1592	1632	363	3450
	1593	1581	649	1554
	1594	1629	396	1560
	1595	1517	335	1584
	1596	1639	437	1505
	1597	1608	393	1594
	1598	1552	380	1631
	1599	1486	386	1447
	1600	1621	499	1775
	1601	1575	387	1570
	1602	1468	453	1567
	1603	1570	390	1488
	1604	1551	394	1298
	1605	1272	394	1361
	1606	1587	376	1371
+	1607	1577	361	2595
	1608	1526	578	1476
	1609	1648	477	1469
	1610	1618	435	1941
	1611	1557	466	1891
	1612	1596	410	1625
	1613	1572	437	1722
	1614	1713	404	1444
	1615	1460	368	1771
	1616	1591	446	1631
	1617	1655	429	1514
	1618	1824	414	1354
	1619	1688	419	1485
	1620	1725	463	1667

	The Year	Born	Couples married	Died		The Year	Born	Couples married	Died
	1621	1661	443	1517		1665	624	272	745
	1622	1696	435	1959		1666	690	209	737
	1623	1374	451	1875		1667	754	193	769
	1624	1512	383	1370		1668	688	228	711
	1625	1482	386	1392		1669	793	192	743
	1626	1431	299	1440		1670	707	228	734
+	1627	1198	313	2494		1671	810	210	733
+	1628	1106	411	9611		1672	830	197	768
	1629	1121	860	1265		1673	786	239	751
	1630	1052	272	909		1674	874	251	842
	1631	1173	169	859		1675	775	201	913
+	1632	1286	355	3485		1676	805	230	913
+	1633	1075	537	3364		1677	843	224	934
+	1634	1054	299	4664		1678	854	239	943
+	1635	512	416	6243		1679	861	250	945
+	1636	789	440	790		1680	807	281	976
	1637	801	213	823		1681	888	214	860
	1638	809	209	638		1682	891	214	734
	1639	811	239	674		1683	892	195	808
	1640	843	217	586		1684	894	234	858
	1641	843	176	587		1685	885	230	848
	1642	832	248	593		1686	910	247	981
	1643	839	194	638		1687	853	281	855
	1644	841	189	659		1688	927	231	860
	1645	904	172	758		1689	853	213	806
	1646	1221	206	1488		1690	911	262	1071
	1647	944	256	1338		1691	825	253	785
	1648	1482	225	1208		1692	893	202	935
	1649	776	233	940		1693	818	219	1084
	1650	639	191	533		1694	760	277	1106
	1651	665	190	577		1695	867	262	1048
	1652	692	178	616		1696	930	274	927
	1653	686	150	575		1697	969	271	777
	1654	694	197	764		1698	1020	241	879
	1655	680	158	570		1699	1008	268	940
	1656	700	182	641		1700	909	217	786
	1657	675	182	731		1701	933	230	906
	1658	659	198	731		1702	952	249	900
	1659	687	187	831		1703	989	190	1245
	1660	657	211	657	+	1704	818	339	3113
	1661	710	179	668		1705	890	405	748
	1662	644	192	788		1706	949	307	842
	1663	675	207	836		1707	1013	240	805
	1664	687	224	761		1708	916	225	908

The

The Year	Born	Couples married	Died	The Year	Born	Couples married	Died
1709	948	240	805	1715	866	309	1024
1710	982	238	811	1716	997	272	905
1711	899	243	855	1717	924	259	988
1712	911	229	894	1718	986	280	768
1713	837	202	860	1719	924	270	997
1714	874	261	948	1720	909	263	934

III. By the firſt Septenary of the Centenary of the Bills of Mortality for the City of *Dreſden*, from 1616 to 1624, it appears that there died in that Electoral Capital 3136 Perſons; and in the laſt Septenary of the ſaid Centenary, from *Anno* 1709 to 1717, 8836.

Remarks upon the aforeſaid Bills of Mortality for the Cities of Dreſden *and* Augſburg. *By Mr* William Maitland, *F. R. S. Ibid.* p. 93.

And by the firſt Septenary of the ſame Centenary of the Bills of Mortality of the Imperial City of *Augsburg*, from 1616 to 1624, it appears that there died in that City 11371; and in the laſt Septenary, from 1709 to *Anno* 1717, only 6297; whereby is evinced the great Viciſſitudes of ſublunary Affairs, in the vaſt Diſparity between the aforeſaid Cities; for as the former has increaſed near $\frac{2}{3}$ in the Number of it's Inhabitants, ſo hath the latter decreaſed near $\frac{1}{2}$ in the ſaid Space of Time.

An Account of the Births and Burials, with the Number of the Inhabitants at Stoke-Damerell *in the County of* Devon. *Communicated by the Rev. Mr* William Barlow No. 439. P. 171. Oct. &c. 1735.

IV. A Survey being taken about *Michaelmas* 1733, of the Inhabitants of *Stoke-Damerell* in the County of *Devon*, the Number of Perſons, Men, Women, and Children, reſiding in the Pariſh, amounted to 3361, By the Regiſter, I find that in the ſame Year, 28 Couple were married. 61 Males and 61 Females baptized, and 62 People buried.

Baptized.	*Buried.*	*Number of People.*
122.	62.	3361.

Whence it appears that the Number of Perſons who died, is one more than half the Number of Children born; and that about 1 in 54 died.

It is to be obſerved, that the General Fever, which almoſt all the Inhabitants of the ſame Place were ill of at the ſame time, was in part within the Year mentioned: alſo that one of the Perſons included in the Number of thoſe buried, was a Foreigner brought from on board a *Dutch* Ship in the River; and that 2 more were drowned from on board a Man of War; but the Ships Companies are not included in the Number of the Inhabitants.

Not from this Account only, but from Experience and Obſervations, both of my ſelf and better Judges, I reckon the Pariſh of *Stoke-Damerell* as healthful an Air as any in *England*.

A ſhort Account of Mr Kerſſeboom's *Eſſay upon the Number of People in* Holland.

V. 1. Every body knows to what uſeful Purpoſes the Bills of Births and Burials at the City of *Breſlau*, the Capital of *Sileſia*, have been applied, by a very learned and ſagacious Member of the *Royal Society*; as alſo what curious Obſervations have been made, both Moral, Phyſical, and Political, by Sir *William Petty*, upon the ſame Argument, ſeveral Years before

and West-Friezland, *as also in* Harlem, Gouda, *and the* Hague; *drawn from the Bills of Births, Burials, or Marriages, in those Places. By* John Eames, *F. R. S.* No. 450. p. 401. Oct. *&c.* 1738.

before, and Dr *Arbuthnot* and others since. Our industrious Author hath not only consulted them, but acquainted himself more particularly with Mr *King*'s Observations in *Davenant*'s Essays, *&c.* in order to render himself more capable of making a just Estimate in this Matter. He begins with the Number of Inhabitants in the two Provinces of *Holland* and *West-Friezland*; these he makes at this time, *viz.* 1738, to amount in all to 980,000, and presents the Reader with the following Table of the Particulars. It exhibits the Number of People of all Ages, living at the same time, from the Birth to extreme old Age; which, because it shews the Chances of Mortality within the Ages mentioned, he calls the Table of Contingency of Life and Death.

The Table of Contingency.

Of above	90	Years old	there are	500
of	90		86 inclusive	2,500
	85		81	6,500
	80		76	13,000
	75		71	20,300
	70		66	27,300
	65	to	61	34,300
	60		56	40,800
	55		51	47,000
	50		46	53,000
	45		41	57,800
	40		36	62,500
	35		31	67,600
	30		27	58,400
				491,500 the Sum above 27 Years.
of	26		21	94,300
	20		16	83,400
	15	to	11	87,200
	10		6	91,800
	5	to	Birth	131,800
				488,500 Sum under 27 Years old
				491,500
				488,500
				980,000 Sum of all the Inhabitants.

This Table is founded upon 3 Principles, *viz.* Correct Observations upon the Tables of assignable Annuities in *Holland*, which have been kept there for above 125 Years; wherein the Ages of the Persons dying are truly entered: Upon a Supposition that there are yearly born in the

two Provinces 28,000 living Children; and laſtly, that the entire Number of Inhabitants in any Country is to the Number of the Births as 35 to 1.

This Table was ſent ſome time after it's Compoſure to Profeſſor *s'Graveſande*, F. R. S. to know his Thoughts, as well concerning the Juſtneſs of it, as it's Fitneſs to aſcertain the Value of Annuities on Lives; and, as he tells us, it met with the Profeſſor's Approbation.

From this Table it appears, (1.) That about half the Number of People in the two Provinces are above 27 Years old, and conſequently that near the other half are under that Age: (2.) Then, by following what hath been obſerved for more than 100 Years in *England*, and particularly in *London*, out of 35 Children born, 18 of them are Boys, and 17 Girls, the People in theſe two Provinces will conſiſt of

504,000 Males.
476,000 Females.

980,000.

He farther remarks, that it appears from the aſſignable Annuities for Lives mentioned before, the Females have in all Accidents of Age lived about 3 or 4 Years longer than the ſame Number of Males; which he looks upon to be appointed as a Compenſation for the continual Exceſs there is in the Birth of the Males above the Females.

Having conſidered the Quantity, he then comes to take notice of the Quality of theſe 980,000 Inhabitants, and ſays he ſees no Reaſon to differ from the Proportion of Mr *King* in *Davenant*'s Eſſays, who with a great deal of Pains and Judgment hath divided the People of *England* in this manner:

The Proportion for every 100,000 Inhabitants is,

Married Men and Women — — — —	34,500.
Widowers — — — — — — —	1,500.
Unmarried young Men and Children — —	45,000.
Servants — — — — — — — —	10,500.
Travellers, Strangers, *&c.* — — — —	4,000.
	100,000.

If this Proportion be admitted, then the Number of each Sort in *Holland* and *Weſt-Friczland* will be as you have underneath. He adds, that the ſaid Provinces can raiſe at this Time 220,000 able-bodied Men, deducting $\frac{1}{15}$ for Diſeaſes and other Infirmities. But then he admits at 16 years of Age, whereas Dr *Halley* admits none till 18, Perſons under that Age being generally too weak to bear the Fatigues of War, and the Weight of Arms. He then proceeds to rectify the Miſtakes of the learned *Iſaac Voſſius*, who makes but 550,000 in *Holland*, *Weſt-Friezland*, &c. diſallows Sir *William Petty*'s Account of the Number of People in *London*.

London,' becauſe he makes them alone equal to the Inhabitants of *Holland* and *Weſt-Friezland* together.

He cloſes the whole with a Table of the preſent Values of Annuities upon Lives, in Proportion to the ordinary or common Bonds charged upon thoſe Provinces, and ſubject to the extraordinary Taxes raiſed at this Time, *viz.* 1738. You will find annexed, the Degrees of Mortality, or Fatality, ſaid to be in the *Hague* and *Haagambagt*, as alſo the Numbers and Conditions of the Inhabitants of *Amſterdam*, *Harlem*, *Gouda*, and the *Hague*, not omitting *London* at this preſent Time.

The two Provinces of *Holland* and *Weſt-Friezland*.		*Amſterdam.*	*Harlem.*	*Gouda.*	*Hague.*	*London.*
Married Men and Women,	338000	86156	17420	6900	14850	241800
Widowers, ...	14700	4218	760	300	720	13100
Widows, ...	44100	13858	2280	900	2380	45700
Unmarried Youth and Children,	441000	93990	22700	9000	16190	215700
Servants, ...	102900	28318	5300	2100	4870	85000
Travellers, Strangers, *&c.*	39300	14460	2040	800	2490	52300
Total	980000	241000	50500	20000	41500	653600

The Fatality of the Quarters. *dead.*

Spring to Summer	307
Summer to the Autumnal Equinox	286
Autumn to Winter	287
Winter to Spring	286

The Fatality of the Months 31 Years, one with another.

	dead.
January	102
February	88
March	95
April	77
May	112
June	100
July	92
Auguſt	95
September	99
October	93
November	95
December	99

Hence it appears, that *March* is leſs fatal at the *Hague* and *Haagambagt* than *April*, and *April* than *May* and *June*; that *May* is the moſt fatal Month of all; that the remaining Months are nearly equal. It appears

appears further, that three Parts or Seasons of the Year are very nearly equal; but that the other Quarter or Season, beginning at the Vernal Equinox, is more fatal than any of the rest by one fifteenth Part.

A TABLE *of* Annuities *for* Life.

Let the Annuity be 100 Guilders a Year, upon a Life under a Year old.

			Guild.	Guild.	Sti.
It's present Value is	— — — —		1667	that is 6	0 *per Cent.*
Upon a Life of 5	Years to	1 inclusive	1869	5	7
10	6		1835	5	9
15	11		1770	5	13
20	16		1667	6	0
25	21		1587	6	6
30	26		1515	6	12
35	31		1429	7	0
40	36		1334	7	10
45	41		1212	8	5
50	46		1093	9	3
55	51		971	10	6
60	56		840	11	8
65	61		709	14	2
70	66		570	17	11

USE.

Question, Let it be desired to know the present Value of any Annuity for Life, for Instance, of 90 Guilders a Year, which was granted in the Year 1703, upon a Life then of three Years old.

Answer, The Life now (in 1738) is between 37 and 38 Years old; hence the Number between 40 and 36 gives 1334, for the present Value of an Annuity of 100 Guilders; hence $\left(\frac{1334 \times 90}{100} =\right)$ 1200 Guilders is the present Value of the Annuity for that Life.

There are other Uses mentioned; but for these I refer to the Essay itself.

2. Some time ago an Abstract of a Political Essay, written by Mr *W. Kerssboom*, a *Dutch* Gentleman, (*intituled*, Verhandeling *tot een Proeve om te weeten de probable* Menigte *des* Volks *in de Proventie van* Hollandt *en* Westvriesland) was read before this Honourable *Society*; wherein the Author, to the great Disparagement of the City of *London*, has

An Answer to that Part of Mr W. Kersseboom's *Essay, which treats of the Number of*

the Inhabitants of London; *by* W. Maitland, *F. R. S. Ibid* p. 407.

has asserted *, that the City of *Paris*, in the Year 1684, and at the close of the last Century, contained more Inhabitants than the City of *London*.

And to prove that *Paris* contains a greater Number of Inhabitants than *London*, he has had recourse to the Accounts of Christenings annually published in both Cities, without giving himself the Trouble to inquire into the Nature of those his Authorities; which if he had, he would soon have discovered, that the former, is a perfect Account, while the latter, is perhaps the most defective of any extant; for the Christenings therein mentioned, are only those whereat the Parish Clerks are present: which, I am of Opinion, cannot amount to near $\frac{2}{3}$ of the whole, as I shall endeavour to make appear.

The Burials in the annexed Table, by some Typographical Errors in the Political Account of my History of *London* †, from which it is taken, being increased 491 above the real number, in *Graunt*'s Account ‖, the Sum Total whereof, amounting to 90350, must be reduced to 89859; and as in the annexed Term of Years, there appears to have died of the Plague 1741 **, three and a half of which, I compute, would have died of common Distempers, out of each Hundred, which amounting to about 61, the same being deducted from 89859, the real Number of the Burials, the Sum will be reduced to 89798, which taken from 90883, the Number Total of the Christenings, the remaining Sum will be, 1085, which being divided by ten, the Medium thereof will be 108½ yearly in Favour of the Christenings.

A Decenary account of the Christenings and Burials of *London*, in the following Years.

Years.	Christened	Buried. Com. Dist.	Buried Plague.	Totals Buried.
1626	6701	7400	134	7534
1627	8408	7713	4	7717
1628	8564	7740	3	7743
1629	9901	8771	0	8771
1630	9315	9228	1317	10545
1631	8524	8288	274	8562
1632	9584	9527	8	9535
1633	9997	8392	0	8392
1634	9855	10899	1	10900
1635	10034	10651	0	10651
Tot. Gen.	90883	88609	1741	90350

This Difference in Favour of the Christenings, is owing to the Citizens of that Time being almost of the same Religion; but the Civil War breaking out soon after, the People deviated into a Variety of Sects, subverted the Church of *England*, and assuming the Civil Power, established a new Hierarchy, or Church-Government. But the Mem-

* *Kersseboom*'s Verhandel. p. 14. *ib.* 17. † *Maitland*'s Hist. *Lond.* p. 535.
‖ *Graunt*'s Nat. and Polit. Observ. 3d Edit. *Lond.* ** *Maitland*'s Hist. *Lond.* p. 535.

bers

bers of the abolished Church continuing to baptize among themselves, (without reporting their Christenings to the new-appointed Members of the Company of Parish-Clerks) occasioned a very great Defect in the account of Christenings annually published by the said Parish-Clerks.

From this *Epocha*, is to be dated the Majority of the Burials in the Bill of Mortality over the Christenings of *London*: and though the Church of *England* was soon after re-established, yet the numerous Dissenters of all Denominations, persevering in their Separation, continued to baptize within themselves, without sending in Accounts of their Christenings to the restored Members of the Company of Parish-Clerks; and the Schism still continuing, the Accounts of the Christenings and Burials of this City remain upon the ancient Foot of Division and Imperfection.

Add to this, that not only all the foreign Churches in *London* christen within themselves, but likewise many Churches and Chapels of the Church of *England*, that send not in their Accounts to the Company of Parish-Clerks, which, together with those of the Dissenters and Foreigners of all Denominations, amount to no less a Number than one hundred and eighty-one Congregations, whose Accounts of Christenings are not published: By which it is evident, that the vast Disparity between the Christenings and Burials of this City, is not owing, as Mr *Kersseboom* vainly imagines *, to the Residence of the Court, Convention of Parliament, and great Resort of People from all Parts, but in Fact to the great Defect abovementioned.

However, that Gentleman, from the aforesaid very defective Account of the Christenings of this City, has calculated the Number of it's Inhabitants by a Medium of the Christenings in the Years 1684 † and 1685; whereby he makes the Number at that Time amount to 500,344: But as this Number, is only taken from a Medium of two Years, he imagines it too great; therefore to reduce the same to the Number of ‖ 469,700, by a Medium of 20 Years, he has unwarrantably precluded the Sum of 14,702, the Number of Christenings in the Year 1684, to make room for the Sum of 11,851, the Number of Christenings in the Year 1674; whereby the Number of the Inhabitants of *London*, is very much lessened.

And as a farther Instance of Mr *Kersseboom*'s Partiality in Favour of the City of *Paris*, he has calculated the Number of it's Inhabitants (without mentioning the Uncertainty of a Calculation founded on a short Space of Time, as he has done in the Case of *London*) at a Medium of the Christenings for the Years** 1670, 1671, and 1672, whereby he makes them at that Time, amount to, 610,300; adding, the Number

* *Kersseboom*'s Verhandel. p. 25. † *Kersseboom*'s Verhandel. p. 14. ‖ Idem ibid. ** Ibid. p. 16.

muſt have been greater at the End of the laſt Century; as by his extravagant manner of Calculation it ſhould be at preſent.

But as it appears by the above-ſpecified ten Years Account, that the Chriſtenings of *London* greatly exceed the Burials of that Time, I think it will not be denyed, that they exceed the ſame at preſent; eſpecially if we conſider, that the Number of Chriſtenings in *Paris*, at a Medium of 9 Years (preceding that of 1737) exceeded that of the Burials 98 yearly; notwithſtanding that City, not only abounds with a vaſt Number of Religious of both Sexes, who are ſworn to Celibacy, but likewiſe many Thouſands of Students belonging to the Univerſity, who lead a ſingle Life; whereas in *London*, there are no ſuch Perſons, to prevent the Increaſe of it's Inhabitants.

And as in my Political Account of *London*, it appears *, that at a Medium of 9 Years, there are annually buried in *London* 29,542, and in *Paris* only 17,804, which is 11,738 in Favour of the former; ſo muſt the Births in *London* at preſent (according to the above-ſpecified ten Years Account, the Reaſons aforeſaid, and the *Paris* Account of Chriſtenings) yearly exceed thoſe of *Paris* 12,320; whereby is ſhewn, that the Inhabitants of *London* exceed thoſe of *Paris* above $\frac{3}{5}$ in Number.

By what has been ſaid, I doubt not but Mr *Kerſſeboom*'s Aſtoniſhment will not only ceaſe, in reſpect to the great Difference between the Chriſtenings and Burials of *London*; but he will be likewiſe induced to do Juſtice to this injured City, by acknowledging that the Inhabitants thereof vaſtly exceed thoſe of *Paris* in point of Number.

What Mr *Kerſſeboom*'s Partiality in Favour of the City of *Paris* is owing to, I know not; unleſs it be out of Pique to Sir *William Petty*, (with whom he ſeems not well pleaſed) for ſaying, that the City of *London* contained as many Inhabitants as the Province of *Holland* and *Weſt-Frieſland*: Which, I think, will be no difficult matter to make appear, by allowing that Gentleman his ſuppoſed Number of 28,000 † Children to be annually born in the ſaid Province; whereas, according to the above-ſpecified ten Years Account, and the *Paris* Proportion of Births, there muſt be annually born in *London* 31,008 Children: Therefore, as this Number, according to my Calculation ‖, is the Produce of 725,903, the preſent Number of the Inhabitants of *London*; ſo muſt 28,000 **, the Number of Children ſuppoſed to be born yearly in the Province of *Holland* and *Weſt-Frieſland*, be the Produce of 655,485, the preſent Number of the Inhabitants of the ſaid Province. Notwithſtanding Mr *Kerſſeboom*, by his exceſſive and unprecedented reckoning of the Births at $\frac{1}{35}$ part of the People, has calculated them at 980,000; whereas by Dr *Halley*'s Method of Calculation (which is ſo highly approved of by Mr *Kerſſeboom*, that he ſeemingly would be thought to make it the Standard of his Calculations) the Inhabitants of the Province of *Holland* and *Weſt-Frieſland* do not amount to 29 times the Number

* *Maitland*'s Hiſt. *Lond.* p. 540 and 548. † *Kerſſeboom*'s Verhandel. p. 3.
‖ *Maitland*'s Hiſt. *Lond.* p. 541. ** *Kerſſeboom*'s Verhandel. p. 3.

of

of the Births; which gives room to ſuſpect, that Mr *Kerſſeboom* has introduced this unheard-of Exceſs, to increaſe the Number of People in the ſaid Province of *Holland* and *Weſt-Frieſland.*

3. Mr *Kerſſeboom* having advanced in his *Firſt Treatiſe*, that the Provinces of *Holland* and *Weſt-Frieſland* contained 980,000 Souls, of all Ages, on a well-grounded Suppoſition, that annually are born in the ſaid two Provinces 28,000 Children alive; but it having been the Opinion, that this ſhould be more clearly demonſtrated, has thought it neceſſary to comply therewith. In order to which, the Author has divided the Provinces into three general Diviſions, diſtinguiſhed with the Letters A, B, C; and given the Names of the ſeveral Cities, Towns, and Villages, belonging to the ſeveral Letters juſt now mentioned; and ſuppoſes, on good Grounds, (though not on a Mathematical Enumeration, which the Author could not do, for Reaſons aſſigned in his Firſt Treatiſe, Page 38.) that in the Firſt Diviſion marked

A. — are born alive annually 3890 Children.
B. — — — — annually 19070 and
C. — — —— annually 5040.

which is together ——— annually 28000 Children.

Extract by John van Rixtel, *F. R. S. of Mr* W. Kerſſeboom's *Second and Third Treatiſe, confirming the Manner how to know the probable Quantity of People in the Provinces of* Holland *and* Weſt-Friesland, *beſides a Foundation on which to prove the probable Lives of Widows, and likewiſe a Rule whereby to know the Duration of Marriages.* No. 468. p. 315. *Read* Jan. 27. 1742-3.

And, as it has been proved in his Firſt Treatiſe, by what has been there obſerved, in relation to Annuities for Life; that for every Child that is born, the whole Number of People is 35 times as many; ſo it will prove, that theſe Numbers being multiplied together, it renders 980,000 Souls.

But as it was impoſſible for the Author (as has been hinted before) to get an exact Account, from all Places, of the Births, Weddings, and Burials, (from which two laſt the Firſt is to be cited and proved) he proceeds to give you the chief Obſervations he was able to obtain; and believes that theſe, joined with thoſe contained in his Firſt Treatiſe, will be a ſufficient Proof to his general Calculations.

Mr *Kerſſeboom* then goes on, with giving an Account how many People were buried in the City of *Dort* every Year, from 1700 to 1739 incluſive, amounting, in 40 Years, to 28,977 Perſons; which is annually, on an Average, 724. —— The Marriages are 202 Couple annually, during the ſame time, which ſhould produce (according to the Author's Calculations in his Firſt Treatiſe, Page 24) 325 Children *per* 100 Marriages, and conſequently 656 Children *per Annum*; but has found it, on an Average, to be 651. —— This City being a Sea-Port, and driving a large Trade to *Scotland*, and on the *Rhine*, and conſequently many of the People, whoſe Traffick brings them to *Dort*, may die there, it is ſuppoſed, that about 680 Children are born annually there, and that conſequently this City may contain 24,000 Souls.

Next to this, the Author gives an Account of *Haerlem*, how many People died there in 84 Years, from 1656 to 1739 inclusive, namely, 132,132 Persons, which is annually, on an Average, 1573. —— The next is, how many Marriages from *Anno* 1690 to 1739 inclusive, namely, 21,910, is annually 438, on an Average. —— About the Births, Mr *Kerssebcom* refers to his First Treatise, Page 54, where he supposes, that 1450 Children may be born alive annually; and endeavours to demonstrate it further, by giving an Account of the Births for 60 Years, namely, from 1680 to 1739, and finds it to be 1453; from which it is calculated, that this City contains 50,500 Souls as mentioned in his First Treatise.

The next Account is that of the Burials of *Delft* and *Delfshaven*, from the Year 1724 to 1739, being 15 Years, and is found to be annually, on an Average, 723 Persons; but there is subjoined, for the greater Certainty, an Account from the Year 1696 to 1739, which proves it to be 748 Persons annually.

The Marriages are in the same Time of 44 Years, on an Average, 224 *per Annum*, which should produce 728 Children, according to the Rule laid down before, namely, 100 Marriages producing 325 Children; but is found to produce from 1690 to 1739 inclusive, to be 648 *per Annum*, on an Average; from whence it is supposed those two Places contain 25,000 Souls.

The City of *Leyden* comes next in Consideration. It appears by a List for 50 Years, namely, from the Year 1690 to 1739 inclusive, that there have been buried in that City annually, on an Average, 1919 Persons; and married during the same Time, annually, on an Average, 558 Couple, which, agreeable to the former Rule, would produce 1813 Children *per Annum*, but is found to have been 1834 *per Annum*, on a Medium, as aforesaid; the Author concludes consequently, that this City contains 63,000 Souls.

The next City in View is *Amsterdam*: It appears by a List, that since the Year 1696 to 1738 inclusive, there have been buried in this City 7323 Persons annually (*Jews* excepted); and there having been married, during the same Time of 43 Years, 2311 Couple annually, produced, according to the Author's Computation, 7134 Children annually, at a Medium; and takes it thence for certain, that *Amsterdam* contains (including 20,000 *Jews*, as observed in his First Treatise, Page 21.) 241,000 Souls. The Author proceeds, in the like curious Manner, about other Places; but least, dwelling too long on this Particular, it might prove tedious in this Place, I will proceed with observing, that the Author gives next a Table how long 432 Widows lived during a Century, and shews it to have been near 14 Years each on a Medium; and then subjoins a List how many Years married People of different Ages continue to live probably together, before the Bonds of Matrimony, by the Death of either Party, are dissolved; namely,

		live between
Thoſe whoſe Ages together are	40	24 and 25 Years.
— — — — — — —	50	22 23.
— — — — — — —	60	23 21.
— — — — — — —	70	19 20.
— — — — — — —	80	17 18.
— — — — — — —	90	14 15.
— — — — — — —	100	12 13.

And finiſhes with rejecting the Method of calculating the Quantity of People after the manner of *Voſſius*, *Auzout*, *Petty*, and others. ——

The *Third* Treatiſe contains, 1*ſt*, A Copy of a Letter written by the Author in the Beginning of the Year 1741, to Mr *Eames*, and laid before the *Royal Society* ſoon after, by the ſaid Gentleman.

2*dly*, A Demonſtration, in 29 Tables, that Mr *Simpſon*'s Calculation of Lives, as 1 to 26, is a Miſtake, and his own Hypotheſis, as 1 to 35, right; and proves from Mr *Maitland*'s Obſervations, Page 541, that Children in *London*, of two Years old, continue to live, on a Medium, above 37 Years; and obſerves, that Dr *Halley*'s Table has it full 38 Years and a half. ——

The Author ſuppoſes, 3*dly*, That out of every 100 Children born, Five come dead into the World; and that out of every 100 Children born alive, near 20 die under a Year old; and ſhews, 4*thly*, how much Mr *Simpſon* differs in his Calculation; namely, That full 32, out of 100 Children, die, under a Year old. ——

The reſt of this Treatiſe conſiſts in divers Calculations and Tables of of Intereſt, and the Value of Annuities for Life on different Ages and Intereſt; and concludes with an Explanation of the ſame, and the Uſefulneſs thereof.

CHAP. X.

PHARMACY and CHYMISTRY.

I. THE Knowledge of this Remedy was firſt purchaſed from a famous *Negro* Poiſoner, at a great Expence, by one who ſtyles himſelf, *Iſaiah Burgeſs*, *Doctor of Phyſic*; and the Secret devolved to myſelf, by means of a Manuſcript of the Doctor's, which, amongſt others, I have procured, for my *Hiſtory of the Phyſical and Chirurgical Writers of this Kingdom*. The Author intended this little Tract, which contains *Obſervations on the moſt conſiderable Diſtempers in* America, ſhould be made publick; he wrote it, at the Requeſt of his Friends, when an Expedition was deſigned into *America*; and particularly declares, that he purpoſed the Divulgation of this ſpecific Antidote, *that ſuch as ſhould go to the*

An Antidote to the Indian Poiſon in the Weſt-Indies, *by* Edward Milward, *M. D.* No. 462. p. 2. *Read* Jan. 7. 1741-2.

the Weſt-Indies, *amongſt the* Spaniards, *might meet with a Remedy in caſe of Neceſſity.* What prevented the Doctor from executing this his laudable Deſign, I know not.

" The *Negroes*, ſays he, uſe a Poiſon of a ſtrange and extraordinary " Nature. The Doſe is very ſmall, and it hath no ill Taſte; ſo that, " mixt with Meat or Drink, it is not perceivable. It cauſeth divers " Symptoms, and the Effect is various, according as the Doſe is large " or ſmall. It kills ſometimes in very few Hours, ſometimes in ſome " Months, and at others in ſome Years. The Symptoms are according " to the Quantity given: If great, it cauſeth Evacuations upwards and " downwards; of Excrements firſt, then of Humours, and laſtly of " Blood, with Fainting-Fits, and Sweatings. Death follows in 6 or 7 " Hours. The *Negroes* turn white.

" If the Doſe is but ſmall, the Sick loſeth his Appetite, feels Pains " in his Head, Arms, and Limbs, a Wearineſs all over, Soreneſs in " his Breaſt, and Difficulty of Breathing, (ſo that one appears as being " in a Conſumption) and at laſt dies languiſhing.

" All Remedies yet publickly known, are of no Force nor Virtue " againſt this Poiſon; and the Patient certainly dies. Nay, I queſtion " whether the beſt Cordial Remedies can put the leaſt Stop to the " Efficacy of it's Venom, or retard Death, and put it off, longer than " the Intention of the cunning Poiſoner had fixed it, in proportioning " the Doſe.

" I know that the *Spaniards* have knowledge of this very Poiſon, and " am ſatisfied, that I have ſeen ſeveral *Bocaniers* die of it, given them by " *Spaniſh* Women. I am alſo perſuaded, that it is the ſame Poiſon " uſed in *Spain* and *Italy*.

" This Poiſon hath but one ſpecific Antidote yet known; the Know- " ledge of which coſt me very dear: And it was with much Difficulty " I could perſuade a famous *Negro* Poiſoner to part with his Secret.

" The Antidote is, the Root of the *Senſible Weed*, as it is commonly " called, or *Herba Senſitiva*. It grows like a Shrub, has no Prickles, " bloſſoms yellow, and bears little Cods, full of ſmall black pretty Seeds, " of which the Women make Necklaces and Bracelets. Take none of " the Root but what is in the Ground; waſh it well, and ſplit it in two. " Take a good Handful of theſe Roots ſo ſplit, and ſteep them in 3 " Quarts of good clear Water in an earthen glazed Pot, having a Cover. " Uſe but a moderate Fire, that it may boil but very gently. The De- " coction has no ill Taſte, and you may either give it ſo, or add Sugar, " as you ſhall think beſt. Give to the Patient a good Glaſs of this De- " coction, as warm as he can drink it; an Hour after give another, and " ſo for ſome time, as you ſhall think it neceſſary to make a perfect Cure. " There is no Danger of giving too much; it can do no harm at all. " Several People have taken this Decoction, though they have not been " poiſoned, thinking it would do them good in other Diſtempers; ſo " that one who any ways ſuſpects he has had ſome of that Poiſon given

" him,

" him, may drink it very ſafely, and in what Quantity he pleaſes.
" The reſt of the Plant is to be rejected as bad and noxious."

The Doctor enforces his Obſervations by remarking, that he had been a Practitioner in thoſe Parts for above 25 Years. Many *Negroes*, he ſays, were wonderfully preſerved and cured by taking of this Antidote, though, for Brevity's Sake, he gives but one Inſtance; which is, " of a ſtrong *Negro* Man, about 30 Years of Age, and in perfect " Health, who being one Night at a Plantation 4 Miles diſtant from " that where he lived, was invited to drink a Dram of Rum, by an- " other *Negro*, who mixt Poiſon with it. The Fellow drank it up, " perceiving nothing to be in it; but as he was taking Leave, on the " other's bidding him Farewel, and telling him he ſhould never ſee " him again, he ſuſpected he was poiſoned; and putting his Finger " in his Mouth, vomited up great Part of the Poiſon, though there " remained enough of it to cauſe continual Evacuations in him up- " wards and downwards; of Excrements firſt, then of Humours, and " laſtly of Blood. As he was coming home, he fainted away ſeveral " Times, and calling at length to ſome Neighbour-*Negro* Houſes, " was brought home extremely altered; turned white, and was, as it " was thought, expiring. The Root was immediately ſent for, and " the Decoction made, and given him in great Quantity. He conti- " nued taking it for 3 or 4 Days, and on the 5th went to work along " with the reſt of the *Negroes*."

That the *Senſible Plant* is endowed with the Property of reſiſting Poiſon, hath been, before this, taken Notice of. For Sir *Hans Sloane* hath obſerved from *Piſo*, that the *Root* of this Shrub is an Antidote againſt the *Shrub* itſelf, which is very poiſonous, and kills by Degrees, making the unhappy Sufferers Cachectical, Short-winded, and Melancholy, till they die *. This greatly corroborates what our Author has advanced; and it is obſervable, that he likewiſe directs all Parts of the Plant, except that Part of the Root which is in the Ground, *to be rejected, as bad and noxious:* Though whether this be exactly the ſame Plant with what our Author mentions, I dare not determine; as Sir *Hans Sloane* enquires whether it be not the *Æſchynomene, ſeu Mimoſa arboreſcens Americana, &c. flore albo*; whereas Dr *Burgeſs* expreſsly ſays, that it *flowers yellow:* though this may, poſſibly, be a Miſtake in him.

I am ſenſible it may be objected, that the *Negro* Poiſon is of various Kinds; and that therefore, though this Remedy may be ſo extraordinary a Specific in ſome Caſes, it may be unavailable in others. That the *Negroes* may have the Knowledge of different Sorts of Poiſon, I deny not; but it would appear, from the Univerſality of the Effects of this Medicine, as the Doctor affirms *many have been wonderfully cured and preſerved by it*, and does not mention a ſingle Inſtance of it's Miſ-

* Nat. Hiſt. of *Jamaica*, Vol. II. *p.* 57.

carriage, as though the *Negroes* in the *Weſt-Indies* uſed but *one* Kind of Poiſon, or, if different, yet ſuch as comes within the Power of this Remedy. Beſides, as we cannot be aſſured, but by the Conſequence, whether the Poiſon be of that Sort, as to be within the Reach of this Remedy, or not, I think there is all the Reaſon in the World it ſhould be adminiſtered under any Suſpicion of the *Indian* Poiſon: Eſpecially, as the Doctor aſſures us of it's great Innocence; and I believe every one will readily agree with me, that it is no ſmall Recommendation of a Medicine, *That let what will become of it's good Effects, it can do no Harm.*

Dioſcorides hath rightly obſerved in his *Alexipharmics, that very different Poiſons produce the ſame Effects upon Human Bodies; and that therefore they are, for the moſt part, curable by the ſame Remedies. For though the Kinds of Poiſons are various, yet the Effects which ariſe from them are common, and but few.* And Dr *Mead* is of Opinion, *that though there be a great Variety of internal Poiſons, as well Mineral as Vegetable, yet they do all of them ſeem to agree in their primary Effects, and Manner of Operation.* Eſſ. III. And in another Place, *That virulent Plants, although they may be diſtinguiſhed even from one another by particular Virtues, do however kill by a like Operation and Force.* From whence it ſeems reaſonable to infer, that although Poiſons may be various in themſelves, yet it is not impoſſible they may be cured by the ſame Remedy; as they produce like Effects, and ſeem to kill by a like Manner of Operation. And a very remarkable Inſtance of this we have in all corroſive Poiſons, whether of the Mineral or Vegetable Kingdom, which, however different in themſelves, produce their Effects univerſally by eroding the Coats of the *Stomach*, and the *Primæ Viæ*; and which are all curable in like Manner, by ſheathing and blunting their acrimonious Particles, by means of ſmooth, lubricating, and oleaginous Medicines.

But be this as it will, I think the Remedy deſerves, at leaſt, a fair and impartial Trial, as the Author has not indulged in any rhetorical Flouriſhes, or Theory, but ſeemingly confined himſelf to Truth, and plain Matter of Fact. And, indeed, ſhould it be found to ſucceed but *One* Time in 20, in ſuch deplorable Circumſtances, it cannot but be a Diſcovery of the greateſt Conſequence; eſpecially as we are ſufficiently aſſured beforehand, that all Cordial and Alexipharmic Medicines beſides, can be of no Service at all. And this may ſerve as another Argument, why, under any Probability of a Perſon's being injured by the *Indian* or *Negro* Poiſon, this Remedy ſhould be adminiſtered; even though we cannot poſitively be aſſured, whether it be by this very Poiſon or not: For in Caſes where all other Remedies are likely, if not ſure, to prove unavailable, we may as well adviſe this as any.

One Thing more I muſt beg leave to add, with regard to the Trial of this Medicine; that it would be neceſſary to obſerve, whether the ſame Root, dried, would be of equal, or any Efficacy; that if ſo, the

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Benefits of it may be extended to other Climates wherein this Herb does not naturally grow: Particularly as the Author is convinced, that the ſame Sort of Poiſon is uſed both in *Spain* and *Italy*.

II. 1. Ambergris is called *Ambra Indica*, *Ambra Orientalis*, *Ambra odorifera*, and *Ambra vera*; but moſt commonly *Ambra gryſea*, or *chryſea*. It has alſo ſeveral barbarous Names, as *Porambar*, *Puambar*, and *Pinambar*; alſo *Ambra rufa*, *pinguis*, *Selachitica*, *Sechra*, and other ſuch like, which I ſhall paſs over in Silence, as conducing little or nothing to my Purpoſe.

Of Ambergris, by Caſpar Neuman, *M. D. Prof. Chym. at* Berlin, *F. R. S.* No. 433. P. 344.

There are few Subſtances concerning the origin of which there have been ſo many various Opinions among Authors. One aſcribes it to the Vegetable Kingdom, another to the Animal, and a third to the Mineral Kingdom. But others not contented with the 3 Kingdoms, into which all natural Bodies are commonly reduced, have thought fit to make it a Subject of an Aëreal Kingdom; and others again will have it to belong to none of theſe Kingdoms, but to a Marine Kingdom: and yet the whole Sea, with all it's various Contents of Animals, Fiſhes, Shells, Plants, Stones, Waters, Salts, *&c.* may be aſcribed to one or other of the three uſual Kingdoms; and therefore there is no Need of any ſuch new Diſtribution.

I ſhould be guilty of great Tedioufneſs and Prolixity, if I ſhould inſiſt upon all that has been ſaid of it by theſe various Authors: Wherefore I ſhall touch but lightly upon what appears palpably abſurd, and examine only what Opinions ſeem more probable, and are received by ſeveral Perſons, giving my own Opinion alſo concerning them.

As for the Aëreal Kingdom, I know but of one Author, *Oelven*, who has ſtood up for it; for he has taken Ambergris for a *Meteor*, or Body generated in the Air, and has endeavoured to ſupport this evidently falſe *Hypotheſis* by various Reaſons. But as this Opinion is ſufficiently confuted by the very Weight, which ſometimes amounts to 100 ℔, and by the Subſtance and Mixture of the eſſential Parts of Ambergris, I ſhall not dwell any longer upon it, eſpecially as it was confuted alſo in 1707.

Many ſtand up for the Animal Kingdom, but ſo as in ſome Meaſure not to forſake the Aëreal; for they will have the origin of Ambergris to proceed from volatile Animals. Theſe differ egregiouſly one from another, and may be divided into 2 Claſſes. The firſt take it to be the *Dung of Birds*, to which Opinion they have been led by the ſmall Bills and Claws, or little Pieces at leaſt of them, which are often found in Ambergris. Nay they go ſo far as to deſcribe the very Bird from which it proceeds. They ſay it is of the Size of a Gooſe, with beautiful Feathers, and Spots, and is called in the *Maldivian* Tongue *Anacangriſpaſqui*, and in that of *Madagaſcar Aſchibobuck*. *Ferdinand Lopez de Caſtagneda* * and others affirm, that this Bird feeds upon various fragrant

* *Rerum à Luſitanis in India Orientali geſtar. Script.* Lib. iv. Cap. 35.

Herbs, and that it depoſits the precious Dung proceeding from them, on Rocks and Stones in and about the Sea; and that this Excrement is digeſted and macerated by the Sun, and depurated by the Moon, and ſo being ripened by the 2 celeſtial Luminaries into Ambergris, prepared and perfected, it is afterwards torn off by Storms, and waſhed into the Sea by the Waves, and at laſt thrown upon the Shore; or elſe is ſwallowed by the Whales, which not being able to digeſt it, ſoon vomit it up again. The other Claſs, of which the principal are *Denis* *, *Monconys* †, *Lemery* ‖, and *Pomet* **, to whom moſt of the *French* Authors adhere, ſay the Ambergris is the Comb of a Sort of *Bees*, which build their Cells about the Rocks, whence they are carried away by Storms, and being toſſed about by the Waves, are attenuated, torrefied, and digeſted by the Salt Water and Heat of the Sun, into Ambergris, in which Form it is caſt on the Shore. Thoſe, who embrace this Opinion, endeavour to confirm it by that white, viſcid, tenacious Subſtance, which is commonly precipitated from the Eſſence of Ambergris, and is thought by them to be of the Nature of Wax.

That both theſe Opinions are falſe, it is evident from the following Circumſtances: 1. There is a ſufficient Quantity of Ambergris found in thoſe Places, where none of theſe Birds or Bees are to be ſeen. 2. Where there are few or no Rocks or Stones: 3. Where the Stones and Rocks are free from the Dung of Birds, and Cells of Bees.

That the firſt Opinion in particular is falſe, is evident, becauſe, 1. Thoſe Parts of Birds which are ſometimes found in Ambergris, are not the Bills and Feet of a Gooſe, but only ſome light and very tender Particles. 2. It cannot be imagined, how the Bills and Claws and other Parts of different Birds ſhould get into the Body and Dung of the Birds ſuppoſed to breed Ambergris, which are ſaid to be of the Size of a Gooſe. 3. The eating of fragrant Herbs by no Means renders the Dung fragrant. 4. It is contrary to all Experience, to ſay that the Sun by it's Digeſtion gives a fragrant Smell to any Excrement; for on the contrary it promotes Putrefaction, which does not produce an agreeable Smell, but a nauſeous Stink; eſpecially when many ſoft Excrements are joined together; as we often find large Maſſes of Ambergris, that are yet viſcid. But if the Excrements are ſmall and dry, the Sun draws out of them all their fragrant Particles, as we ſee in the Dung of many Birds, which are quite dried up by the Sun, and reduced to an inſipid Earth. 5. This Dung of Birds would be diſſolved by the Sea Water, or at leaſt reduced into ſmall Pieces, notwithſtanding it's having

* Rec. des Memoires & Conferences ſur les Arts & les Sciences 1672. M. Aug. Pag. 222, & ſ. it. Mediſeri Coſmograph. Tom. I. p. 101. it. Ejus deſcriptio Inſulæ Madagaſcar, Cap. vi. pag. 43. it. Odoardus Barboſa, it. Andr. Tevet & Franc. Belloforeſtus.

† Monconys in Itinerario ſuo Edit. Pariſ. en Suite de la II. Partie, p. 143. item Edit. Londinenſ. pag. 71.

‖ Traité Univerſal des Drogues ſimples, pag. 34.

** Hiſtoire generale des Drogues, Part. II. Liv. I. pag. 57.

been

been ever so diligently irradiated by the Beams of the Sun and Moon. 6. The Waves of the Sea cannot be expected to wait till the Dung has been sufficiently digested by the Sun and Moon, but must be frequently washed away in it's more imperfect State, and so be quite dissolved and dispersed in the Water. Whence then do those solid and uniform Pieces of Ambergris arise, which amount sometimes to 100 ℔. 7. The Inhabitants, Fishermen, and Mariners employed in getting Ambergris, are wholly unacquainted with these Birds and Excrements. 8. If it follows from the Bones, Beaks, and Claws of Birds being found in Ambergris, that this Substance must be the Dung of Birds; I would ask in the first Place, whether any Person has ever known an Instance of these Parts of Birds being discharged with their Excrements. And if this is affirmed, I may with equal Reason assert, that Ambergris is the Dung of Shell Fishes; for there are as many Fragments of Shells as Parts of Birds found in it. 9. This Opinion is contradicted by the Substance, natural Mixture, and chymical Analysis of Ambergris; for no Sign of an Excrement can be found in it; to pass over other contradicting Circumstances.

The Opinion of the Bee-hives may also in like Manner be refuted: For, 1. Such Bees and Bee-hives must have been observed by several Persons; and yet not one, either in *Asia* or *America*, has ever seen them. Therefore this Opinion must rest wholly on the Authority of *Denis* and *Monconys*, and those who implicitly assent to them. 2. If ever so many Hundred Thousand Bee-Hives were really observed to be about the Rocks; yet it is well known, that the Honey would entirely dissolve in the Water, and leave the Comb empty. 3. If these tender Cells were emptied of their Honey, the remaining Mass would not be strong enough to resist the Violence of the Waves, and would be torn in Pieces, far from resembling such a large uniform Mass as Ambergris. 4. If any one should still maintain, that these Cells do resist the Waves, he must allow that we should find a cellular hollow Substance in Ambergris, which we certainly do not. *Borellus* * indeed, who was of this Sect, was of Opinion, that these emptied Cells were afterwards filled in the Sea with various Substances: but this is a meer Fiction, and Imagination of his own. For these waxen Cells must still continue to be Wax, and no one can imagine that they would be filled accidentally in the Sea with Ambergris. If that was the Case, then it would again contradict the Opinion, that Ambergris is produced by the Bees. I should rather think, that if these Cells were tossed about in the Sea, they would be filled with various Substances; and if any one can bring himself to imagine, that the Mixture of various Substances accidentally brought together is Ambergris, he will again contradict the Production of it by the Bees. Besides the Form of the Cells would remain, which no body pretends to have seen. 5. If any one should object, that the Wax is

* Petr. Borell. Obs. Med. Phys. Cent. iv. Obs. 66.

conglo-

conglobated into one Mass by the Heat of the Sun. I answer; that I find by Experience, that if I expose a Honey-comb to the Sun, and digest it, turn it, or manage it in any Manner whatsoever, this Effect is not produced; and granting that this could be done, yet it would still continue to be Wax, and of an uniform Substance, which Ambergris is not. 6. If we apply Wax to the Flame of a Candle, it will not flame before it melts, which Ambergris does. 7. Wax and Honey retain their own specifical Smell, which is very different from that of Ambergris. 8. This whole Class may be convinced by Chymistry alone; for, in the Examination of Ambergris, there is not the least Trace of Honey or Wax to be discovered: nor can *Lemery* * himself prove from that white and viscid Substance, which is precipitated in the Essence of Ambergris, if he will but carefully examine it, that it is Wax, as he has imagined. *Kaempfer* †, who was in *India* himself, openly contradicts these People, especially if they add this gross Circumstance, that there has some Ambergris been found, in which crude Honey still remained; for he says, "All the modern *French* Writers are "mistaken, who follow *Denis* in this Point."

I should now consider that other Opinion, which makes Ambergris an animal Substance; but as this relates to marine Animals, which the Authors unnecessarily form into a separate Kingdom; but as I have begun at the Top with the aëreal Opinion, I shall descend gradually, stopping at present upon the Earth, in order to consider those Opinions, which derive the Origin of Amber from the vegetable Kingdom.

Sylvaticus ‖, in the first Place, says that Ambergris is a *Gum*; which Opinion is easily overthrown by considering the constituent Parts of Ambergris; for it is not even a Gummo-resin, of which at least some Part will dissolve in Water; much less a pure Gum, which ought wholly to dissolve in Water; nay the very reverse of this is true of Ambergris, and therefore there is nothing of a Gum in it.

Others will have Ambergris to be a *Resin* **, or *balsamino-resinous Tear*, of a certain Tree, as they pretend, though it is not yet known what Tree it is. These Trees are said to grow near the Sea, and to drop the Resin into the Water, where it is tossed about, impregnated with Salt Water, digested by the Sun, and so becomes Ambergris. But this Opinion appears to be fabulous; for, 1. These Trees must needs grow very close to the Sea, for their Resin to drop into it. 2. They must have very deep Roots, or else they must be frequently subverted by the Washing of the Waves. 3. If the Resin fell Drop by Drop into the Sea, each Drop being surrounded immediately by the

* Loco citat. & in ejus cursu Chemiae.

† Amoenit. exot. p. 632, 633, 634.

‖ In Pandect.

** Alexand. Geraldinus in Itiner. suo ad Pontif. Leon. X. ex Libavio Lib. iv. Singular. C. H. in Scholiis, pag. 320. A. D. Boyle V. Philosoph. Transact. No. 97. pag. 613. & seq. See Vol. II. of this Abridgment, Chap. iii. §. 69. 1.

Water

Water would find it difficult to join with the reſt into a Maſs. 4. Theſe Trees are wholly unknown to Mariners and Fiſhers of Ambergris, to Inhabitants and Strangers, as has been obſerved by *George Eborhard Rumpffius* *, who has ſufficiently exploded this Opinion. 5. The contrary Mixture of Ambergris with expreſſed Oils, and many other Subſtances, plainly ſhews it not to be a vegetable Reſin.

Averrhoës † ſays that Ambergris is a *Sort of Camphire*, and yet he did not know what Camphire itſelf was: and beſides, with regard to Volatility, Solubility, Colour, Smell, and many other Properties, there is as much Difference between Camphire and Ambergris, as between Light and Darkneſs.

Others again pretend, that Ambergris proceeds from a certain Fruit ‖, which the Whales greedily ſwallow, and ſo digeſt it in their Bodies into Ambergris; but this is a *Chimaera*, which does not deſerve an Anſwer; what remains of it's imaginary Derival from the vegetable Kingdom, relates to the Sea, and has nothing probable in it; but is directly contrary to the Nature and Property of Ambergris.

But to make an End of this Part, I ſhall now produce the remaining Opinions concerning ſome *marine Bodies*, as alſo the reſt of the *Vegetable* Subſtances. *Julius Ceſar Scaliger*, and *Serapius*, have taken Ambergris for a Sort of *Fungus* **, and have ſaid, that it grows at the Bottom of the Sea, from whence being broken looſe, it is afterwards thrown on the Shore. But this Opinion confutes itſelf, becauſe there is no Sort of *Fungus* in the whole World, that has not it's own certain characteriſtic Figure, which by no Means agrees with Ambergris.

Libavius †† and *Weckerus* ‖‖ will have Ambergris to be the Froth of the Sea, but, to omit any ſtronger Objections, it is ſufficient to obſerve, that in very many of thoſe Places, where the Sea moſt works and froths, there is no Ambergris found, though, according to this Hypotheſis, there ought to be the greateſt Quantity.

Cardan *† takes Ambergris to be *Sperma Ceti*; but how different that is from Ambergris, is too obvious, to need any Argument.

Eichſtadius ‡† and *Fragoſus* ‖† relate, that Ambergris is the Liver of a certain Fiſh; but every one knows that a Liver has it's *Parenchyma* or *Capſula*, and conſiſts of Filaments of Veins and Arteries, not to mention that a Liver, by Diſtillation, yields very different Parts from thoſe that are obtained from Ambergris.

* Valentini Oſt-Indiſche Sendſchreiben ſub No. xi. pag. 56.
† In Colliget. Cap. 56.
‖ Nic. Monard. de Simplicibus Medicam. Edit. Plantin. Antv. pag. 13.
** Juſti Fidi Klobii Ambrae Hiſtoriae, pag. 18.
†† Lib iv. Singularium, Cap. i.
‖‖ Weckerus in Speciali Libr. Sect. ii. p. 79. item Sylvaticus, in Pandect.
*† De Subtilitat. pag. 284.
‡† In Lib. de Confect. Alkerm. Cap. xii.
‖† In Lib. de Medicam. ex India in Europ. delatis. Cap de Ambaro, p. 89.

Many adhering to what they call the marine Kingdom, are of Opinion that Ambergris proceeds from *Fiſhes*; but then they differ ſo much in their particular Sentiments, that we may divide them into 3 general Claſſes. The firſt ſay, it is abſolutely generated in Fiſhes; the ſecond, with more Reaſon, that it floats in the Sea, and is ſwallowed by Fiſhes: the third determine nothing poſitively, obſerving a Sort of Neutrality, and only ſay it is found in Fiſhes, without declaring whether it is generated in them, or ſwallowed by them. From theſe 3 principal Opinions many Subdiviſions have ariſen, both with regard to Fiſhes, and to their Deglutition and Generation of it. With regard to Fiſhes, ſome ſay it is found only in the greater, others in the ſmaller alſo. Some ſay it is found in all Sorts of Whales, others only in one Species; though theſe again differ in the Denomination of this Species. With regard to their ſwallowing of it they differ alſo; for ſome ſay it is greedily ſwallowed by all Fiſhes, others only by one Species. Some ſay the Fiſhes are killed by it, others that it does them no Injury at all. Some ſay they vomit it up, others that they diſcharge it downwards. Others again contend, that Ambergris is ſwallowed not only by Fiſhes, but by other Animals alſo. Nor are the Opinions leſs various with regard to the Generation of it.

Gabriel Nakke and many others confirm what the celebrated *Rumpfius* * writes from *Amboina* to *Ten Rhyne*, that not only the *greater Whales*, but alſo the *ſmaller Fiſhes*, and even *Birds* and *Boars* (ſome mention *Foxes* too) greedily ſwallow Pieces of Ambergris, which they vomit up again. Hence ſays he ariſe ſo many various Opinions, not only among the common People, but alſo among many Authors, whilſt ſome aſcribe it to Whales, and others to Hogs, and both Parties imagine it to be generated in theſe Animals; whereas it is found in them only by Accident.

Of thoſe who entertain the Opinion, that Ambergris is found only in *one Sort of Fiſh*, a certain Species of Whale, ſome call this Fiſh *Azel* †, affirming at the ſame Time, that this Fiſh greedily ſwallows it, and dying ſoon after, is ſought after by the Fiſhermen with great Induſtry. Others call this Fiſh *Mokos* ‖, ſaying it is above 20 or 30 Feet in Length, that it lives in the *Eaſt-Indies*, and is taken about *Japan*. *Andreas Cleyer* called this Fiſh *Cetus Ambrophagus*, or the Amber-eating Whale, and ſent a Draught of it to *Mentzelius* at *Berlin*. Others ſay it is a certain Sort of Whale belonging to the *Genus* of *Lamiae* **. Others again, among whom is Mr *Paul Dudley*, who reſided in *America*, think that Ambergris is afforded only by that Sort of Whale, which is called the *Sperma Ceti Whale*.

* Loco citat. Valentini ſub No. viii. pag. 50.
† Geſner. de Aquatil. & quidem de Cetis diverſis Lib. iv. pag. 204.
‖ Kaempferi Amoenitati exot. Faſcicul. 3. pag. 635.
** Valentini Oſt-Indiſche Sendſchreiben, pag. 50.

Many

Many ſide with neither of theſe Parties, and ſay that Ambergris is not found in any particular Fiſh, but in all the larger Fiſhes in general; and do not decide the Controverſy, whether it is ſwallowed by them, or generated in them. They differ only in this, that they do not aſſign the ſame Place in the Fiſh for the Ambergris: for many affirm that it is contained in the *Stomach* of the Whales, and others will have it to be in the *Inteſtines*. Hence have ariſen two Opinions, one that they vomit up, and the other that they diſcharge it downwards. But all theſe Opinions tend to one and the ſame Concluſion; that Ambergris is not generated in theſe Animals, but ſwallowed by them. For it is ſelf-evident, that whatſoever is ejected, either upwards or downwards, muſt neceſſarily have been in the Stomach before; and whatſoever is thrown up muſt neceſſarily proceed from the Stomach; and therefore the Ambergris that is in the Stomach, if it is not vomited up, will naturally be thrown down into the Inteſtines; ſo that it's being ejected upwards or downwards conſtitutes no real Difference. It is well known, that there is nothing naturally in the Stomach but Juices; and that all the ſolid Contents of it muſt have been taken in by the Mouth. If therefore Ambergris is really found in the Stomach or Inteſtines of the Whale, how can any Man of Judgment imagine that it is generated there? Therefore thoſe eminent Authors, who think, that Ambergris is vomited up by the Whale, or diſcharged by the *Anus*, or found in the Stomach, or in the Inteſtines, all concur in this certain and undoubted Truth, that it is ſwallowed down by theſe Animals, and not generated in them. Hence however many have imagined, and eſpecially the Inhabitants of *Madagaſcar*, with moſt Fiſhermen and Mariners, that Ambergris is nothing but the *Excrement* of the Animal. In *Japan* alſo, they call the Ambergris which is either found in the Body of the Whales, or ejected by them, in their Language *Kuſura no fuu*, which is ſaid to expreſs the Dung of Whales *.

Joh. Matth. Faber ſays, if the Whale ſwallows Ambergris and diſcharges it again, the Vulgar may be allowed to call it the Excrement or Dung of a Whale; but Men of Judgment cannot allow it to be really ſo. Give me leave to illuſtrate this by an Example. Crude Quickſilver, or the Globules of *Regulus* of Antimony, otherwiſe called the perpetual Pills, are ſwallowed by one Perſon and voided again; and when they have been well waſhed are given to another, and ſo on to 10, 20, or more different Perſons ſucceſſively; as I have ſeen it done with Quickſilver in the Iliac Paſſion. Now if this Quickſilver or Antimony is voided by a living Perſon, or found in his Body after Death, in the true Form of Quickſilver or Antimony, would any one account theſe to be animal Subſtances, becauſe they are found in a human Body? or would any take theſe metallic Subſtances to be human Dung, or call them human Excrements, becauſe a Man has voided them by Stool?

* Kaempf. Loco citat. pag. 635.

Surely the moſt ignorant would laugh at him, even though he ſhould affirm, that theſe Subſtances had been ſwallowed down by 100 Perſons ſucceſſively, and voided again after having ſtaid ever ſo long in their Bodies.

It is juſt the ſame Caſe with the ſwallowing and voiding of Ambergris: it is not indeed ſuch a metallic Subſtance as *Regulus* of Antimony or Quickſilver; but however it is a Mineral, as we ſhall ſee in it's proper Place. I ſhall add a few Words about it at preſent. Ambergris is an extraneous Subſtance, that ſwims in the Sea, and is ſwallowed as a Delicacy by the Fiſhes, and voided by them again undigeſted. It ſeldom ſtays long enough, to be found in their Bodies. *Monardes* tells us, that in his Time 100 ℔. Weight of Ambergris was found in the Inteſtines of a Whale near the *Canary* Iſlands; and adds, that a great Number of them was afterwards killed, and none found in any of them. Many hundreds of Whales may be killed without finding any in them; and if any does happen to be found, it muſt be, becauſe the Compactneſs or Bulk of the Maſs, or perhaps ſome Diſeaſe, has obſtructed it's Paſſage through the Inteſtines.

It therefore is an indubitable Truth, that Ambergris is ſwallowed by various Fiſhes, eſpecially Whales; that it is afterwards voided by them; that it ſometimes ſtops in their Stomachs or Inteſtines; all which Circumſtances have been confirmed by the joint Teſtimony of ſeveral credible Perſons. But we muſt not therefore conclude, that it is generated in theſe Animals; or that, becauſe it has ſtaid ſome time in their Bodies, it is to be accounted an animal Subſtance.

The laſt Opinion which I ſhall here mention is, that Ambergris is an *Animal Recrement*, or ſingular Subſtance generated in the Whale, as Caſtor, Civet, Muſk, Bezoar, *&c.* are in the particular Animals which produce them. This Opinion has had, and ſtill has, it's Favourers; and has been lately publiſhed to the World, as a new, certain, and true Diſcovery, in two Accounts ſent a few Years ago from *America* to the Royal Society.

The ſame continued, Part ii. No. 434. P. 371. Sept. *&c.* 1734.

2. It is ſtill freſh in the Memory of the Royal Society, that two ſingular Accounts of this Subject have been ſent from *America*, one by Dr *Boylſton* *, and the other by Mr *Dudley* †, both aſſerting and defending the above-mentioned Opinion. I have the greateſt Regard for the ſincere Intention and Labour of theſe worthy Gentlemen: but I have ſome Doubt with Regard to their Accounts, ſo far as they aſſert that *Ambergris* is a *true animal Subſtance*, or *generated in the Whale*.

I ſhall not repeat what they have ſaid at full Length, but only the principal Members of their Accounts, with ſome Circumſtances; and chiefly what Mr *Dudley* has ſaid in the following Words:

1. Ambergris is found only in the *Sperma Ceti* Whales.

* See Vol. VII. Part iii. Chap. i. §. xi. 1.
† Ibid. Art. 2.

2. It

2. It consists of Balls, or globular Bodies, of various Sizes, from about 3 Inches to 12 Inches Diameter, and will weigh from 1½ ℔ to 22 ℔.

3. They lie loose in a large oval Bag or *Bladder*, of 3 or 4 Foot long, and 2 or 3 Foot deep and wide, almost in the *Form of an Ox's Bladder*, only the Ends more acute, or like a Blacksmith's long Bellows.

4. They have a *Spout* running *tapering into, and through the Length of the Penis.*

5. They have a *Duct*, or Canal, opening into the other End of the Bag; and

6. Coming from towards the Kidnies.

7. This Bag lies *just over the Testicles*, which are above a Foot long, and is placed lengthways at the Root of the *Penis*, about 4 or 5 Foot below the Navel, and 3 or 4 Foot above the *Anus*.

8. It is almost full of a deep Orange-coloured Liquor, *not quite so thick as Oil, and smelling strong*, or rather stronger, of the same Scent with the Balls of Ambergris, which *float and swim loose in it.*

9. The Inside of the Bag is very deeply tinged with *the same Colour as the Liquor*, which may also be found *in the Canal of the Penis.*

10. The Balls seem to be pretty hard, while the Whale is alive, in as much as they are many Times found upon opening the Bag

11. Large concave Shells of the same Substance and Consistence, that have scaled off from them.

12. And the Balls themselves seem to be composed of several *distinct Coats* inclosing one another, something like the Coats of an Onion.

13. As to the Number of Balls, he was told by Mr *Atkins*, that he never found above 4 in a Bag, and in the Bag, where he found one that weighed 21 ℔, which was the *largest he ever saw*, there was no other. He further says, that

14. The Whale-men have observed, that the Ambergris was found only in such Whales, as are *old and well grown*, and of the Male Sex. But as to this Particular Mr *Atkins* says,

15. He never saw nor certainly heard of a *Sperma Ceti* Female taken in his Life: the Cows of that Species of Whales being *much more timorous* than the Males; and almost impossible to be come at, unless when haply found asleep on the Water, or detained by their Calves. This he affirms for a Certainty, that the Boats can never come near them when they are awake, they are so very shy and fearful. Mr *Atkins* further says,

16. That to 1 *Sperma Ceti* Whale, that has any of these Balls, there are 2 that have nothing but the deep Orange-coloured Liquor aforesaid in their Bags. In the last Place

17. Mr *Dudley* boasts, that Truth is the Daughter of Time, and that it is now at length found out, that this *Occultum Naturæ* is an *animal Production*, and bred in the Body of the *Sperma Ceta* Whale, analogous to what is found in some Animals of the Land, as the Musk-Hog, &c.

&c. and towards the End of his Account he says, I hope the Society will accept of this first Essay, and allow my poor Country the Honour of discovering, or at least ascertaining the Origin and Nature of Ambergris; however

18. He confesses just before, that as for his own Part, he dares not pretend to give any Opinion upon the Point, but contents himself with relating Matter of Fact: Which Relation however

19. I have chiefly taken from Mr *Atkins*, who used the Whale-Fishery for 10 or 12 Years together, and from several other famous Whalemen, who lived in those Parts.

As for Dr *Boylston*'s Account, the Sum of it consists in the following Articles.

(a) That Ambergris is found in no other Species of Whale, than that which yields the *Sperma Ceti*, and only in the Male of that Species; and that in one it was found to the Weight of 20 ℔. *more or less*.

(b) That it is found scarcely in *one of a hundred* of them.

(c) That it is contained in a Cyst or *Bag*.

(d) That this Bag is sometimes found empty, and yet entire.

(e) That this Bag is no where to be found, but near the *genital Parts* of the Fish.

(f) That the Ambergris is, when first taken out, moist, and of an exceeding strong and offensive Smell.

(g) But whether or not the Ambergris be naturally or accidentally produced in that Fish, he leaves to the Learned to determine; and

(h) Lastly, that his Account is taken only *from the Whale Fishermen.*

It appears therefore from these Quotations,

1. That the two Accounts agree in some Parts.

2. That they differ in some Parts; which Difference however does not contradict the principal Question.

Both of them agree in these Particulars: 1. That the Ambergris is found only in the Male *Sperma Ceti* Whales; 2. That it is found *in a Cyst or Bag*; 3. That Pieces are found weighing 20, 21, or 22 ℔. 4. That this Cyst is situated *very near the genital Parts of the Fish*: 5. That the Ambergris, when first taken out, is moist, and of a *very penetrating, but strong and offensive Smell.* 6. That they had these their Accounts and new Discoveries from the *Whale Fishermen.*

But they differ in the following Circumstances: 1. Mr *Dudley* relates, that this Bag or Cyst has a Duct or *Canal at each Extremity*, one proceeding from the Kidnies in the upper Part of the Bag, and the other in the lower Part, passing into and through the *Penis:* on the contrary, Dr *Boylston* says this Cyst has neither Inlet nor Outlet. 2. Mr *Dudley* relates, that though some Fishes have no Ambergris in them, yet that Liquor is always found in them, which we mentioned under No. 8. But Dr *Boylston* affirms, that this Bag is sometimes found quite empty. 3. Mr *Dudley* relates, that if they found Ambergris in one Fish, they found

found two without any: but Dr *Boylſton* ſays, that *in* 100 *Whales* there is hardly one found that contains any Ambergris.

However theſe 3 Differences may eaſily be reconciled. As for the firſt, where Dr *Boylſton* relates, that the Bag has neither Inlet nor Outlet, that may ariſe only from the Negligence of the Fiſherman, who gave him the Account, and did not obſerve every Thing ſo accurately as Mr *Atkins*'s Fiſherman did; for how could the Bag be found ſometimes full and ſometimes empty, if it had neither Inlet nor Outlet? For the ſecond, that the Bag is ſometimes found empty, this may be meant either of the Balls or of the Liquor, and indeed it does not abſolutely contradict Mr *Dudley*'s Account, whilſt both may be natural, or happen ſo at that Time. Laſtly, the 3d Difference makes no Difficulty; but both Accounts agree that Ambergris is found only in ſome Male Whales, and not in all; and I imagine, that each of them ſet down only a certain Number for an uncertain one.

Having now examined both theſe Accounts, I ſhall venture to affirm, that the Subſtance, which they have taken for Ambergris, is not really ſo, but quite of another Nature. I entirely agree with Mr *Prince*'s Opinion, as all Men of Judgment will do, who have only a general Conception of the principal Parts of Anatomy, or only know where and how the principal Parts are ſituated in large Animals. This Opinion is related in Mr *Dudley*'s Account, in the following Words: "The Re-
"verend Mr *Prince* of *Boſton*, a very worthy Divine, and one of my
"intimate Acquaintance, in a neighbouring Town, who took the pre-
"ceding Relation from Mr *Atkins*, apprehends the Bag aforeſaid to
"be the *urinary Bladder*, and the Ambergris Ball to be a *certain Con-*
"*cretion*, formed out of the greaſy odoriferous Subſtance of the Li-
"quor aforeſaid contained within it." For my own Part I declare, that, 1. The Bag in Queſtion is nothing elſe than the *urinary Bladder* of the Whale; 2. That the imaginary Ambergris found in it is nothing elſe than a *Calculus* of the *Bladder*; and, 3. That this penetrating odoriferous Liquor in the Bag is nothing elſe than the *Urine of the* Whale. Do but conſider the preceding Extracts, where, under No. 3. it is ſaid that this Bag or Bladder is 3 or 4 Foot long, and 2 or 3 Foot wide; that it is almoſt in the Form of an *Ox's Bladder*, or like a Blackſmith's long Bellows; is not this a Deſcription of an urinary Bladder? eſpecially as under No. 4, 5, 6, 7, all the other Requiſites, and the proper Situation of it are prolixly deſcribed, how it is connected with the *Penis* and Kidnies, being placed under the Navel, above the Teſticles, at the Root of the *Penis*; moreover, under No. 8. how it is almoſt full of a penetrating and ſtrong ſmelling Liquor, which is uſually found in this Bladder, though none of the imaginary Ambergris is there; can this Liquor be any thing elſe than the Urine of the Whale? And granting what I have extracted from Dr *Boylſton* under *(d)*, that the Bladder is ſometimes found empty (though he does not explain himſelf clearly on this Article, but I rather believe, that by the Word empty he does not mean empty

of

of Urine, but only of *Calculi*) it is nothing impoſſible or unnatural, for it may ſometimes happen, that the Whale may have voided his Urine juſt at the Time of being killed. The Urine is farther confirmed under No. 9. where it is affirmed, that the ſame Liquor (namely the Urine) is found (as all Urine is) in the Canal of the *Penis*, or *Urethra* of the Whale. Who now can queſtion but that the Balls lately found, and taken for Ambergris, are mere *Calculi* of the Bladder of the Whale? Let us conſider a little more attentively what I have extracted under No. 10, 11, 12, 13, and 14, and conſider that theſe Balls are of the ſame Smell with the Liquor, and (as Mr *Prince* ſays) of the fat Subſtance of the Liquor; alſo what Dr *Boylſton* relates under *(f)*, that they are of an exceeding ſtrong and offenſive Smell; alſo their being formed of diſtinct Coats and *Strata*, after the Manner of Onions, where they grow, are generated, and hardened one above another; and that, according to this Situation, they are eaſily decorticated and pulled aſunder: I aſk, whether all theſe are not natural and common Circumſtances to all *Calculi*, or Stones, found in the Gall or urinary Bladder, or in other Parts of Animals? Why then ſhould ſuch a *Calculus* be taken for Ambergris? the urinary Bladder for a particular Cyſt? and the Urine for a particular Liquor? This is further confirmed under No. 14. where we read, that the Whale-men have obſerved, that the Ambergris (I call it *Calculus*) is found only in ſuch Whales as are *old* and well-grown. Secondly, by what is quoted under *(b)* from Dr *Boylſton*, that *ſcarcely in one of a hundred of them* has any Ambergris in it (or rather is troubled with the Stone;) theſe 2 Circumſtances alſo are quite natural, and common both to Men and Beaſts: 1. That the old are ſooner infeſted with the Stone than the young; 2. That as not all Men, but ſcarcely one in a hundred has the Stone, this may be quite natural alſo in irrational Animals. Beſides, this agrees with other animal Concretions, that 2, 3, 4, or more, are often found in the Bladder, which may eaſily obtain a round Figure from their continual Agitation in the Urine; though I have obſerved, that the Figure of *Calculi*, and alſo of Bezoar Stones, generally ariſes frem a *Nucleus*, which is covered by the firſt Coat or Cruſt, that aſſumes the Form of the contained *Nucleus*, whether round, oblong, or angular. At other times the Figure of the *Calculi* ariſes from a greater or leſs Space and Motion: for if they are ſo many in Number, as not eaſily to move about in the Bladder, then they ſeldom are round, but for the moſt Part uneven and irregular: ſo likewiſe they often ſplit into Scales, if there are many of them, and if any Colliſions of the Stones happen in the Bladder from the Motion of the Animal. Nor in the laſt Place does this Circumſtance cauſe any Doubt in me, when they relate, that *only the Male Whales* contain theſe Balls, becauſe it may be, that only the Males are afflicted with that Diſeaſe, or that we have not yet ſufficient Experience with Regard to the Females, becauſe (No. 15.) *it is almoſt impoſſible to come at the Cows of that Species of Whales*, and conſequently very few of theſe Females, nay *very rarely*

rarely any of them are taken; and becauſe, among the Male Whales, according to the above quoted Obſervation of Dr *Boylſton*, there is hardly one in a hundred that is found to labour under this Diſtemper.

That very Circumſtance produced by both theſe Gentlemen, that this Subſtance is *not found in every Male Whale*, but ſcarcely in one of 100, and only in thoſe that are *old* and full-grown, makes evidently againſt them, and ſhews that it is not ſuch an animal Recrement as Muſk, Caſtor, *&c.* and confirms my Opinion, that it is nothing but a *Calculus*.

If their imaginary Ambergris was a *Recrement of Nature*, if thoſe ſtrong ſmelling Balls were any thing innate in the Male Whales, if that Bladder was a particular Cyſt, and not the urinary Bladder, and the Subſtance found in it any thing natural, like the Muſk, Civet, and Caſtor, in their particular Animals; to which Mr *Dudley* endeavours to compare this morbid calculous Concretion, then *this Subſtance would be in all the* Sperma Ceti *Whales*, *as Caſtor is found in all Beavers*, *Musk in all Musk Animals*, *and Civet in all Civet Cats*; nor would it then be found in the urinary Bladder, and *all abſolutely* (not one in a hundred, or only the old ones) would *always and inevitably have* ſuch Balls.

If that Subſtance was innate in theſe Fiſhes, and natural in a healthy State, like Caſtor, Muſk, Civet, and ſuch like, then not only the *Sperma Ceti* Whales in *America* would afford it, but thoſe alſo which are taken in *Europe*, in the *Spaniſh*, *French*, and *Britiſh* Seas, eſpecially in the Northern Ocean, but no one has ever ſeen any in thoſe Countries.

Mr *Dudley* ſays, in his Account, that the greateſt Ball of Ambergris, which he ever ſaw, weighed 21 or 22 ℔. which, conſidering the Size of the urinary Bladder, is *a pretty large Calculus*. But I would aſk whence thoſe great Maſſes come, which are not round, or of any certain Shape, are of the Size of 6 Feet, and weigh 182 ℔. or more, which are not coated like an Onion, incruſted, crumbly, or of an Orange Colour, much leſs of a ſtrong or offenſive Smell; but are not offenſive, are irregular, compact, grey, whitiſh, and of a ſweet Smell? *Whence*, I ſay, *do theſe Maſſes proceed*, *which are ten*, *nay twenty*, *times as big as the Pieces mentioned by them*, and are too big to be contained in the Cyſt of the oldeſt and largeſt Whales?

I aſk further, how this Ambergris can be thrown upon the Shore or on the Land? That it ſhould proceed from the living Animal, is impoſſible, becauſe the Cyſt has it's Outlet only through the *Penis*, and therefore only ſmall Pieces can paſs through that Canal. If any one would contend, that ſuch Pieces come from dead Whales, I could eaſily reply; how then do they get out of the Bladder? eſpecially as ſuch Bladders are membranous, and of a very tenacious Texture, ſo that one might reaſonably ſuſpect, that the Bladder could not burſt ſo eaſily after Death, or give a free Exit to theſe Balls. I imagine, that the Ambergris would ſometimes, if not often, be found ſwimming with the Bladder, which no one has ever ſeen or heard of.

How

How can the Bills and Claws of Birds, Shells, Fiſh-bones, and other extraneous Bodies, which are ſometimes found in Ambergris, paſs through the Kidnies and Ureters into the urinary Bladder, or rather into the imaginary Cyſt of Ambergris?

Laſtly, to paſs over other Arguments, I ſhall produce only one, my *primary*, and indiſputable, *regulating*, *chymico-phyſical Argument*, which ought to be looked upon as deciſive in the preſent Queſtion, as in all other natural Subjects, and never has deceived, or can deceive, if it is but attended to with due Circumſpection.

It is well known, that not only Caſtor, Muſk, and Civet, but that *all Animals*, and all *Parts of Animals* whatſoever, *by chymical Trial, eſpecially by an open Fire or Diſtillation* per ſe, *yield* either an *empyreumatico-urinous Spirit*, or a Phlegm of the ſame Sort, or a *fetid animal Oil*, or therewith an *urinous volatile Salt*, and either all theſe together, or 1 or 2 of them, or at leaſt ſome Sign of an urinous Liquor, or empyreumatic animal Oil. I do affirm, that *all animal Subſtances muſt neceſſarily diſcover ſome of theſe*, and ſtrike the Smell and Taſte, when they are tried by the Fire, which is true even of the foſſil Shells; for by this Proof they reveal their animal Origin. And thus alſo the *imaginary Balls of Ambergris* will plainly and ſufficiently *demonſtrate* by this Proof, that they are not only a mere animal Production, but alſo of a *mere urinous Origin*, *being generated from the Urine of the Whale.* But on the contrary, if any one tries in like manner, by *Diſtillation with an open Fire*, the true *Ambergris*, *purified* from all viſible animal Parts, *that has not been formerly ſwallowed by any Animal*, *but perfectly pure*, and examines what is obtained from it, he will not find the leaſt of any thing urinous, or of any empyreumatic *animal Oil*, or of any thing animal, but every thing *quite different*, *and otherwiſe modified*, *another Liquor*, *another Oil*, *and ſomething of another Salt*, as I ſhall hereafter demonſtrate.

This therefore may be taken as an infallible Sign and undoubted Truth: If in the analyſing of Ambergris, there appears ever ſo little of animal Subſtance, whether oleoſe, or urinoſo-ſaline, then *this does not proceed from Ambergris*, *as pure Ambergris*, *but from ſome other animal Subſtance*, *accidentally mixt with it*, *which muſt be conſidered as ſomething foreign*, *impure*, *and not belonging to the Compoſition of Ambergris*; whether it had formerly been ſwallowed, or, if not ſwallowed, had Bills of Birds, or other ſmall Parts of Animals mixt with it.

But that Ambergris, which has been *ſwallowed* by Fiſhes or other Animals, has received ſome Sort of Alteration, at leaſt ſome *animal Taint*, can hardly be denied, whether it has been ejected either upwards or downwards, or found in their dead Bodies. It is ſufficient, that it has been in ſome Manner *infected* by animal Juices and Food, or at leaſt corrupted by being ſwallowed together with putrid Food, almoſt digeſted into Excrement, and conſequently made worſe rather than better. Hence it generally has a worſe Smell, and is more black; nay

even

even Experience teaches the Inhabitants themſelves to know ſuch Ambergris as has already been ſwallowed, merely by it's outſide appearance, and in ſome places, as I mentioned before, they even call it the Dung or Excrement of the Whale.

Beſides ſince both the above-mentioned Accounts, ſent from *America*, are taken chiefly from the ſame ſort of Perſons, *ſuch whoſe Employment lies in the Whale-Fiſhery*, and indeed *partly from one having heard another ſay*; they are ſo much the farther from deſerving to be eſteemed as undoubtedly true, or new, with regard to the true Origin and Eſſence of Ambergris.

Therefore I leave this Opinion, and turn my ſelf now to the laſt Claſs, of thoſe who take Ambergris to be a mineral Subſtance, or place it's Origin in the Mineral Kingdom.

Hugo de Lindſchott pretends that Ambergris is an *Earth**, but if he underſtood this in a larger Senſe, and had recourſe to the firſt original phyſical Principles, then this Opinion might be allowed. But as he has not ſufficiently explained himſelf by this, much leſs declared it to be more than a *ſimple* terreous Mixture, and as it is probable, that *Lindſchott* did not mean that Denomination in any ſuch phyſical Senſe; but took Ambergris for a *mere terreous Subſtance*, I cannot but pronounce this Denomination and Opinion to be erroneous, contrary to Nature, Experience, and the known Property of Ambergris; for it is well known, that *Earths are not eaſily inflamed or readily melted, or diſſolved by Spirit of Wine*; to paſs over many other Properties of Ambergris.

Others have in ſome meaſure attended to the *Liquability* and *Inflammability* of Ambergris, as *Crato* † and many more, who take it for a *native and true Sulphur*. Dr *Salmon* ſays it is a marine Sulphur ‖. This Denomination is indeed excuſable, conſidering that Ambergris partakes of an inflammable, or ſulphureous Principle. For not only the Ancients, but very many Moderns alſo, give the name of Sulphur to every inflammable Subſtance, whether Mineral, Vegetable, or Animal, to Oil, Fat, Reſin, Wax, Pitch, Balſam, Wood, Suet, Coal, Bitumen, Spirit of Wine, &c. But as this general Denomination expreſſes *nothing ſpecifical*, but only gives occaſion to various Imaginations, and as at the ſame Time it plainly appears, that thoſe very Perſons, who take Ambergris to be a native and true Sulphur, have not the leaſt Regard to the inflammable Principle in both, but have taken Ambergris for a *common*, natural, perfect, and *true Sulphur*, otherwiſe they would not have called it in expreſs Words a native and *true Sulphur*, but only a ſulphureous Body or Subſtance. But as it is notorious, that Ambergris is not *true Sulphur*, this Opinion can be eſteemed only falſe and erroneous.

1. Let Ambergris be thrown on burning Coals, and let it be tried,

* *Vide Klobii Ambræ Hiſtoria*, p. 19. † *In Conſiliis à Laur. Scholtzio Collect. column.* 1093. ‖ *London* Diſpenſatory, p. 398. Edit. *Lond.* 1696. 8vo.

whether the *Smell* of it agrees with the Smell of Sulphur. 2. Let Ambergris be tried with a fixt alcaline Salt, whether it will afford *Hepar Sulphuris*, *Tartarum Vitriolatum* &c. 3. Whether Ambergris will reduce *Regulus* of Antimony again into *crude Antimony*. 4. Whether Ambergris being diſſolved in Lime-water, or an alcaline *Lixivium*, will become *Lac Sulphuris*. 5. Whether Ambergris and Quickſilver will produce Cinnabar; and whether many other Preparations, which are made with true Sulphur, can be made alſo with Ambergris. All theſe Trials will prove fruitleſs, as *Libavius* has already objected to *Crato*.

Thoſe come nearer the Truth, who take Ambergris not only for a *Mineral*, but for ſuch a Mineral as it really is, a BITUMEN, or ſort of Bitumen; but theſe have not been able to agree in ſome Circumſtances: For

Some ſay that Ambergris is produced in a *liquid Form*; others in a *dry Form*; and others will have it to be in a viſcid Form, or of a middle Conſiſtence.

They differ alſo in this; that ſome affirm it comes from under the Earth on the *Shoar*, and is carried into the Sea; and others endeavour to prove, that it comes from the *Abyſs*, or rather from under the Earth of the bottom of the Sea into the Sea.

Thoſe who are of Opinion that Ambergris is liquid at firſt, or that it comes into the Sea in a *liquid Form*, ſay it is in it's own Nature at firſt a *liquid Bitumen*, or Species of *Naphtha*, and among theſe are *Ebuſina*, *Simeon Sethi*, *Navius*, *Avicenna*, *Agricola*, *Solenander*, *Bertinus*, *Libavius*, *Gracias ab Horto*, *Hadrianus Toll*, *Jo. Euſebius Nurenbergius*, *Franciſcus Hernandez*, and many others, who all agree that *Ambergris comes into the Sea from the flowing of a bituminous Spring*, *or of a Spring of Naphtha*, and differ only in ſome Circumſtances; for Inſtance, *Avicenna* and *Pſellus* will have it to flow into the Sea together with the Waters, from *lateral Springs*; others, on the contrary, among whom is *Nicolas Chevalier* *, who in 1700 deſcribed the great *Amſterdam* Piece of Ambergris, affirms, that it riſes by itſelf from the *Bottom of the Sea*, and is as it were diſtilled by the central Fire from *Kircher's Hydrophylacia*.

Others, who entertain the Opinion, that Ambergris comes into the Sea in a *dry Form*, ſay it is a ſort of Amber, or *dry Bitumen*, which is carried alſo into the Sea in the ſame manner as the common or yellow Amber. *Caeſalpinus* indeed calls it a Gem, but at the ſame time places it under the Species of Amber. *Oelvan*, who took Ambergris for a Meteor, ſays however, in a certain place of his Treatiſe †, that Amber bears a great Affinity with Ambergris, but that there is this Difference, that Ambergris is found in the hot Countries, where all Flowers and Spices acquire the utmoſt Perfection of their kind, and the moſt fragrant

* *Deſcription de la Piece d'Ambregriſe*, pag. 54, &c. † *Der Monathlichen curieuſen Natur-Kunſt-Stauts und Sitten Præſenten, Zweijtes Stuck im* Februar. 1708. pag. 56.

Smell;

Smell; but Amber only in the cold Northern Regions, and in the *Baltick* Sea, and is therefore of a more thick and hard Subſtance. Laſtly, the moſt experienced and learned *Henckelius* * ſays, that Ambergris, Amber, and Aſphaltus, or oriental Amber, common Amber, and black Amber, do not differ in eſſential Principles, but only *in ſome Accidents and Degrees*, which laſt Opinion greatly agrees alſo with Experience.

In the laſt place they, who think that Ambergris comes into the Sea *in a viſcid Form of a middle Conſiſtence*, ſay it is at firſt like ſoft Pitch or Cow-dung at the Bottom of the Sea, and hardens gradually. *Helbigius* affirms, that Ambergris is neither a Gum nor a Reſin, nor the Dung of Birds, nor the Comb of Bees, but a true *Viſcus*, lying at the Bottom of the Sea like Pitch, and growing in a manner like a marine Pitch, as he had been informed by a Merchant from *Batavia*, who had ſeen it with his own Eyes †. *Rumpffius*, in his Letters to *Ten Rhyne*, ſays it is certainly a Fat, coming from the Bottom of the Sea, ſoft at firſt and viſcid, but afterwards hardened by the Saltneſs of the Sea ‖. *Aldrovandus* **, after producing various Opinions, at laſt concludes in theſe Words: But we judge theſe Diſtinctions to be of no Value, for we affirm it not to be the Excrement of Fiſhes or Whales, but a kind of *Bitumen*.

Borelli †† indeed endeavours to form an Objection againſt Ambergris being a Bitumen; ſaying that Bitumens *ſtink, and are unfit for internal Uſes*. But in ſuch caſes we cannot always conclude from the *Genus* to the *Species*, or from the *Species* to the *Genus*: For even common Amber ſhews *Borelli*'s Objection to be inſufficient; for all acknowledge it to be a Bitumen, and yet *it does not ſtink*, and is *frequently and ſecurely given inwardly*; not to mention ſeveral Springs, which afford a *moſt fragrant* Bitumen.

Nicolaus Monardes ‖‖ ſays, there are various Opinions about the Origin of Ambergris, but the *moſt true* is, that it is a *kind of Bitumen*, flowing from a Spring, and hardening as ſoon as it comes to the Air, juſt as Coral and other ſubmarine Subſtances are ſoft under Water.

Jo. Fabeo Lyncaeus ** ſays, this is moſt certain, that Ambergris is nothing but a *Bitumen*.

But, to ſum up briefly what has been ſaid, moſt Writers of Natural Hiſtory agree in this: 1. That there are both ſolid and liquid Bitumens: 2. That all Bitumens are to be referred to Minerals: 3. That dry Bitumens are nothing elſe, than a tenacious inflammable Fat of the Earth: 4. That Ambergris being indued with the ſame Properties; is conſequently, and without any Contradiction, not only a *Mineral*, but alſo in *Genus* and *Species* a Bitumen.

* See *Bethesda portuoſa*, pag. 74. † *Ephem. Nat. Cur. Decur.* 1. *Ann.* IX. *ex.* x. pag. 459. ‖ *Valentini Ooſt-Indiſche Send-Schreiben*, pag. 50. ** *Muſ. Metallis*, Lib. III. pag. 432. †† *Loco citat. Obſervationum.* ‖‖ *De Simpl. Medicam.* pag. 12. ** *Jo. Fab. Lyncaei Expoſit. in Rech.* pag. 565.

Therefore altho' with regard to the original Conſiſtence of Ambergris, whilſt one affirms that it comes into the Sea in a ſolid Form, another under a viſcid and tenacious Form, and a third under a liquid Form, more might ſtill be added, yet I do not ſee, that this is very neceſſary, ſince *theſe 3 Opinions, as being the chief of all that have hitherto been propoſed*, may eaſily be reconciled, and in ſuch a manner combined, that in ſome reſpect all 3 may think right.

No one perhaps, who knows any thing really of the Origin of many ſubterraneous Bodies, will deny, that all Bitumens were *liquid* at firſt, tho' they have not come in a liquid Form into the Sea.

Both Ambergris and yellow Amber muſt neceſſarily have been at firſt, *if not quite liquid*, yet for ſome Time in a *viſcid* Form; or Ambergris, when thrown upon the Shoar, muſt at leaſt have been of ſuch a Texture, that if perhaps it had been hardened in the Sea, it might eaſily be ſoftened in the Sun: For otherwiſe neither the little Bills of Birds, Shells, and little Fragments of Shells, nor other ſmall Bodies, could have been found in it; as many ſorts of Inſects and other extraneous Bodies are well known to be found in yellow Amber.

Laſtly, that Ambergris in a *dry Form*, tho' it ſeems to be an impure and ſofter ſort of Amber, yet appears to be a true *Bitumen*, is plain to every one.

On this occaſion, it will not be amiſs to obſerve the Words of *Hernandez*, who ſays, that Ambergris comes from ſome Springs of *Naphtha* into the Sea, and is caſt on the Shoar by Storms, being a *moſt odorous, inflammable*, or ardent Subſtance, *ſometimes harder and ſometimes ſofter, ſometimes friable, and ſometimes tanacious*, ſo that it may be bent between the Fingers and Teeth in a manner like Wax.

After all that has been ſaid, it is my Opinion,

1. That Ambergris, in like manner as yellow Amber, comes out of the Earth into the Sea.

2. That it comes into the Sea, not like Naphtha or *Petroleum*, but in a thicker, flexible, and probably viſcid and tenacious Conſiſtence.

3. That in the firſt Concretion or Formation of Ambergris, a liquid Bitumen, or ſort of Naphtha, concurs and is mixed with it.

4. That great Pieces may be generated indeed at the ſame Time, but that for the moſt part, a ſmall matter only riſes at firſt; to which another grows afterwards like a *Stratum*, and ſo more afterwards, forming very irregular Figures, under which Formation it is always ſomewhat ſoft, ſo that various Subſtances may ſtick to it, and that it hardens from time to time, till it acquires the Conſiſtence of Wax.

And as Ambergris generally appears under the Form of *Strata*, or Coats, this Circumſtance perhaps has miſled the Inhabitants of *America*, to imagine that it is generated after the manner of a *Calculus* or Bezoar; when they might have conſidered, that divers other ſubterraneous Bodies, both bituminous, as Pit-Coals, Alum, and other Minerals, as Talc,

Talc, Slate, Iſinglaſs, &c. are found in *Strata*, under the *ſame Figure* with animal *Calculi*.

However I do not think it neceſſary, to ſearch with over much Exactneſs into it's *primordial Generation*. For who can explain with Certainty in what manner common Amber is produced, which is a much leſs precious Subſtance, and found in greater Quantity. How are Metals, Semimetals, precious Stones, Spars, and innumerable other mineral Subſtances generated? We know very little with Certainty, *in what manner* many other ſubterraneous Compounds *are formed*, making only Conjectures about them, tho' we may inform ourſelves about many of them *what they are*. This may beſt be done by Chymiſtry, which gives the trueſt Light into all Controverſies of this Kind, and that with ſo much Certainty, that it will not admit of any Contradiction.

To conclude, I cannot help wondering, that *Paul Herman*, who was well verſed in the *Materia Medica*, did not ſo much as mention Ambergris in his *Cynoſura*; tho' indeed it was better to be quite ſilent about it, than to propoſe any thing ſo ridiculous as *Fuchſius* * has done, who was of Opinion, that there was no ſuch thing in the World as *native Ambergris*, but that it was all factitious. But let us leave this idle Opinion in the Grave with it's Author, and conſider rather whence Ambergris is brought, and in what manner Commerce uſually brings it before us.

Ambergris is moſtly brought from the *Eaſt-Indies*, from and about the Iſlands of *Madagaſcar*, *Molucca*, *St Maurice*, *Sumatra*, *Borneo*, *Cape Commorin at Malabar*, and from the Ethiopian Shoars, which are ſaid to produce Ambergris from *Sofala* quite to *Brana*. Beſides as Ambergris is carried to great Diſtances by the Sea, there are a hundred other Places in the World, where it may be found.

It is worthy of our Conſideration, that this precious Bitumen is frequently found in *very large Maſſes*. I will not inſiſt upon what *Faber Lyncaeus* relates from *Gregory de Bolivar*, that there are Pieces of Ambergris found, weighing 100,000 ℔. much leſs what is extant in *Gracias ab Horto*, that there are whole Iſlands full of Ambergris, much leſs ſhall I regard what is told by one *Iſaac Vigny*, a *Frenchman*, who had travelled, that he knows a Country, ſo rich in Ambergris, that a hundred Ships might be laden with it. Theſe I ſay are mere hyperbolical Fictions; but the following are credible, or may ſerve at leaſt to prove the Certainty of great Maſſes of Ambergris being found.

In 1555, at *Cape Commorin*, a Piece of Ambergris of about 3000 ℔. was found, and ſold at that Time for Aſphaltus, or common Bitumen. *Joh. Hugo Lindſchot* ſays, there was a Piece formerly found about this *Cape* weighing 30 Quintals. *Monardes* and *Hernandez* mention Pieces of 100 ℔. *Gracias ab Horto* mentions one that was of the bigneſs of a Man, and another that was 90 Hands breadth in Length, and 18 in Breadth. *Montanus* ſpeaks of a Piece of 130 ℔. which was kept by the King in

* *Fuchſius de Compoſ. Medicamentor.* Lib. I. pag. 211.

Satſuma,

Satsuma, in 1659. In 1666 a Piece was thrown up at the River *Gambia* near *Cape Verd*, that weighed 80 ℔. and was brought into *Holland*. In 1691 there was a Mass of 42 ℔. at Amsterdam. *Daniel de Bruel* affirms, that a Piece was found about *Malacca* of 33 ℔. There is a Piece at *Rome* as big as a Man's Head. Both at *Rome* and at *Loretto*, and in many other places of *Italy*, there are many Curiosities artificially made of Ambergris, which evidently appear to have been made out of very large Pieces.

The above-mentioned *Vigny* brought a considerable Piece from the *East-Indies*, for he sold it for 1300 *l.* Sterling. *Kaempfer* also testifies, that in his Time a Piece was found in *Japan*, weighing 100 Catti, or about 130 *Dutch* Pounds.

The two Brothers *Joh. Andreas* and *Marcus Matsperger*, in 1613 bought a Piece of *Robert Struzzi* at *Venice*, weighing 48 ℔. 8 ℥.

But to mention no more, we have a late and most convincing Example in that great Piece of Ambergris, which the Dutch *East-India* Company bought of the King of *Tidore* for 11,000 Dollars. It was at first of the Shape of a Tortoise, weighed 182 ℔. was 5 Feet 8 Inches thick, and 2 Feet 2 Inches long. *Chevalier* has given a prolix Description of it in a little Treatise printed at *Amsterdam* in 1700, and has added various Figures representing it in different Views. It was kept many Years at *Amsterdam*, and after it had been shewn as a great Rarity to several hundred, perhaps thousands, Persons; was at last broken to Pieces, and sold by Auction, so that many Persons now alive have been witnesses of it, and consequently it can no longer be doubted that Ambergris is found in very large Masses. I would only ask how those *American* Gentlemen can reconcile these vast Masses of Ambergris with their Cyst.

The same continued; Part III. No. 435. p. 417. Dec. 1734.

3. There are several sorts of Ambergris, of which that which has been *swallowed* is the worst, for it generally retains something of the Stink of the Animal, and therefore may easily be distinguished from good Ambergris. Thus also that which is *quite black* or *quite white* is of no Value, and that also which seems *smooth*, *uniform*, *and too pure in outward Appearance*, may be suspected, for it is seldom genuine, and is generally adulterated, if not quite factitious. On the contrary, that which is *ash-coloured* and streaked, or whitish with Spots of black or yellow, and covered with a blackish Crust, may be accounted the best, tho' it is not quite pure, but mixed here and there with little Bills of Birds, Particles of Cuttle, Spines of Fish, or other Bodies. It is not necessary however that it should be always mixed with such Impurities; but we may choose that which is purest: only it is worth observing, that the best Ambergris of all has generally these Mixtures.

The chief Proporties of good Ambergris, except those already mentioned, are it's being light, and feeling almost like Wax, at the same Time friable, but yet a little tenacious, so as to stick to the Mortar or Pestle, having a fragrant smell, catching Fire readily at a Candle, easily melting

melting at the Fire, or upon a burning Coal, and having no remarkable bitter, auſtere, acid, or ſaline Taſte.

The common way of trying whether Ambergris is genuine or not, is to run a hot Needle into it, when ſomething like *melted Reſin* ought to ſtick to the Needle; or to throw it upon burning Coals, or to melt a little of it in a Silver Spoon over a Candle. This Proof indeed has it's uſe, but if you are not exactly acquainted with the Smell, and obſerve many other Circumſtances, but only attend to this melting, you may be deceived; for the factitious Ambergris may anſwer this Trial: Nor is that Proof more certain, which is recommended by *Etmuller*, who ſays that the true Ambergris ſoftens in the Hand like Wax, but the factitious is friable; which properly may eaſily be given by Art, and is not always found in that which is genuine.

Ambergris is adulterated with Wax, Reſin, Storax, Benjamin, Amber, Laudanum, Muſk, Civet, Lignum Aloës, rotten Aſh, Rice Flour, Tree-Moſs, and ſuch like, whilſt one Impoſtor ſtrives to improve upon another, in finding a ſtill better Proportion and Mixture. But this Fraud is eaſily diſcovered.

Factitious Ambergris is generally uniform, all over of the ſame Colour and Mixture, *like a maſs of Pills*, or a Paſte, which never happens ſo equally in the true.

The falſe Ambergris commonly *ſoftens* in the Hand *ſooner* than the true.

But the factitious Ambergris is beſt known by the *Smell*; for as the true Smell is *quite Specific*, and not to be compared with any thing elſe in the World, ſo it cannot eaſily be imitated by Art; but the *Smell* of one or other of the adventitious Ingredients will *prevail* and diſcover the Fraud; and this will appear more evidently, if it is thrown upon Coals, or melted in a Silver Spoon over a Candle: or if you hold a Piece of it to a Candle, you may *diſtinguiſh the Smell*, and at the ſame Time obſerve it's *melting* and *flaming*: If the Ambergris is genuine, it will *bubble* as it melts, and after melting remain *brown*, and give a *Smell like Amber*, only not ſo ſtrong: But if it is ſpurious, theſe Properties will fail one way or other. For it will either not melt at all, or too ſoon, or too late. In melting it will yield ſomething either fetid, or too fragrant, or of a quite different Smell from the Exhalations of true Ambergris, after burning it will not have the *ſame Appearance with Regard to Colour*, and will look like a Coal, or Aſhes, or Earth.

But if the adulterated Ambergris ſhould have no *foreign Smell*, but be compounded with ſome inodorous Subſtance, ſuch as the aſh coloured Tree-Moſs, yet even then the Fraud may eaſily be detected: for ſuch Ambergris will have *too weak a Smell*, and being thrown upon the Coals will make a great *Smoak*, if not *ſtink*; *nor will it melt ſo equally in every Part*, nor will it bubble in melting like the genuine. Laſtly, it will not catch *ſo eaſily* at the Candle, nor flame *without Intermiſſion* till it is quite conſumed, as the genuine Ambergris will.

Beſides

Beſides all fictitious or adulterated Ambergris will diſcover itſelf in diſſolving, and appear quite different from the true.

Laſtly, not to mention any more Trials, the falſe recedes *in Diſtillation by an open Fire.*

Therefore the true Ambergris is a *Bitumen*, and *comes the neareſt to Amber* of any Bitumen yet known, approaching very near to it, except in Hardneſs and Tranſparency.

Tho' the Word Bitumen ſignifies only a Mineral Compound, yet moſt Writers of Natural Hiſtory have reſtrained it to ſignify *a tanacious Fat of the Earth, eaſily catching Fire*, with which Character our Ambergris perfectly agrees. The Baſis and greateſt Weight of it's eſſential Parts are Fat and Oil; and in one Dram of Ambergris there are at leaſt ℈ ij ſs or $\frac{5}{6}$; ſo that if we take it's Denomination from the principal Part, it may be called a *Fat*. But as this Fat or Oil is neither vegetable nor animal, but evidently mineral, it may properly be called a *Fat of the Earth*. That it is a *tenacious* Body, or a *tenacious* Fat, will not be diſputed; for otherwiſe it would be eaſily pulveriſed, and not ſtick to the Mortar and Peſtle. And that it *eaſily catches Fire* may be evident to any one, that will but hold it to the Flame of a Candle. Thus there is nothing wanting of any of the requiſite Qualities of a Bitumen.

When I ſaid that Ambergris *comes nearer to Amber than any other Body*, it was not out of any vain Imagination or Conjecture, but from Experience. For Ambergris being melted in a dry Form over a naked Fire, and ſo gradually exhaling, or being thrown on a *burning Coal*, diſcovers a plain *Smell of* Amber. And if it is put in Water over the Fire, it melts juſt like Reſin, and gives a Smell to the Water, tho' it does not mix with it. And this Smell is eaſily ſeparated again by Diſtillation; but the ſurrounding Moiſture at the ſame Time hinders the Reſolution of the Compound, and the Exhalation of ſome of it's eſſential Parts. In ſhort, by this Method the Amber Smell does not diſcover itſelf ſo well as by melting it dry.

Ambergris has the ſame Effect *in the Preparation of Varniſh* as yellow Amber, that is, if it is melted, and Linſeed Oil quite freed from Water is poured upon it, or if other Varniſhes, that are not very oily, are mixed with it.

But nothing ſhews Ambergris ſo well as the *Diſtillation* of it by an open Fire, for here *every thing has exactly the ſame* Appearance as in Amber. The Learned and Famous *Herman Nicholas Grimm*, who was a long Time in the *Eaſt-Indies*, diſtilled gradually ℥j of Ambergris in a Glaſs Retort by an open Fire, and obtained firſt an aqueous Liquor, then (as he expreſſes it) a ſpiritual Liquor, alſo an Oil of a yellow Colour, a ſmall Quantity of volatile Salt, beſides a *Reſiduum* like Pitch in the Retort. He declares plainly at the ſame Time, *that the Liquor, Oil, volatile Salt, and* Reſiduum, *and ſo all the Parts, have the ſame Appearance and the ſame Properties, as the Parts coming from the Diſtillation of Amber*

would have, excepting only that the Oil yielded a Smell rather more fragrant *. I have repeated this Experiment myſelf, and *found every Thing the ſame*, with this only Difference, that there was *no ſubſtantial* Reſiduum, but only a little Powder from ℥i of Ambergris, hardly amounting to a Grain. But this does not by any Means derogate from Mr *Grimm*'s Experiment, for the Difference aroſe from his ſtopping a *little too ſoon* in his Diſtillation, or not letting the *Fire be ſtrong enough* at the latter end, in which Caſe ſuch a *Reſiduum* remains. And this very Circumſtance makes very great Alterations in the *Reſiduum* of Amber; and for my Part, I continued the Diſtillation of the Ambergris as long as I poſſibly could, that I might diſcover whether there would remain any materially fixt, or ſaline, or at leaſt terreſtrial *Reſiduum*. But there remained *nothing ſubſtantial*, only a *ſmall Quantity of an almoſt inviſible Powder*; and thus I found that Ambergris might be totally diſtilled by the Continuation and Violence of the Fire. From ℥i of Ambergris I obtained ℈ ijſs of Oil, gr. v. of Water, gr. ij of Salt, and about gr. i. of Powder. The other 2 Grains were loſt, *partly by ſticking to the Sides*, *partly by exhaling and evaporating*: *the Oil and Salt*, *as the 2 principal Parts*, were of the ſame Nature *as the Oil and volatile Salt of Amber*, *and conſequently by no Means urinoſo volatile*. From which Proportion of the Ingredients or conſtituent Parts, this Conſideration may be drawn, that this *ſo little ſaline and terreſtrial Subſtance*, is able however to condenſe a far greater Portion of oily Parts, or to reduce it into a firm, tenacious, and dry State; alſo that this Circumſtance agrees for the moſt Part with Amber, and conſequently *confirms it's Affinity alſo in this Part*. I ſhall add one Thing more, that it is not eaſy in all Sorts of Amber to ſeparate any thing ſubſtantially ſaline, ſeeing that a ſmall Quantity of it is eaſily involved in a large Quantity of Oil.

Since therefore this precious Material exerts it's Powers chiefly in yielding a *fragrant Smell*, it has hitherto been chiefly employed where a *ſweet Smell* is deſired, as in Balſams, Sneezing Powders, Dentifrices, Electuaries for the Teeth, Powders for the Hair, Waſh-balls, and in giving a Scent to Garments, which are Things rather of Delicacy than Uſe. Since alſo in former Times *many medicinal Qualities*, analeptic, aphrodiſiac, cephalic, apoplectic, bezoardic, and many other Virtues were aſcribed to it, it has been uſed in the Shops much more than at preſent, in different Preparations and Compoſitions, rather Galenical than Chymical, and moſt commonly in Powders. But I ſhall paſs all theſe over, and mention only one, which has been hitherto the moſt uſual *Preparation* of Ambergris, namely the *ſimple Eſſence of Ambergris*, in which there is nothing but Ambergris with a *Menſtruum*, and the rather, becauſe in the *Solution of Ambergris* I have made an Obſervation or two, which I have not found as yet in any Piece that has hitherto been publiſhed.

* Ephemer. Nat. Curioſ. Dec. xi. Ann. 1. pag. 495.

It has been hitherto looked on as a Maxim, that *Spirit of Wine rectified per se* does not diſſolve Ambergris; and from hence Authors have taken their Argument, or this Concluſion, that Ambergris is neither vegetable, nor animal, nor a reſin, nor an oily pinguedinous or reſinous Body, but a *bituminous Mineral*, becauſe rectified Spirit of Wine *touches it very little, much leſs diſſolves it*, but has the ſame Effect upon it as on *Aſphaltus*, Bitumen, Amber, and other bituminous Compounds, from which it extracts very little, but never forms a perfect Solution. The learned *Hoffman* ſays *, "All reſinous Bodies are eaſily diſſolved and "extracted by the moſt rectified phlogiſtic Spirit of Wine, but *this is "not the Caſe with Ambergris, which is not diſſolved in ſuch a Spirit "without the greateſt Difficulty.* And becauſe we obſerve, that inflammable Bodies, which proceed from the Earth, as Amber, *Jews* "Pitch, and Pit-coal, are alſo very hard to be diſſolved, and *do not "eaſily unite* with a very ſpirituous Liquor, therefore we ſubſcribe to "their Opinion, who determine, that Ambergris is to be referred to "the *Genus* of Bitumen, the Origin of which is in the Earth, *&c.*" He ſays moreover, "ſince Ambergris is ſo difficult to be diſſolved, "for this Reaſon we meet with no genuine Solution of Ambergris in "the Shops. For they generally prepare it with Muſk, Civet, or eſſen- "tial Oils of Cinnamon, *&c.* and ſo we have indeed an Eſſence of a very "ſweet Smell, which is not without it's Virtue and Uſe, but *partakes "very little of Ambergris*, which rather remains *untouched*." So much as has been hitherto known in the World of the Solution of Ambergris in an inflammable or burning Spirit, has been produced by *Hoffman*, nor has any other fundamentally confuted his Opinion, chiefly as ſuch a Solution in general, eſpecially *in the moſt rectified Spirit of Wine per ſe*, has not only been thought very difficult, but a total Solution of it has been accounted impoſſible. But ſince I have found by Experience, that it is not only poſſible, but eaſy too, I hope a Diſcovery of it will be very acceptable.

This whole Buſineſs requires only a *little Management*. Take good tartariſed Spirit of Wine highly rectified, (though in Caſe of Neceſſity ſimple Spirit of Wine not tartariſed but highly rectified will do) put into it $\frac{1}{12}$ Part of pure, genuine Ambergris, in ſmall Pieces, put it in a gentle Digeſtion, which may heat gradually, till the Menſtruum juſt begins to boil; and you will have a total Solution. I have always diſſolved ℈ij of Ambergris in ℥i of Spirit, and have found only the impure Part that is mixed with it, weighing only 2, and ſometimes not above 1 Grain, as a *Reſiduum* at the Bottom of the Glaſs. If any one would make an extemporary Trial of this Affair, let him do it in a Glaſs not quite full, and ſtopped gently, not too cloſe for fear of breaking, over Embers, or rather over the Flame of a Candle, and as ſoon as the Spirit begins to boil he will be convinced of the Truth. But if

* Obſerv. Phyſic. Chym. ſelect. Lib. I. Obſerv. xviii. pag. 67, &c.

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an *oily* inflammable Spirit is used for the Menstruum, whether it is drawn from any oily Vegetable, or whether any essential Oil is dropped into a highly rectified Spirit of Wine, the Solution will proceed *the more quickly*; but *neither Spirit of Roses*, nor any other abstractitious Spirit, *unless it is full of oily Particles*, succeeds better than plain Spirit of Wine highly rectified.

The following Circumstances are worthy of Observation.

1. If plain Spirit of Wine highly rectified, without any alkali, or tartarised Spirit of Wine is used, then there is a total Solution made in the above-mentioned Proportion; but this Solution, or Essence of Ambergris as it is called, *is not tinged with a sufficiently deep red.*

2. The Residue is of *no small Bulk*, so that great Part of the Ambergris seems to be undissolved; whereas, in reality, if the Solution is filtrated, and *what remains in the Filtre is dried and weighed*, it is found to be very little, a *mere Powder*, or something lightly terrestrial, if the Ambergris made use of was genuine.

3. If *the Spirit was not sufficiently dephlegmated*, or if *a sufficient Heat* was not applied, then either no Solution, or only a mere *simple Extraction* follows.

4. But if tartarised Spirit of Wine, which has stood with Salt of Tartar only *in Infusion*, without a following Abstraction, is used in the Solution, then the Solution will be *sooner* and better *tinged.*

From these 4 Circumstances proceed the following Consequences and Explications.

(a) As a *Colour* is generally looked for in the Essence of Ambergris, many perhaps have had a Solution with Spirit of Wine, which *not being much coloured*, has not been known to be what it was.

(b) And the rather because they saw a *Residuum so copious in Appearance*, which at first deceived me, so that I thought little or nothing had been dissolved, till by drying and weighing it I perceived it was not only very little, but a mere foreign *Powder*, that had no Relation to the Solution or Essence of Ambergris.

(c) If this Solution has not succeeded according to Expectation, then either the Spirit of Wine has not been *sufficiently rectified*, or else a *proper Heat* has not been used, and perhaps most have thought Ambergris to be a fragrant Substance, which, if it is too strongly digested, or exposed to a strong Heat in Infusion, will let the best and most subtle Part exhale, and therefore that a gentle Heat is to be used; though indeed such a vehement Heat is not required for *all Sorts of Ambergris*, and yet the Solution has succeeded.

(d) In the last Place, this Conclusion follows, that, if any one has a red Essence, and has used nothing besides the Menstruum but Ambergris, the Menstruum was *Spirit of Wine tartarised by Infusion*, whence the Tincture does not proceed originally from the Ambergris, but from the *fixt alcaline Salt*, which then is only exalted by the oily Parts of the Ambergris. The Certainty of this Circumstance appears, if a most

rectified oily Spirit of Wine is digested *only with Salt of Tartar per se*, for this will produce a red Tincture, which they call Tincture of Tartar. If this Spirit of Wine is not oily, then neither the Tincture of Tartar will be so beautiful, but only tinged with a yellowish Colour, or none at all. But if you add a Drop or 2 of *essential Oil*, for Instance, Oil of Annised, you will see the Colour grow deeper in a Moment.

The Conclusion therefore is this: *(α)* That if a pure rectified Spirit, or Spirit of Wine tartarised by Abstraction, is used, there *happens a complete Solution, but without any particular Tincture.* *(β)* But if Spirit of Wine tartarised by Infusion is used, the *Solution is tinged*; and this Tincture chiefly depends on the *Salt of Tartar being* more in Substance, and is to be considered rather as a Tincture of Tartar so far as relates to Colour. *(γ)* But if it appears deeper coloured than Tincture of Tartar, then the *oily Parts of the Ambergris* contribute to the Increase of the Colour, in the same Manner as if a Drop or 2 of essential Oil had been added to Tincture of Tartar. *(δ)* If therefore *alcalised Spirit of Roses*, made either by Fermentation or by repeated Abstraction upon Roses, is used for the Menstruum, and a fine Essence of Ambergris is procured, it ought not to be concluded, that Spirit of Roses *alone is a singular Menstruum appropriated to Ambergris:* for this is only what I have said before, that in alcalised Spirit of Roses there is *something of an alcaline Salt*, and *some oily Parts*, which raise a Tincture in the same Manner as if the Tincture of Tartar was prepared of Salt of Tartar with an *oily* Spirit of Wine, and without either Ambergris or Roses, and the Solution of Ambergris always proceeds in the same Manner as a Solution with another tartarised Spirit of Wine, or even with a simple rectified Spirit without Tartar.

But that such an Essence or Solution of Ambergris, which has been rightly prepared with good *Spirit of Roses*, should afford *a stronger and more pleasant Smell*, than when it is prepared with simple Spirit of Wine, is quite natural. For Spirit of Roses by itself has a *strong and fragrant Smell*, but simple Spirit of Wine has *none at all.* Besides it is well known, that Ambergris does not by itself give any *remarkable Smell*, but as soon as any fragrant Body is mixed with it, the *Smell and Fragrance of the Ambergris* is at once in a Manner awakened from Sleep, and really *exalted.*

Therefore it is not without Reason, that the officinal Essence of Ambergris may be prepared with alcalised Spirit of Roses, because of it's stronger Smell. But since many cannot bear the *Smell and Taste of Roses*, those will be in the right, who besides this rosated Essence, keep also in their Shops the *pure Essence of Ambergris* prepared only with highly rectified and alcalised Spirit of Wine. But that this Tincture may be sufficiently efficacious, and the Solution sooner made, and the Colour fixt, it will be of Service to *alcalise* the Menstruum *doubly.* Therefore take good tartarised Spirit of Wine by Abstraction, or *distil* a genuine rectified Spirit of Wine with a fixt alcaline Salt; and this being

ing once alcaliſed, muſt be *poured again* upon a pure and calcined fixt alcaline Salt, digeſted for ſome Time, then decanted, and uſed as a Menſtruum for the Eſſence or Solution of Ambergris. This, *by Reaſon of it's diſſolving Power*, will act in the ſame Manner as the beſt and moſt precious Spirit of Roſes, nay *will hardly yield to it*, unleſs the Spirit of Roſes was tartariſed or alcaliſed.

It remains now to prove and demonſtrate what I have ſaid; that an inflammable *oily* Spirit *promotes and accelerates the Solution of Ambergris*, which is viſible to any one. Take the moſt rectified inflammable Spirit, and put into it ſome Bits of Ambergris, if you find they will not yield, put in ſome Drops of pure *diſtilled eſſential Oil*, *not adulterated with expreſſed Oil*, then what I have ſaid will ſoon be manifeſted. The Reaſon of this is no great Myſtery; for *ſuch Oils* themſelves diſſolve Ambergris. I have tried the Experiment not only with various aromatic fragrant eſſential Oils, as Oil of Lavender, Mint, *&c.* but alſo with the *Italian* Oil of Citron (*oglio di cedro*), and with the reſinous Oil of Turpentine, and alſo with rectified Oil of Amber, and have always perfected the Solution with theſe Oils. On the contrary, not the leaſt Solution or Extraction could be procured with an *expreſſed Oil*, as *Oil* of Almonds. Hence it evidently appears, *Schroder*'s * Eſſence of Ambergris, who tells us firſt to digeſt and expreſs Ambergris with *Oil of Almonds*, and afterwards to abſtract rectified Spirit of Wine upon this Expreſſion, is abſurd, rather *hindering* than promoting it's Diſpoſition to diſſolve.

In like manner I have made Trials, with an Intention to diſſolve Ambergris, with *dulciſied Spirits*, both alcaline and acid, and have therefore infuſed and digeſted Ambergris with the dulcified Spirits of Vitriol, Nitre, and Salt, and alſo with dulcified alcaline Spirits, ſuch as dulcified Spirit of Urine, or the vinous Spirit of Sal Ammoniac ſo called, prepared with quick Lime or Salt of Tartar; but theſe have *extracted little or nothing*, nor would they in the leaſt take hold of the Ambergris or diſſolve it. There was ſomething ſingular indeed in the Infuſion with *dulciſied Spirit of Vitriol*; for this Spirit, with what little it had extracted, formed *ſome ſaline Particles*, which faſtened themſelves to the Side of the Glaſs, in which the Infuſion was made.

In the laſt Place I ſhall add ſomething about that *white*, *viſcid Subſtance*, *appearing like Suet*, which commonly *precipitates*, or ſeparates itſelf from the Solution or Eſſence of Ambergris, which *Lemery* takes to be *Wax*, and uſes as an Argument to prove that *Ambergris is nothing but Wax*, or a Product of Bees, in which Opinion this Gentleman, however otherwiſe judicious, is miſtaken.

1. If this white Subſtance ſeparates itſelf, I have commonly obſerved 3 Circumſtances, one of which at leaſt, if not all 3, is required for the Precipitation. For either the Solution has ſtood in a Glaſs not quite

* Pharmacop. Medico-Chymica, *Lib.* iii. *cap.* 29. *pag.* 502. *Edit. Witzel.* 1677.

full,

full, but only filled to ½ or ⅓ Part, or the Orifice of the Glaſs has been negligently ſtopped, whence the moſt ſubtile Spirit has by Degrees exhaled, and therefore in Proportion to this Exhalation ſome Part of the diſſolved Amber has fallen again, or elſe the Solution has ſtood upon ſome Part of the undiſſolved Ambergris. For if the Solution is immediately decanted, the Glaſs quite filled with it, and carefully ſtopped, and all Exhalations avoided, then there has not eaſily been any Precipitation, nor would any ſuch white Subſtance appear, and ſo the *Evaporation of the fineſt Spirit is the true principal Cauſe*, ſo that what was before diſſolved is again let go by this Spirit as it flies off. 2. This *whitiſh Subſtance*, which *Lemery takes for Wax*, is nothing elſe but the *depurated or perfectly reduced Ambergris:* for the moſt rectified Spirit of Wine, or other Menſtruum uſed in this Solution, if I treat this whitiſh Subſtance in the ſame Manner as I did the Ambergris, diſſolves it again and imbibes it. On the contrary, let the Proof be made with Wax and the moſt rectified Spirit of Wine, and ſee whether this Spirit will eaſily diſſolve, imbibe, or mix itſelf with the Wax in the ſame Manner, to omit other Circumſtances.

I could add an Obſervation or 2 more concerning the *compound Eſſences* and other *Preparations of Ambergris*; but as this Diſcourſe has grown to a much greater Length than I at firſt intended, I ſhall reſt here, thinking what I have already ſaid ſufficient, and ſhall be much obliged to any one, who ſhall favour me with better, more ſufficient, and more *demonſtrable* Accounts of Ambergris, it's *Origin*, *Nature*, *and Compoſition*.

Berlin, Oct. 15, 1729.

An Account of the Experiments relating to Ambergris, made by Mr John Browne, *and Mr* Ambroſe Godfrey Hanckwitz, *FF. R. S. with Mr* Newman's *Vindication of his Experiment, drawn up by* C. Mortimer, *R. S. Secr. Ibid. p. 437.*

4. Mr *Browne* and Mr *Godfrey*, two moſt experienced Chymiſts, and Fellows of the Royal Society, were deſired carefully to repeat Mr *Newman*'s Operation upon Ambergris.

Mr *Browne* thinking ℥i, which the learned Profeſſor had uſed in his Experiment, to be too ſmall a Quantity, took ℥iſs of Ambergris, reduced to Powder with very dry Tobacco-pipe Clay, which he always uſes in order to obtain the Salt of Amber. He expoſed it to various Degrees of Heat in a Retort, and obtained firſt a clear Phlegm like the pureſt Water, then a brown Spirit like that of Malt, which was ſucceeded by an Oil of a browner Colour, and laſtly by a very ſtrong Fire a thick black Balſam. He confeſſes that the Oil and Balſam agree in Smell with thoſe obtained from Amber; but he could not obtain any volatile acid Salt as from Amber, nor did this Spirit of Ambergris make any Motion with alkaline Bodies, as that of Amber does, which abounds with ſuch an acid Salt. He looks upon that volatile Acid as the true *Criterion* of Amber. The *Reſiduum* alſo from the Diſtillation of Amber is hard, and black like Jet; but from this Diſtillation the Tobacco-pipe Clay remained in Powder, but juſt tinged with black. Therefore as he could not diſcover through the whole Operation any Acidity, or any Volatility, he leaves it as a Doubt whether Ambergris is an animal

mal Excrement or not: but he obſerves that all that is odorous or agreeable is loſt by a very gentle Fire.

Mr *Godfrey* firſt diſtilled with a Retort ℥ij of Ambergris mixt with twice the Weight of the pureſt white Sand. Secondly he diſtilled two Ounces more in like Manner, and had in both Operations a limpid Oil and a bituminous *Reſiduum*. The Oil being rectified *per ſe*, afforded a Phlegm of a grateful ſubacid Taſte, like a mild Vinegar, and then followed a limpid, balſamic, bituminous Oil, like *Petroleum*. Thirdly he diſtilled ℥ſs of Ambergris by itſelf, and obtained the ſame by a pretty moderate Fire. After he had diſtilled the Ambergris to the utmoſt Drineſs, he urged the *Reſiduum* with a very great Fire; and there remained at laſt gr. iij of a white, ſaline Earth, fermenting a little with Acids, or running *per deliquium*, when expoſed to a moiſt Air. As he could not obtain any volatile Salt, or any Phoſphorus from the Coal, or blackiſh *Reſiduum* of the 2 firſt Operations; he pronounces that Ambergris is moſt certainly neither any animal Subſtance, nor the Excrement of any Animal; for he can obtain Phoſphorus from the Dung of all known Animals *. Therefore he determines that Ambergris is a Bitumen coming very near to Amber; but he does not allow it to be a true Amber, becauſe it does not yield an acid volatile Salt like that of Amber.

He repeated the Experiment again with equal Parts of Ambergris and powdered Glaſs; becauſe it might be ſuſpected that ſomething of an alcaline Earth might have been detained in the Sand, and have abſorbed the Acid of the Ambergris, if there was any in it. But the Operation exhibited the ſame; only the Phlegm had a Taſte of a neutral Salt, not acid; and after melting the powdered Glaſs, the bituminous Reſiduum, free from the glaſſy Maſs, lay upon it like a black Coal, and had diſperſed itſelf through the whole internal Face of the Retort quite up to the Neck, in Form of black Flours or Flakes, very thin and ſhining.

The whole Diſpute about theſe Experiments may eaſily be compoſed, if Ambergris is but conſidered as a mixt Subſtance compoſed of various foreign Bodies, like other Minerals, and not as a ſimple, pure Body like Metals; for no Ore of any Metal whatſoever, for Inſtance, Lead, affords in every Part an equal Quantity of Metal, or certain Mineral mixt with it. In like manner various Parts of Ambergris do not contain the ſame Quantities of that acid Salt; as we ſee in Mr *Godfrey*'s Experiments; for in one the Phlegm had a ſubacid Taſte, an indubitable Sign of that Salt, in the other a Taſte of a neutral Salt; and the Part examined by Mr *Newman* had more of ſuch a Salt than the reſt. Beſides the more the Salt is intangled with Oil, the more difficult it is to be ſeparated. It has happened in like manner in ſome Experiments with quick Lime, as Mr *Newman* mentions in a Letter to Mr *Godfrey*, in which he tells him, that it has ſucceeded differently in *France* from

* See below, §. V. Art. 2.

what

what it has in *England*; whence a certain *Frenchman* has declared, that the Experiments in *England* were quite falſe. Moreover Mr *Newman* has written to Sir *Hans Sloane*, that he would not be underſtood to mean that Ambergris is really Amber, but only that it is of the *Genus* of Amber, or a Bitumen approaching very near to Amber, which was the Opinion of the Ancients, who called both AMBRA, diſtinguiſhing common Amber by the Epithet *Citrina*, and Ambergris by *Odorifera*. He adds in the laſt Place, that he cannot be deceived with Regard to that volatile acid Salt, of which he obtained a Grain or two, for it diſſolved in Water like Salt, and turned the Syrup of Violets red, like other Acids; and it muſt be volatile, having riſen in Diſtillation.

A Method of making Soap-Lees *and* Hard Soap, *for Medicinal Uſes, by M.* Claud. Joſ. Geoffroy, *F. R. S.* No. 463. p. 71. *dated*, Paris, July 23, 1741, *N. S. read* April 1, 1742.

III. To make the Lee, I take, for Inſtance, of the beſt calcined Lime, that has been the leaſt expoſed to the Air, 5 ℔; of good Salt of *Kali* or Glaſs-wort of *Alicant*, pulverized, and paſſed through a fine Sieve, 10 ℔. I divide the Lime and the Salt of Glaſs-wort (called in *England Barillia*) into 2 equal Parts; then I put the Lime, broken into Pieces not bigger than an Egg, into new ſtone Pans, and cover it with as much Salt of Glaſs-wort as is deſigned for each Pan. I pour afterwards on theſe ſeveral Mixtures hot Water by little and little, to give Time to the Lime to open itſelf, till it turns into a ſort of Meal, which will happen after I have poured 3 half Pints * into each Pan. I then add to it the reſt of the Water that is required, ſtirring this Mixture with a Stick of white Wood; when there are 18 or 19 Quarts of Water in each Pan, there is enough for diſſolving the Salts. In this State the Pans are left for 12 or 15 Hours; after which this Lee is filtrated through brown Paper, ſupported by a coarſe Cloth, fixed to the 4 Corners of the filtring Frame. When the whole Maſs of the Lee and of the Lime is well drained, I put it into an iron Pot that is very clean, with 10 Quarts of Water, to the Quantity taken out of each Pan, and let it boil an Hour; then I filtrate it a ſecond time. Afterwards it is put into another iron Pot that is very clean, and as it evaporates by Degrees, it is filled up again with the firſt Lee prepared, without boiling. I let it continue to evaporate till the 28 Quarts of Water, that have been uſed for making the Lee of the Mixture that was at firſt put into each of the Pans, be reduced to 2 Quarts and ½ a Pint, or ſo long till a ſmall ſalinous Film forms itſelf on the Top of the Lee. This Liquor turns almoſt black, becauſe it corrodes the Iron; but this is no Inconvenience, as will appear hereafter. In this State of Concentration, if one lets a Drop of it, whilſt it is hot, fall on a Piece of Glaſs, it will be very quickly covered with a fine and greaſy Film, which makes it look as if it was congealed. At the Bottom of this Lee is found a Salt in Flakes, which, being melted in a Crucible, produces a *Lapis infernalis* of a ſtrong cauſtic Power. One may know alſo, that the Lee has acquired the neceſſary Degree of Concentration,

* The *Paris* Pint is near a Quart *Engliſh*.

when,

when, becoming more active, one ſees, that the Edge of the Pot that has been wetted by it, turns red, whilſt the lower Part of the Side all around, down to the Surface of the Liquor, takes a greeniſh Colour. Then the Pot muſt be taken from the Fire, and the Liquor left to cool ſo far as to be put into Glaſs Bottles without cracking them: The Bottles ought to be carefully corked, not only to prevent the Salts contracting a Dampneſs from the Air, which would leſſen the Degree of forced Concentration, which has been acquired by the Evaporation, but alſo to preſerve what is ſulphureous, which would exhale, if the Liquor remained long expoſed to the Air: For I ſuſpect, that that Sort of *Hepar*, formed by the Union of the cauſtic Salt with the Sulphur of the Aſhes of the Glaſs-wort, ought not to be neglected. Now, the better to direct thoſe who have a Mind to work after theſe Proceſſes, and to furniſh them with the Degrees of Concentration this Lee is to have, in order to make with Oil a ſolid Soap out of it as ſpeedily as poſſible, I take a glaſs Phial with a narrow Neck, and fill it with clear Water up to a Mark made on the Neck. That which I now make uſe of, being filled up with Water to that Mark, contains juſt ℥iij: I afterwards empty it carefully, and, inſtead of clear Water, I fill it with that concentrated Lee as far as the foreſaid Mark, and then I weigh it. If the Weight be increaſed 8½ or 9 Drams, that is, near 3 Drams in each Ounce, this ſhews that the Lee is neither too much nor too little concentrated. A hydroſtatical Balance, a Water-poiſe, and other Inſtruments, might alſo give this Degree; but in the Country they are not at hand, and I judged it beſt to point out only what is moſt eaſy. Soap-boilers uſe for this End a freſh Egg; if one half of it ſinks into the Lee, they judge the latter to be of the firſt Strength, that is to ſay, that this is the Lee which they ought to employ laſt of all in their Manufacture; if the Egg ſinks in to ⅓, the Lee is called the Second; and, laſtly, if the Lee covers the whole Surface of the Egg, it will be called the Firſt, and will be that with which they begin their Operation or Boiling. But this Way of trying has not all the Exactneſs which can be deſired, becauſe all Hens Eggs have not the ſame ſpecific Gravity. Beſides, as I make my Soap without Fire, I muſt take the Lee that is moſt concentrated.

Leſt the Iron, which is corroded by the Lee, ſhould enter into the Compoſition of the Soap, one need only to evaporate the Lees in earthen Pans put over a *Balneum Mariæ*; but as this Evaporation is ſlower, it will conſume much more Coals. One may even ſee in thoſe Pans by different Marks, that the Liquor approaches the deſired Degree of Concentration, partly by a Piece of Wood marked with Notches, partly becauſe if there is the leaſt ferruginous Speck in the Earth of thoſe Pans, the Liquor will penetrate that ferruginous Place, and make a Spot there. By uſing earthen Pans you will get a very limpid Liquor, and which will only have a very pale Straw-colour, even after it's perfect Concentration.

The Lee prepared in Iron, being kept for ſome Time, clears up, and leaves a black Sediment, which is that Part of the Iron which it has ſeparated by corroding the Sides of the Pot. And yet this ferruginous Lee, together with the Oil, will form a white Soap, if one has let that black Sediment precipitate. This Sediment is true Iron: I have made myſelf ſure of it, by calcining it in a Crucible, after having moiſtened it with Oil.

One Ounce of concentrated Lee to the Degree above-mentioned contains ℥iij gr. xviij of Salt; when I diſſolve this Salt again in diſtilled Rain-water, and filtrate it, I find in it gr. iij of coarſe Earth, which cannot penetrate the Pores of the Filtre.

If I uſe it to make Soap of it, I take one Part to two Parts of the beſt Oil: I mix them gently in a *China* Bowl, ſtirring them with a *Spathula* of white Wood, till both Liquors are come to a Conſiſtence of Butter that is churning: This Thickening is much ſooner done in Winter than in Summer. I keep the Veſſel in a dry Place, that the Moiſture of the Air may not diminiſh the Strength of the Lee. The Mixture from Day to Day grows to a Body, and when it is in the Sun in Summer, and upon the Mantle of the Chimney in Winter, the Phlegm evaporating ſooner, it becomes perfect Soap in 4 or 5 Days, provided the Lee be ſufficiently concentrated. It will be well however, that during the Time the two Liquors are binding together, the Mixture be ſtirred with the *Spathula*, that the Water may not be kept in, but evaporate the ſooner. When the Soap is made, it eaſily comes out of the Veſſel, but it has not yet loſt all that Moiſture it ſhould loſe; ſo that though one may uſe it in that State, yet it is better to keep it 12 or 15 Days longer; at the End of which Time if I decompound it, I always find the whole Oil I have employed; that is to ſay, out of ℥xviij of this perfect Soap, I get ℥iſs of Oil, and ℥ij gr. xxiij or xxiv of Salt of Glaſs-wort. So after this Method a Patient may eaſily make his own Soap, and be ſure of the Ingredients; perhaps even in the great Manufacturies, one Day or other, they may prefer this to that which is now in Uſe.

As to what relates to the Oil of Lime *, of which I have ſpoken in my Experiments, it is the *Caput Mortuum* of the *Sal Ammoniac*, after Diſtillation of the volatile Spirit by the Means of Quick-lime; it is expoſed in a flat Veſſel to the Moiſture of the Cellar, whence a *Deliquium* is formed, which we call Oil of Lime. It is Lime diſſolved by the Means of the Acid of the Sea-ſalt, which is contained in the *Sal Ammoniac*; other Chymiſts call it the fixed Liquor of *Sal Ammoniac*. Your Soap-boilers are obliged to add Sea-ſalt to their Soap, which I believe, for my Part, comes from their making uſe of Pot-aſh in their Lees, which they would have no Occaſion to have recourſe to, if they employed true Salt of Glaſs-wort, ſeeing my ſtrong Lee of Salt of Glaſs-

* Huile de Chaux.

wort

wort makes Soap immediately; beſides, the Salt of Glaſs-wort contains Sea-ſalt, which I have demonſtrated by making Salt of *Glauber* with pure Salt of Glaſs-wort and Oil of Vitriol: If inſtead of Salt of Glaſs-wort one makes uſe of Pot-aſh with Oil of Vitriol, it will not make Salt of *Glauber*, but inſtead of it produce Tartar vitriolate.

In deſcribing this Sort of Soap, I had no other View, than not to deviate from the Way of making *Alicant Soap*, and to know well the Proportions, in order to apply them to the making of the Soap I propoſe, and to fix them with regard to the Lime and the Salt of Glaſs-wort, which for many and various Reaſons is preferable to other fixed Salts, as being that which forms the beſt, the moſt deterſive, and the mildeſt Soap, as it has been found by Experience in all our Manufacturies.

The Obſervations which I have lately laid before the Academy, prove that the Oil, which has paſſed through the Lees of Lime and of Salts, is, perhaps, eaſier to digeſt than any other. I there demonſtrate, that the Oil ſeparated from the Soap by the Means of Acids, as I have pointed out, is found to have acquired a Property which it had not before; for it diſſolves in Spirit of Wine, and perfectly unites with it; which it could not do whilſt it was crude, that is to ſay, before it had formed Soap, or had been boiled with metallic Limes.

IV. Take of the whole Plant of *Nantsjera Patsja* of the *Hortus Malabaricus* any Quantity; cut it and bruiſe it, and boil it in a ſufficient Quantity of Spring Water: Squeeze out the Liquor, add an equal Weight of Sugar, and boil to the Conſiſtence of a Syrup without Clarification.

Mr Alexander Orme's *Pectoral Syrup, ſent in a Letter to Sir* Hans Sloane, *Bart. &c. from* Culcutte, *dated* Jan. 25, 1733, No. 461. *p.* 769. Aug. *&c.* 1741.

A Drop or two, with a little Honey, given to new-born Infants, greatly helps the neceſſary cleanſing of the Bowels. Three or four Drops are a ſafe Puke for them, and cleanſe the Stomach and Bowels from that Phlegm that cauſes their Gripes.

It is of great Service in moſt Aſthma's, and has relieved, when the beſt Remedies have failed. If the Fit is violent, give a large Spoonful of it, which will ſoon procure a Vomit or two. If the Fit is moderate, two Tea Spoonfuls 3 times a Day will be ſufficient.

In Fevers that are attended with a laborious Breathing, it has been found ſerviceable.

It is excellent in the Small-pox, as well to vomit in the Beginning, as to help on the neceſſary Salivation in the Confluent Sort.

It helps Coughs, and promotes Expectoration.

From theſe few Hints, a Phyſician will be able to adjuſt it's Uſe in other Diſtempers. I ſhould not recommend it, had not repeated Experience convinced me of it's Uſefulneſs: And that it may be of Uſe to Poſterity, I mean to Phyſicians that are really ſuch, I give the Receipt of it to be given to the Preſident and Cenſors of the College of Phyſicians, *London*.

An Account of the Experiments shewn by Sigiſmund Auguſt Frobenius, *M. D. F. R. S. at a Meeting of the Royal Society,* Nov. 18, 1731, *with his* Spiritus Vini Æthereus, *and the* Phoſphorus Urinæ, *from the Minutes of that Day, by* C. Mortimer, *M. D. R. S. Secr.* No. 428. *p.* 55. Apr. *&c.* 1733. *Fig.* 149.

V. 1. He took a Solution of *Phoſphorus* in the Æthereal Spirit of Wine, *which he called Liquor Luminoſus*, and poured it into a Tub of warm Water; whereupon it gave a blue Flame and Smoke, attended with ſo ſmall a Degree of Heat, as not to burn the Hand, if put into it.

He poured ſome of his Æthereal Spirit of Wine upon a Tub of cold Water, and ſet it on Fire with the Point of his Sword [which being firſt heated a little, he touched with it a Piece of *Phoſphorus* lodged before-hand on the Side of the Tub]. After the Deflagration the Water was cold.

He then ſhewed a very extraordinary Proceſs with *Phoſphorus glacialis Urinæ*, or *Stick Phoſphorus*, of Mr *Ambroſe Godfrey Hanckewitz.*

He had a very pompous Machine, which he calls *Machina Frobeniana, pro reſolutione Combuſtibilium. (inventa anno* 1730.) It is really an Improvement of the common Bell, under which the *Oleum Sulphuris per Campanam*, is commonly prepared. This Machine conſiſted of a concave Plate of Glaſs A B, with a Hole in the Middle C, which communicated by a Glaſs Pipe C D, with a Glaſs Receiver E E F, which ſtood underneath the Plate A B. Upon the Plate A B ſtood a maſſy Golden *Tripus*, ſuſtaining a Baſon, about 4 Inches Diameter G H, having within it another ſmaller one I K, of the ſame Metal, about 2½ Inches Diameter; this was heated a little: He then took ſmall Pieces of *Phoſphorus* out of a Baſon of Water, which he ſoaked up with brown Paper, ſo that the *Phoſphorus* might be quite dry, which he put into a Spoon, and flung it into the ſmaller Golden Baſon I K; where it immediately took Fire: Then he lowered down a large Glaſs Bell L M O, of about 18 Inches Diameter, and containing ¼ of a Sphere; the Rim L M being exactly ground to fit cloſe on the Plate of the Glaſs A B. This Glaſs Bell was ſuſpended by a Wooden Circle P Q P Q, to which were faſtened 4 Cords, that united into one Knot at R, and from thence went a Rope over a Pulley S, in the Crown of the Machine, and coming down by the Side of one of the Pillars, ſerved to raiſe up or let down the Bell.

At the firſt firing of the *Phoſphorus*, the whole Bell appeared Luminous, and full of Flame for a few Minutes: When the Deflagration of the firſt Spoonful was over, he flung in another, and ſo on, till there were ℥ij of *Phoſphorus* conſumed, from which were ſublimed a large Quantity of *Flores* into the Bell, and ſome fell down upon the concave Glaſs A B. The Bell at firſt felt cold, and never grew more than moderately warm. As the *Flores* began to cover the Inſide of the Bell to ſome conſiderable Thickneſs, the Flame was not ſeen thorough ſo brightly as before, but the whole appeared of a light Azure, or Sky-colour, which *the Doctor likened to the Formation of the Firmament*: The *Flores* ſublimed *he likened to Snow.* Then the Bell being drawn up again, and the Golden Baſons taken out, there remained in the ſmaller Baſon an almoſt fixed red *Earth*, or *Caput mortuum.* On the Admiſſion of the cold Air, the Snow [*Flores*] began ſoon to melt as

per

per Deliquium; which *he compared to the Formation of Dew and Rain*; and as it dripped from the Inside of the Bell upon the Concave Plate A B, it ran through the Hole in the Middle of it C, by the Tube C D, into the Receiver E E F; where it was collected in Form of a clear transparent Liquor, somewhat clammy like Gum-water, which *he called Water*.

Some of the *Flores* mixed with any combustible Matter, as common Olive-Oil, *&c.* and put into a Golden Bason set over a Lamp, fired immediately, and flamed like *Phosphorus*, being, in reality, *Phosphorus* regenerated, and burnt away to a Substance like Tar.

Some of the clammy Water was put into a Golden Bason set on a Lamp, and by augmenting the Fire *per gradus*, in about ¼ of an Hour's Time, when all the airy Bubbles were exhaled, the Liquor became hard like Gum, which had been dissolved in Water, and was nearly dry, and perfectly transparent: *This he called Vitrum Molle.*

Next Day he made some more of this *Vitrum Molle*, which he put into a Crucible heated red hot, and then set it in a Wind-Furnace, and gave it the greatest Heat for a quarter of an Hour; when the Matter in the Crucible appeared fluid, like melted Glass. He then poured it out into an Iron Pan; the Matter remained red hot some time; when it was perfectly cold, it was hard, transparent, and brittle like common Glass; but it soon began to relent, and in twenty-four Hours was almost all turned to Water again.

He said, "If this *Vitrum Molle* be again entirely resolved in the Air, "which will take up near 14 Days time, by distilling off the Water, "and letting the Remainder melt *per Deliquium* again, till all the saltish "Matter be resolved into Water, there remains an insipid whitish "Earth, which fluxed in a Glass-Furnace, gives a true fixed Glass."

Some Experiments upon the Phosphorus Urinæ, *which may serve as an Explanation to the preceding, with several Observations tending to explain the Nature of that wonderful Chemical Production, by Mr* Ambrose Godfrey Hanckewitz, *Chemist, F. R. S. Ibid. p.* 58.

2. I repeated the Experiment of the Deflagration of *Phosphorus* under a Bell, which had been first shewn to the *Royal Society* by Dr *Frobenius*, but I found that a much more simple *Apparatus* was sufficient, than the pompous Machine he made use of. I took a strong wide-mouthed Glass Jar, which serves as a Stand for the Concave Glass Dish to rest on. In the Middle of the Glass Dish is a Hole communicating with a Pipe, which goes down into the above-mentioned Jar. Instead of the Golden Basons, a *China* Cup a little warmed, serves perfectly as well for burning off the *Phosphorus*: The last and main Thing is a large Glass Bell, which fits nearly close upon the Glass Dish. This Bell may be easily lifted off and on with the Hands by an Assistant, without any Frame or Ropes to suspend it.

I took one Ounce of *Phosphorus*, which I deflagrated in the same Manner as is described in Dr *Frobenius*'s Experiment, and obtained of the white sublimed Flowers 3x, that is 3ij more than the Weight of the *Phosphorus* before Deflagration: They were so very light as to their Volumen, that they just filled an half Pint Pot.

The

The ℥x of Flowers being ſet in a cool moiſt Place, expoſed to the Air, did reſolve into a *Liquamen*, weighing ℥iv ℥ij, which *Liquamen* much reſembles *Ol. Sulph. per Campanam*; but contains an acid Salt, more fixed in the Fire than any other Salt we know of in Nature, and having many other Properties peculiar to itſelf, which other acid Salts have not.

The *Phoſphorus* receives this fixed Acid from the Urine only; for the Salt of Urine is ſo fixed, that upon a live Charcoal with a blowing Pipe it plays and rolls about like Silver upon the Cupel. Whereas all other liquid Acids evaporate with Eaſe; this on the contrary is ſo fixed, as to require a greater Heat for it's Evaporation than that which keeps Lead in Fuſion; and the *Phlogiſtick* Part, notwithſtanding it's Lightneſs, is ſo intimately and firmly connected with the reſt of it's Principles, as to ſuſtain a Degree of Heat equal to that of red hot Iron, during which Heat the Salt ſparkles and emits Flames very bright for a good while, which is very wonderful and agreeable to behold; and this Sparkling being over, it remains red hot in Fuſion, and perfectly tranſparent; and by greater Heat may be vitrified, as will be ſhewn hereafter.

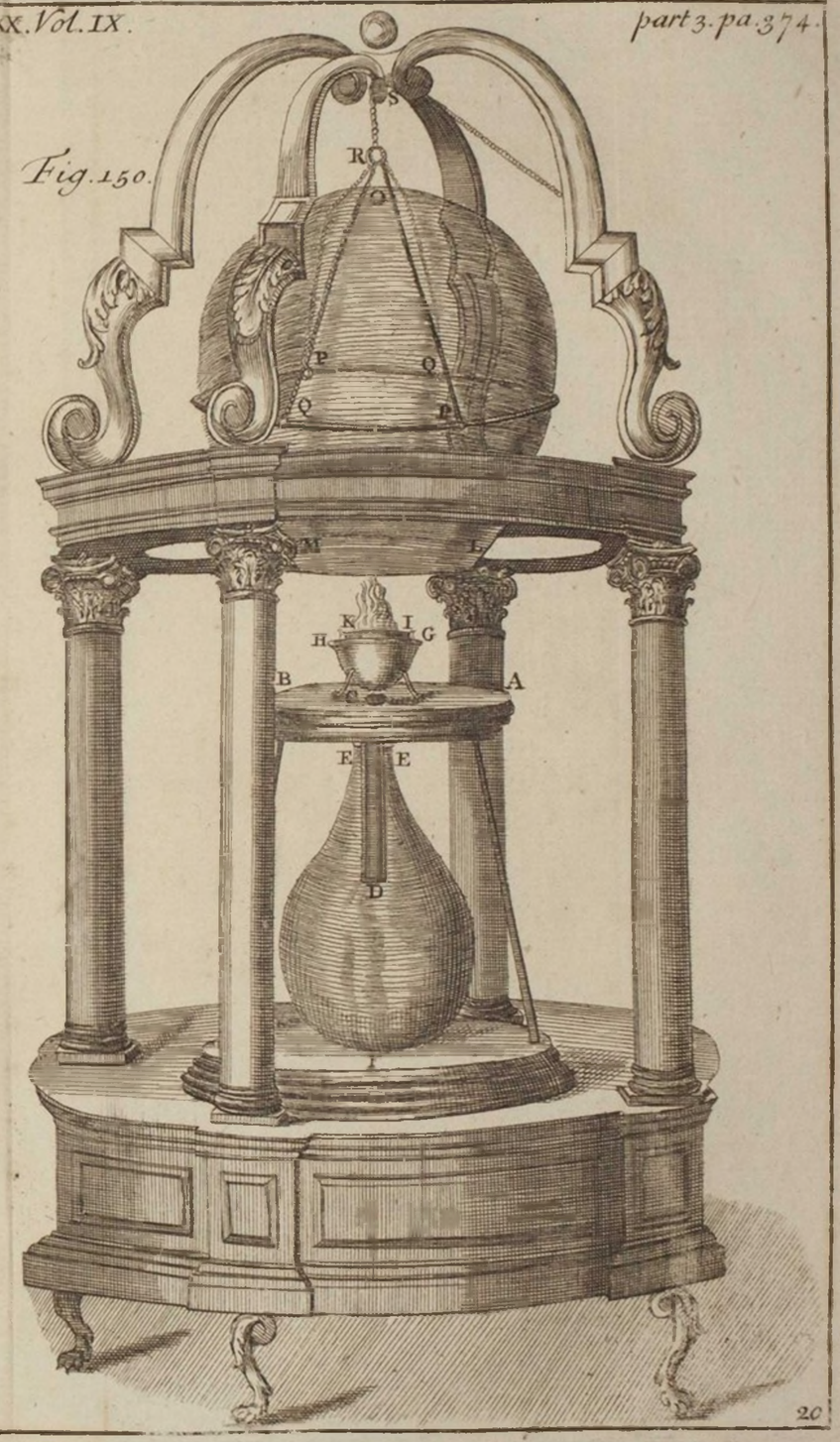
I put the abovementioned *Liquamen* into a Glaſs Retort, which I ſet in a *Baineum Mariæ*, and diſtilled it to a ſtrong Inſpiſſation. It yielded only an inſipid Phlegm, except that towards the laſt it came over a little impregnated with the Acid, but not ſharper upon the Tongue than as if it had been a Mixture of Vinegar ℥ſs with Water ℥iv.

Then removing the Retort with the inſpiſſated Liquor into a Sand-Furnace, I increaſed the Heat gradually, ſo as to make the Sand and Retort thoroughly red hot, till at laſt the Bottom of the Retort was ready to melt; I then left it 'till next Day, when being perfectly cold, I broke the Retort, and found a moſt admirable white Salt at the Bottom, which was ſo united with the Glaſs as not to be ſeparated from it; and ſome was ſpread all over the Retort quite up to the Neck, and, as near as I could gueſs by View, it ſeemed to be as much in Quantity, could I have taken it out to weigh it, as the original *Phoſphorus* from whence it was produced: It's Taſte was very ſharp and ſaline; but notwithſtanding it's great Fixity in having endured a melting Heat for ſeveral Hours, it relented again in a moiſt Air, and in a few Days was entirely reſolved into a *Liquamen*.

The *Phoſphorus*, after it's Deflagration, leaves an almoſt fixed red Earth, or *Caput Mortuum*, behind it, as is mentioned in Dr *Frobenius*'s Experiment. Although one would have imagined that all the inflammable Parts of the *Phoſphorus* had been burnt off in the firſt Deflagration, which ſeemed very violent, yet this red Earth retains ſo much of an unctuous *Phlogiſtic*, that being placed over a red hot Fire, it ſwells up, and keeps in Fuſion a great while, emitting Flames and Flaſhes of Light, ſo long as it is kept upon the Fire; but when cold again, if expoſed to a moiſt Air, it relents and reſolves as the Flowers do: For the

acid

Fig. 150.



acid Salt of the Urine adheres ſo ſtrongly to it, that although it undergoes ſeveral ſtrong Ignitions, it will relent again as often, when ſet in the Air.

I took ſome of the white Salt that ſtuck to the Retort, and in order to try the utmoſt Degree of it's Fixity, I put ſome of it into a Crucible, and gave it a vitrifying Heat, in which it remained ſome Hours, but was not yet run to Glaſs, appearing only like a fixed white Earth as hard as Stone, and ſhining as if it was juſt ready to vitrify; yet it was ſo far fixed, as not to relent any more in the Air; had no ſaline Taſte, nor was diſſolvible in Water. I therefore took another Portion of the ſame Salt of *Phoſphorus*, which I kept a longer Time in the vitrifying Heat, and I found it at laſt run into perfect Glaſs.

Thus we ſee what a wonderful Subject is *Phoſphorus!* And how ſurpriſing is it that ſuch an inflammable Body, conſiſting of the unctuous and acid Parts of the Urine, ſhould thus become Glaſs!

The Concluſion which I muſt now make from this remarkable Experiment is, That here is a perfect Tranſmutation of Bodies; the *Phoſphorus* being tranſmuted into a fine tranſparent Glaſs of a bluiſh green Colour, coming nearer to the Hardneſs of a Diamond than any other Glaſs, and in the ſame Quantity as the *Phoſphorus* at firſt uſed, which, without any Addition, produces this Glaſs Ounce for Ounce. Here I muſt ſtop, having brought theſe wonderful Experiments to a *ne plus ultrà*.

I ſhall add here further, that the crude *Phoſphorus*, without any Deflagration, but only cut very ſmall, or ſcraped fine with a Knife, and laid upon a Glaſs Diſh in moiſt Air, will in about a Week's Time reſolve into a *Liquamen* near eight times it's original Weight: Which *Liquamen* is the ſame in all Reſpects as that which comes from the ſublimed Flowers by Deflagration, and may be vitrified likewiſe. In ſcraping the *Phoſphorus*, take great Care not to do it too haſtily, leſt by heating it, you ſet it on fire.

Reflections on theſe Experiments.

The Chemical *Phoſphorus* being the principal Subject of the foregoing Experiments, I ſhall, upon this Occaſion, give ſome Account of what *Phoſphorus* is, and what it chiefly conſiſts of. It is my Opinion, that *Phoſphorus* does not naturally exiſt in Animals by itſelf; but when formed out of Urine, by the Means of Putrefaction and Fire, it's principal Contexture is found to conſiſt of a ſubtile Acid concentrated by the Salt of Urine, and of a fat depurated Oil.

Phoſphorus affords us ſo many and wonderful *Phænomena*, that to explain them all would take up a large Treatiſe.

The *Phlogiſtic* Part is ſo ſlightly connected with the other Principles, that the leaſt Motion, Friction, or Warmth, ſets it on fire.

The fixed Part ſeems to conſiſt chiefly in the acid Salt of the Urine, which is at firſt ſo intimately concentrated with the *Phlogiſtic* Part, as in Deflagration to be hurried up or ſublimed along with it; yet being by this Operation freed from it, it becomes fixed, and can by no Degree of Heat be again ſublimed.

Phoſpho-

Phoſphorus may be called an urinous Soap, as it conſiſts of the ſaline and oleaginous Parts of the Urine: But *Phoſphorus* is not to be got in ſo great Plenty out of Urine alone, as when the *Fæces Alvinæ* are elixirated along with it, and then brought to a *Magma* fit for Diſtillation: Nor is there ſo great a Quantity of *Phoſphorus* in the Urine of other Animals, as of Men; nor is it to be got from any Natural Productions, or any Parts of Animals or Vegetables in their crude State, before they have undergone Concoction in the Stomach of an Animal. How far therefore the *Liquor Gaſtricus*, the *Bile*, and *Succus Pancreaticus* may contribute to the Formation of it, is a Diſquiſition I ſhall not here enter upon, but leave it to the Enquiry of Phyſicians.

In regard of the Parts whereof *Phoſphorus* conſiſts, it may be conſidered as the Soot of a deflagrated Oil; and ſo may every combuſtible Subſtance be looked upon as a Kind of *Phoſphorus*, as conſiſting of inflammable Materials.

Phoſphorus is more immediately compounded of a Salt tending to the Nature of *Sal Ammoniac*, of an urinous Salt, of an Acid, and an oily *Phlogiſton*, with a ſubtile Earth; by the Means of theſe Salts exiſting in the Urine, the *Fæces Alvinæ* are the better elixirated, and thoſe Particles extracted which contribute to the forming the *Phoſphorus*. Concerning the Fixity of the urinous Salt, I have ſaid enough already, ſo ſhall not repeat it here. With theſe Salts are very intimately combined in the *Phoſphorus* oleaginous or fat Particles, which are the proper Materials of that ſubtile *Phlogiſton*, the true *Domuncula Ignis*, and indeed the main Conſtituents of the whole Compound.

As for the Preparation of this wonderful Production, it is done by diſtilling the *Saponaceous Magma* in a cloſe Veſſel, with a reverberatory Fire, much ſtronger than that uſed for the Diſtillation of *Aqua fortis*, or the other Mineral acid Spirits; the reſt of the proper *Encheireſis* belongs only to the Operator to manage *ſecundùm Artem*. When this Operation ſucceeds rightly, there comes forth, Firſt, a thick unctuous Oil. Secondly, a more ſubtile Oil, reſembling the *Oleum Philoſophorum*, which is Olive Oil diſtilled from Brick-duſt. Thirdly, the fixed Acid encloſed in a very ſubtile Acid. Near the End of the Diſtillation comes over that depurated Oil which conſtitutes the inflammable Part of the *Phoſphorus*, which is not raiſed up till the laſt, and that by the Continuance of a very ſtrong Reverberatory Fire.

But an Operator that is not well exerciſed in the Degrees of Fire, and doth not know how and when to take away theſe Oils apart, will have nothing but a volatile Salt, and fetid Oil, and get at laſt only a little unctuous opaque *Phoſphorus*; ſuch as the famous *Kunckel*, Dr *Crafft*, and *Brand* did, as they acknowledge in their Writings; but not our hard tranſparent Glacial *Phoſphorus*. Since *Kunckel* therefore, and his Followers, were never able to make the true ſolid Glacial *Phoſphorus*, it was abſurd for him to write, that he could make it even out of crude indigeſted Things, in their natural State; for either this famous Man

ſpoke

ſpoke too much at large, and had never tried the Experiments, or elſe he muſt deſign to impoſe upon the World: For I can boldly contradict him in this Point from the ſeveral Experiments I have made, but never found any true *Phoſphorus*, except in ſuch Things as had undergone Digeſtion in Animals. And I know myſelf to have been for theſe 40 or 50 Years, that is, ever ſince I left the Laboratory of my Maſter, the Hon. Mr *Boyle*, the only Perſon in *Europe* able to make and produce in any Quantity the true ſolid *Phoſphorus*.

I did not content myſelf to work upon the *urinous Sapo* of Man only, but examined likewiſe the Excrements of other Animals; as for Example, of Horſes, Cows, Sheep, *&c.* and got *Phoſphorus*, but not in ſo great Quantities as from Man; probably, becauſe they feed on nothing but Vegetables. I then examined the Dens of Lions, Tygers, and Bears, making Experiments on their Excrements, and likewiſe on thoſe of Cats and Dogs, which being carnivorous Animals, I obtained more *Phoſphorus* thence than from the other Creatures: My Curioſity led me likewiſe to the Rat-Neſts, and Mouſe-Holes, and I had *Phoſphorus* thence. I then addreſſed myſelf to the feathered Tribe, viſiting the Hen-Rooſts, and Pigeon-Houſes, and got ſome ſmall Matters thence alſo: I emptied the Guts of Fiſh in order to get their Excrements, and had a little *Phoſphorus* from theſe, but none from the Fiſhes by themſelves.

I was next induced by *Kunckel*'s Aſſertion, to try what I could obtain out of crude Vegetables, *viz.* Corn and other Fruit: I thought that Putrefaction would bring them the nigheſt to an *Ammoniac* and urinous State, becauſe of the Heat that is produced in them by it; but my Labour was all in vain. After theſe Experiments, I took in Hand Foſſils and Minerals: I began with the common Foſſil Coal, thinking that the *Phlogiſton* in this bituminous Subſtance might have been to my Purpoſe; but I found nothing therein like *Phoſphorus*, there coming over only a bituminous Oil, and at laſt, by increaſing the Fire to the higheſt Degree, there ſublimed ſome white talcly Flowers, which were neither Sulphureous, nor Acid, nor Alcalick, but inſipid like Talc; ſo I gave up all further Experiments upon other Minerals.

I have often wiſhed for a ſufficient Quantity of the Flies which ſhine in the Dark, whereof there are great Numbers in *Italy*, eſpecially in *Tuſcany*; or of our common Glow-Worms, which ſeem to have *Phoſphorus* lodged in their Bodies.

Our *Phoſphorus* is a Subject that occupies much the Thoughts and Fancies of ſome Alchymiſts, who work on microcoſmical Subſtances; and out of it they promiſe themſelves golden Mountains. Of this Number was the famous Dr *Dickinſon*, Phyſician to King *Charles* II: He toiled and laboured many Years in Experiments upon the *Stercus humanum*; and hath ſeveral Times, with the greateſt Pleaſure, ſhewed me *Metallic Regulus's*, he had extracted from it. This is what I have often done myſelf, and no Wonder! for we take in daily with our

Food, and ſometimes in Medicines, both Mineral and Metallick Subſtances, beſides what metallick Veſſels, Kettles, Pots, and Diſhes, furniſh: We ſee a Solution of the Metal upon a Knife after cutting any acid Fruit, by the black Spots it hath upon it, and the metallick Taſte it communicates to the Thing it cuts.

Dr *Liſter* hath ſhewn, that Stones out of the human Bladder being calcined, Iron may be extracted from them by a Loadſtone: And the great *Boerhaave* hath made it evident, by various Experiments, that there is ſcarce any terreſtrial Subſtance either in Men, Brutes, or Plants, which after Uſtion doth not exhibit ſome metallick Particles. Dr *Becher* ſaith, that out of Brick-Earth, mixed with any Fat or Oil, and calcined in the Fire, he hath produced Iron: For it is only the Iron that cauſes the Redneſs of the Bricks, and can be extracted from them again. Moreover, Metals are diſſolved by the Salts and Moiſture in the Earth, and ſo mix with the nutritious Juices of Vegetables; hence it may, in ſome Reſpects, be ſaid, that we eat Metals with the greateſt Part of our Food.

Having given the foregoing ſhort Account of the Production of *Phoſphorus*, I ſhall here ſubjoin, that there is produced out of the *Reſiduum*, after the *Phoſphorus* is made, a particular Salt, which I name *Sal Phoſphori*, or Salt of *Phoſphorus*. This Salt is fixed in ſome Degrees of Fire, yet it may be ſublimed in a cloſe Veſſel, which other fixed Salts cannot be, except they ſtill contain ſomewhat Volatile in them; but this Salt hath no ſuch Thing in it, neither is it any Ways alcalick.

How to produce this Salt, remains as much a Secret as the *Phoſphorus* itſelf; for he that cannot produce this Salt, will never be able to make *Phoſphorus*.

There is ſcarce any Body, out of which a Chemical Operator cannot produce Water and Earth, Salts, or an acid Spirit, and an urinous Unctuoſity, in more or leſs Quantity, according to the Nature of the Body; and where there is one of theſe, there is Fire to be demonſtrated, but not without each other's Help. The *Encheireſis* of this would be too long for this Place, I ſhall therefore omit it here.

From our Preparation of *Phoſphorus*, we may reflect upon the *Fuligo*, or Soot of all combuſtible Subſtances; for it is the *Phlogiſton* only that burns and produces Flame; it dwells in ſulphureous Bodies, and unctuous Earths, in Pitch, Roſin, Wax, and Oils, and in the Fat of Animals: But the fineſt exiſts in ardent Spirits, which when brought to that ſurprizing Subtilty, as that Liquor deſcribed by Dr *Frobenius* *, do truly deſerve the Name of *Æther*.

Obſervations on the Phoſporus.

I. From what hath been ſaid, we ſee that the *Saponaceous Magma* of Urine has great Affinity with common Sulphur, being a ſulphureous

* Vol. VII. Part iii. Chap. X. §. vii.

Body;

Body, compoſed of an acid and depurated Oil, joined with a ſmall Proportion of Earth.

II. Our *Phoſphoreal Magma* comes very near *Homberg*'s *Pyrophorus*, which wants only the Salt of Urine in it, in the Room of which Allum is uſed to fix the Sulphur.

III. We may obſerve hence, that urinous Particles exiſt in greater Abundance in Animals; but the *Phlogiſton* abounds moſt in Vegetables, from which is prepared that fine *Æthereal Spirit* ſhewn by Dr *Frobenius*.

IV. We produce the *Phlogiſton* out of fat Subſtances, and from the *Phlogiſton* a *Fuligo*, or Soot, and from the *Fuligo* an urinous Salt.

V. From the corroſive Oil of Sulphur, we have a pure ſubtile Oil, which is intimately combined with it, and is the actual Fire of the *Phoſphorus*, that by barely rubbing, or the leaſt Degree of Heat, is kindled into Flame.

VI. He who knows perfectly the Method of making *Phoſphorus*, can chooſe whether he will ſublime his *Magma* of Urine into *Phoſphorus*, or into Sulphur; for the Difference conſiſts only in the *Encheireſis*.

Abſtracts of the original Papers communicated to the R. S. *by* Sigiſmond Auguſtus Frobenius, *M. D. concerning his* Spiritus Vini Æthereus. *Collected by* C. Mortimer, *M. D. Secr.* R. S. No. 461. p. 864. Aug. &c. 1741.

3. Dr *Frobenius* being dead, and ſome learned Chemiſts at *Paris*, in *Germany*, and in *Italy*, having endeavoured, in various Manners, and with different Contrivances, to make this *Æthereal Spirit*; I thought it would be acceptable to the Curious in *England*, to give them an Abſtract of the three Papers the Doctor communicated to the *Royal Society* concerning his *Spiritus Vini Æthereus*. The firſt he gave in on *Feb.* 19, 1729-30, along with what is printed in Vol. VII. but was deſired by the Author not to be publiſhed at that Time. In this Paper he ſays, you muſt "take of Oil of Vitriol, and the higheſt rectified "Spirit of Wine, equal Parts by Weight, not by Meaſure: That the "Oil of Vitriol was to be poured by little and little into the Spirit of "Wine, becauſe they will grow hot upon mixing; that they ſhould be "ſhaken often, that they may mix thoroughly; then to be digeſted "gently in a Glaſs Retort, and a large Receiver to be applied and luted "on, leſt the ſubtile Spirits ſhould fly away: Then diſtil them in an "*Athanor*, in gentle Digeſtion, for 3 Days; and pour back the diſtilled "Liquor, till the Liquor in the Recipient appears double, or of two "Sorts. Thus far he ſays Sir *I. Newton* was acquainted with the Pro-"ceſs *."

He then proceeds almoſt in the very Words of the late Mr *Godfrey* [*Hanckewitz*] as printed in the *Tranſaction* quoted above.

He concludes, by telling us, that the firſt Part of the Proceſs, till one comes to the Separation of the two Liquors is mentioned by *Caneparius*, in his Book *de Atramentis*, firſt printed at *Venice*, and after-

* So long ago as the Time of *Raymund Lully* this Proceſs was in Uſe: See his *Epiſt. accurtatoria*, p. 327, and *Weidenfeld*'s Secrets of the Adepts, p. 251.

wards at *London*; then by the great Mr *Boyle*; afterwards by Sir *I. Newton*: That Dr *Stahl*, and Professor *Hoffmann*, were the first in *Germany* who knew the first Operation from *Kunckel*; but neither of them brought it to Perfection, or knew the Effects of it *. In *France* M. *Homberg* undertook an Experiment somewhat analogous to this, with Sulphur and Oil.

The second Paper was communicated on the 12th of *February*, 1740-1, in *Latin*, and contains an ample Account of the whole Process, with Improvements and Additions: But as the Author in his third Paper, given in *Feb.* 19, 1740-1, in *English*, says, that that is the truest and most advantageous Process, I shall present it to the Reader as follows, only subjoining the Differences and Additions in the second Paper by Way of Note or Explication.

Take ℔ iv. in Weight of the best Oil of Vitriol, and as much in Weight (not Measure) of the best *Alcohol*, or the highest rectified Spirit of Wine.

1. First, pour the *Alcohol* into a chosen Glass Retort; then pour in, by little and little, ℥j of Oil of Vitriol; then shake the Retort till the two Liquors are thoroughly mixed, when the Retort will begin to grow warm; then pour in more of the Spirit of Vitriol, and shake it again; then the Retort will become very hot. Do not pour in the Spirit of Vitriol too fast, or too much at a Time, lest the Glass Retort, by being heated too suddenly, should burst: You must allow about an Hour's Time for pouring in the Spirit of Vitriol, not pouring in above an Ounce at a Time, and always shaking the Retort, till the whole Quantity of the ponderous mineral Spirit is intimately united with the light inflammable vinous Spirit.

2. In the next Place, examine with your Hand the Heat of the Glass Retort, and have a Furnace ready, with the Sand in the Iron Pot, heated exactly to the same Degree as the Retort has acquired by the Mixture of the two Liquors: Take out some of the Sand, and, having placed your Retort in the Middle of the Iron Pot, put in the hot Sand again round the Retort, and apply a capacious Receiver to it; set it into cold Water, and wrap it over with double Flannel dipped in cold Water.

Raise your Fire gradually †, that the Drops may fall so fast, that you may count 5 or 6 between each, and that, beside this quick Discharge of the Drops, the upper Hemisphere of your Receiver appear al-

* But Baron at *Vienna*, knew the whole Process; and it is said *Frobenius* learned it of him.

† Force it from the Beginning with a pretty strong Fire, that not only the Spirit of Wine be carried over, but the Oil of Vitriol along with it; which will most certainly happen, if a middle Degree of Heat be kept up, between a reverberatory Heat, and the other Degrees of Fire: For the Spirit of Wine being mixed with the vitriolic Acid in equal Weight, but by unequal Measure, the Spirit taking up double the Room of the Oil, does in a wonderful Manner make up the Deficiency of the highest Degree of Heat.

ways

ways filled with a white Miſt or Fumes: Continue this Heat as long as they emit the Scent of true Marjoram *.

As ſoon as the Smell changes to an Acid, ſuffocating one like that of Brimſtone, take out the Fire, and lift the Retort out of the Sand, and change the Receiver; for all that ariſes afterwards is only a mere *Gas* of Brimſtone, and of no Uſe †.

If you do not uſe the greateſt Precaution, the Liquors in the Retort will run over; the Fire muſt ceaſe as ſoon as the æthereal Spirits are gone over; for there remains behind an *Oleum Vini*, which is extracted by the Force of the Acid out of the Spirits, which will ariſe, run over, and often cauſe Exploſions ‖.

The ſecond Day, when your Glaſs is cold, infuſe the Remainder, with half as much *Alcohol* ‡; and diſtil again as before, and you will have the ſame: The third Day again with as much, and proceed as at firſt, it gives it again. Go on as long as you can obtain any (of the æthereal Spirit) till all turns to a *Carbo*: Then ſeparate it, and *alcalize* it with Spirits of *Salt Armoniac* made without Spirits of Wine, till all Effervеſcence ceaſes, and diſtil it once more *è Balneo Mariæ*: So is it ready for Experiments **.

The

* Towards the End, the Scent will more reſemble that of *Arrack*; continue this Heat for about 3 Hours, till the Scent becomes offenſive, and like that of *Gas Sulphuris*.

† At this Time you will ſee black Froth ariſing, which will certainly burſt your Glaſſes, and deſtroy your Work if continued.

‖ The Retort with it's Receiver being removed, ſet them by in a cold Place; and when all are thoroughly cold, ſeparate the Receiver from the Retort: There will be two different Liquors in the Receiver, which pour off through a Glaſs Funnel into a Glaſs Bottle, which ſtop up very carefully.

The Liquor will be of two Sorts; that which ſwims at Top, inflammable, of the Nature τῦ φλογιςῦ; that which ſinks to the Bottom, like *Gas Sulphuris*, a ſulphureous Acid. Separate the one Liquor from the other, by the ſeparating Funnel *(per Tritoreum)*.

‡ I ſuppoſe he means, pour in half as much freſh *Alcohol*, as you did at firſt, that is, two Pounds Weight, to the Liquor remaining in the Retort.

** *N. B.* The above-mentioned Liquors are to be purified from the ſtrong ſmelling Sulphur, and ſuperfluous Acid, which is performed in the following Manner:

Pour the Liquor, which ſwam at Top, into a Phial; drop into it, Drop by Drop ſucceſſively, a ſufficient Quantity of Spirit of *Sal Ammoniac*, prepared either from Salt Ammoniac with Quick-lime, or from Salt Ammoniac and Salt of Tartar, with common Water, and not with Spirit of Wine: Every Operator knows the Quantity, *viz.* continue dropping in of ſuch Spirit upon the Liquor of the *Phlogiſton*, till all Effervеſcence ceaſes, and all the acid Taſte, with the ſulphureous Smell, vaniſhes, being precipitated by the volatile *Alcali* to the Bottom.

3*dly*, Let the whole Liquor be rectified in a freſh Retort by a moſt gentle Heat of a *Balneum Mariæ*, or of an Hand as hot as that of a Perſon in a Fever; and then keep it for Chemical Uſes.

4*thly*, The inferior Liquor is to be purified as well as that which ſwam on the Top, but it muſt be done by Oil of Tartar *per Deliquium*, till all Ebullition entirely ceaſes: By evaporating all the Humidity of this Liquor, you will have a peculiar *Terra foliata Tartari*, which, being reduced into a *Calx*, ſhines in the Crucible like oriental Pearls, or a Peacock's Tail. This Earth has nothing of a pungent Taſte, and is to be eſteemed as a Sheet-Anchor in the moſt ardent Fevers.

N. B.

There are more Products to be got from this Proceſs; as, 1*ſt*, A balſamic Oil. 2*dly*, A *Terra foliata Tartari* of a glittering Nature, not fuſible, as is the common, prepared with Wine-vinegar, and fixed Salt, which is of great Uſe in Medicine: And, 3*dly*, A purple Earth out of the *Caput Mort.*

The Doctor propoſed at ſome ſubſequent Meeting to exhibit four other ſimple *æthereal Spirits*, but of ſaline Origins, equally ſubtile with this æthereal Spirit of Wine.

Soon after this the Doctor died, and never diſcovered any Thing relating to theſe elementary æthereal Liquors; only in a Paper he left in my Hands, he gave theſe few Hints of their Nature.

There are 4 Spheres opened, one of the Earth, one of the Sea, one of the Air, and one of the Heaven.

Whoſoever therefore knows how to extract the *Eſſences* out of Vitriol and Nitre, whoſe Centres are Salt, (and the Surface of the Earth is Salt)

1. Poſſeſſes the Salt of the Earth.

2. The Salt of the Sea is made from the Sphere of the Sea, and common Salt.

3. That of the Air is made of *Sal Ammoniac*, and Salts of Vegetables.

4. The Eſſence of Fire is made ſoon and eaſily from a concentrated Spirit of Wine, or of Vegetables. Thus the 4 genuine Elements of Nature are obtained.

Of Phoſphorus, *by M.* Dufay. No. 451. p. 445. *Dated* Dec. 11, 1737.

VI. We have made at *Paris* with Succeſs the *Phoſphorus* of *Kunckel*, as good and as fine as that of Mr *Godfrey*: We made nine Drams at the firſt Operation.

Of Camphire of Thyme, by Gaſp. Neuman, *M. D. Prof. Chym.* Berlin, *and F. R. S.* No. 431. p. 202. Jan. *&c.* 1734.

VII. 1. Sect. 1. Some Years ago I communicated to the *Royal Society* an Obſervation * which appeared ſingular to me, and happened unexpectedly in the Diſtillation and Separation of the eſſential Oil of Thyme; for when I diſtilled this Oil without any Addition, there appeared a ſolid, dry, cryſtalline, white, tranſparent Body. I ſaid among other Things, that this Subſtance, conſidering it's outward Form and

N. B. This Earth is of diverſe Colours, but it is not the common vulgar *Terra foliata* of Tartar; for it does not flow in the Fire, nor has the ſame Taſte as the common. The common is made by pouring diſtilled Vinegar upon fixed Salt of Tartar, till an entire Saturation is made. The Uſes of this were formerly known, and I know not by what Fate (ſays the Doctor) it is coming into Uſe again now. I thought proper to mention the Difference of theſe Preparations, becauſe I am able, from innumerable Experiments, to demonſtrate a real Diverſity in them. I ſhall ſeem to have dwelt too long upon one Thing, but I hope I ſhall be the leſs blamed, ſince I deſign to ſhew, that there are ſeveral æthereal Liquors beſides this above-deſcribed; for there are not only ſuch (φλογιστικὰ, or) combuſtible Fluids, but there are likewiſe ſaline Liquors, and alſo ſome quite inſipid, being a Mixture of Combuſtibles differently graduated, and extracted by no other Heat unleſs their internal Fire. In a Word, as many Spheres as there are of the Elements, ſo many æthereal, or (if you rather chuſe to call them ſo) aëreal Liquids, *viz.* the Æther of the Earth, of the Water, of the Air, and of the Fire.

* See Vol. VII. Part iii. Chap. X. §. i.

Compo-

Compoſition, could not be taken for any thing but a Species of Camphire: For, as the Chymiſts have hitherto noted, diſtinguiſhed, and denominated both natural and artificial Bodies according to their primary Qualities, I thought it could not be reduced ſo reaſonably or conveniently to any other Subſtance, as to that, which has from all Antiquity been called Camphire. I enlarged this Obſervation of mine with ſuch Circumſtances as I judged neceſſary, and referred it to the Conſideration of every one, that they might inform me and others alſo, who ſhould be curious in this Subject. I perceived ſoon afterwards, that Mr *Browne* *, an experienced Chymiſt, differed from me in Opinion about this Production from Thyme, and the Name aſſigned to it by me; thinking the very contrary, that this dry Body emerging from the diſtilled Oil of Thyme, and propoſed by me for a Species of Camphire, and called therefore *Camphire of Thyme*, is no Camphire, and does not deſerve that Name. Therefore I ſhall deſire Leave to explain my Meaning farther, and then leave it to any impartial Perſon to determine, whether it ought to be called Camphire with me, or Oil with Mr *Browne*.

Mr *Browne* ſays, 1. That this Production from Thyme is not Camphire, but a coagulated or condenſed Oil of Thyme. Sect. 2.

2. He builds upon ſome Experiments, which ſhew a Difference between the *Indian* Officinal Camphire, and my Camphire of Thyme; whence he concludes, that it is not Camphire.

I ſaid in general, in my above-mentioned Obſervation, that I had acquired, from our common Thyme, a true, thick, cryſtalli-form Camphire, agreeing in all it's Qualities, and differing only in Smell. In particular I mentioned, 1. How I obtained this Camphire. 2. Why I took this Subſtance for Camphire. 3. Of what Parts Camphire conſiſts. And, laſtly, that I eſteem this Camphire of Thyme to agree in all it's chief Qualities, except Smell, with common Camphire. Sect. 3.

Mr *Browne* confeſſes, indeed, the Exiſtence of this Production, ſaying he had ſeen ſuch a Thing before, which I do not deny, though, during my 5 Years Stay in *England*, I never ſaw it, or heard of it; ſo he allows the outward Form, and diſputes only the Name, contending, that it ought not to be called Camphire. Sect. 4.

But I was induced to refer this Preparation of Thyme to no other Subſtance than Camphire, by the following Reaſons. Sect. 5.

1. It proceeds from an eſſential Oil.

2. It is a white, tranſparent, cryſtalline, hard, dry, friable, ſtrong-ſmelling Body.

3. It will not by any Means diſſolve in Water.

4. On the contrary it diſſolves eaſily in rectified Spirit of Wine, and Spirit of Nitre.

5. The demonſtrable conſtitutive Parts of this Production of Thyme are the ſame as in common Camphire, though with regard to it's ſpecifical Smell, the Proportion of it's conſtituent Parts, and the native

* *Ibid.* Art. 2.

Place

Place or Climate, there is a notable Difference, and thence various ſubtile Differences about Mixtures and Relations, with other Things, may ariſe.

6. In the laſt Place, a Body thus conſtituted could not have a Name aſſigned to it more convenient than Camphire, of all the natural and artificial *Species*, about which Chymiſtry is concerned; for this Subſtance is neither a volatile nor fixed Salt, nor an Earth, nor a Stone, nor a condenſed Juice, nor a Bitumen, nor a Gum, nor a Reſin, nor a Sulphur, nor Flowers, nor a Precipitate, nor a Sublimate, nor Pitch, nor Wax, nor *Phoſphorus*, nor Glaſs, nor Ice, nor Gravel. Much leſs could I call this hard, dry, cryſtalline Body by the Name of any thing unctuous, and leaſt of all of any thing fat, or oily, or liquid; ſeeing it is neither a Balſam, nor a Liniment, nor a *Coagulum*, nor Butter, nor Oil, nor Fat, nor Spirit, nor Water, Tear, Wine, Liquor, Vinegar, or any thing of that Sort. Thus I have never yet been able to think of any thing more convenient than Camphire, to which I could better compare it, or by the Name of which I could more juſtly expreſs it.

Sect. 6. With regard to theſe, and an Account of the Properties juſt now deſcribed, I was led to call theſe elegant, white, dry, pellucid, ſolid, friable, fragrant Cryſtals, obtained from diſtilled Oil, and diſſolving in rectified Spirit of Wine, and Spirit of Nitre, but not in Water, by the Name of Camphire, and ſo diſtinguiſh it from the common and other *Species*, by the Name of Camphire of Thyme; and I affirmed at the ſame Time, that it agreed with the Officinal *Indian* Camphire in all theſe Properties, though at that Time I made no Mention of all and every Affection, Affinity, Effect, Diſtinction, and Sub-diviſion, eſpecially as I had not then acquired any great Quantity of it, ſufficient to make the neceſſary Experiments, not to mention, that the *European* Vegetables, which ſeem naturally to yield this Camphire-like Subſtance, have hitherto afforded but very little of it. Now who can think that theſe excellent Properties of this Production of our Thyme, which I have briefly enumerated, do not agree with the common Camphire? And how could I have given this Subſtance a more convenient and ſuitable Name than that of Camphire, to aſſign it's proper Character, and at the ſame Time to diſtinguiſh it from all other Bodies now known in the World?

Sect. 7. Mr *Browne* muſt excuſe me, if I cannot give the Name of Oil to ſuch white, pellucid, dry, ſolid Cryſtals, which even ſound when ſhaken together; and though he attempts to guard himſelf by adding the Epithets *coagulated* or *condenſed*, affirming it to be a coagulated and condenſed Oil, yet this is not ſufficient for his Purpoſe, ſince ſuch Oils appear in quite another State, and are found to be quite other Things in Chymiſtry, as I ſhall preſently demonſtrate.

Sect. 8. In the firſt Place, Mr *Browne* affirms, that theſe Cryſtals of Thyme, which I have called Camphire, and do ſtill call ſo, are an Oil; but I

am

am hindered from agreeing with this Gentleman by the following Circumſtances.

Theſe Cryſtals are dry to the Touch, and ſo not ſoft, or unctuous, or fat, but quite cryſtalline and divided, which Properties alone would be ſufficient to reject the Appellation of Oil; for the Nature of Oil is diametrically oppoſite, and the Name of Oil is never applied to ſuch a dry and cryſtalline Subſtance, or juſtly to any thing but what is liquid, fat, or at leaſt of an unctuous Subſtance like Butter.

Secondly, he endeavours to ſupport the Proof of this Character, by adding the Epithet *coagulated*: But I muſt beg Leave to tell him, that this is not ſufficient. Sect. 9.

1. Becauſe in all Chymiſtry the Epithet *coagulated* never can nor ought to be aſcribed to ſuch a Subſtance as is quite dry and cryſtalline, and conſequently neither unctuous nor cryſtalline. On the contrary,

2. It is to be aſcribed only to ſuch Things and Circumſtances, in which it collects ſomething by precipitating itſelf in a Manner, and aſſumes a Conſiſtence like curdled Milk, or *Offa alba Helmontii*, or Rob, or Butter, or Ointment. So long as the Name *Coagulum*, or *coagulated*, is aſcribed to it, it cannot be dry, but muſt either be moiſt and fat, or Reſino-viſcous, or unctuous. And if we ſhould grant, that this Word may or ought to be wreſted to Things of a dry Conſiſtence, though this has not yet been introduced in Chymiſtry, this at leaſt muſt be allowed, that it can never be extended to a pellucid, cryſtalline Body, conſiſting in ſeparate, perſpicuous, dry Pieces, compoſed in Order, appearing like a cryſtalline Salt, and hard even to crackling; and therefore ſuch a Subſtance can never be called a *Coagulum*, or coagulated Oil, which has never yet been received or heard of.

3. All coagulated Oils, as Oil of Aniſe, Rue, Olives, *&c.* if they are ever ſo much coagulated by Cold, never become dry, hard Cryſtals, like vitriolated Tartar, or larger, like Sugar-Candy, or Crackling, or Sounding, but at moſt appear like very thin Leaves, and greaſe the Fingers, being generally of a Conſiſtence like Butter, but never degenerate into ſuch a Hardneſs as to repreſent Camphire.

4. Coagulated Oils, with a ſmall Degree of Heat, grow liquid again, and loſe their State of Coagulation, which is not the Caſe with our Cryſtals, which retain their ſolid Form in Summer as well as in Winter, and even when a gentle Heat is purpoſely applied.

In the third Place, Mr *Browne* uſes the Word *condenſed*, for he calls the Cryſtals a coagulated or *condenſed* Oil. If he had ſaid the Cryſtals are a Body condenſed from Oil, he had not diſſented from what I ſaid in my Obſervation. But when he takes them merely for Oil, I cannot agree with him; for it is one Thing to ſay it is condenſed or ſeparated from Oil, and another to call it a condenſed or coagulated Oil: For this laſt Form of Words expreſſes an entire Oil; but the former ſomething ſeparated, newly produced, proceeding from Oil, and appearing quite otherwiſe than the remaining Oil. That Oil, which ſuffers itſelf Sect. 10.

to be coagulated or condenſed, is ſo only in a hundredth, fiftieth, & twentieth Part; but ſuch an Oil ought to coagulate and condenſe itſelf through and through, if not in the Whole, yet in the greateſt Part of it's Weight. But how comes it, that here in the Oil of Thyme, only a ſmall Weight of theſe elegant Cryſtals is ſeparated, and all the reſt of the Oil ſhews not the leaſt Alteration or Sign of Coagulation or Condenſation, but remains equally in a perfect liquid and oily Conſiſtence? The Subſtance, out of which any Body is formed, is one Thing, and the Body ſo formed is another. In the Subſtance in Queſtion there is Oil at the Beginning, and that a diſtilled, eſſential Oil; but after a new Subſtance is ſeparated from this Oil, which does not agree with the Oil, either as to Touch, Sight, or external Appearance, I cannot perſuade myſelf to take this now clear, tranſparent, white, ſolid, cryſtalline Body, for the former reddiſh, thin, and liquid Oil: Much leſs can I take this Subſtance for a coagulated or condenſed Oil, though it is ſeparated and condenſed, or rather cryſtallized from Oil. But if this Method were to prevail of calling Bodies, ſeparated and prepared from this or that Subject, by the Name of the Subject from which they are ſeparated, wonderful Concluſions and aſtoniſhing Confuſions would ariſe in Chymiſtry; and ſo in Relations and Deſcriptions of artificial Things there would be produced hardly any Thing but an equivocal, obſcure, and uncertain Senſe. If from this Reaſon only Camphire was to obtain the Name of Oil, becauſe it proceeds from Oil, and was to have only the Epithet *coagulated* or *condenſed* added to it, on account of it's Conſiſtence and Figure, and ſo I could at once free myſelf from all Objections, when I might juſtly call the common Spirit drawn from Corn, *liquid Corn*, or *liquid Seed*, *rarefied Barley*, *ſpirituous Wheat*, and ſo on, becauſe it is prepared from thoſe Seeds. Thus I might call Flowers of Antimony, *volatile Antimony*; Spirit of Sulphur, *aqueous Sulphur*; Phoſphorus, *coagulated Urine*; cryſtalline lixivious Salt, *condenſed Aſhes*; and ſo many Subſtances might be denominated with Prolixity.

But if I can expreſs any Subſtance by one characteriſtic Word, why ſhould I avoid that, and make Uſe of two or more, and ſo inſtead of the ſingle Word *Camphire*, uſe *coagulated*, or *condenſed Oil?* It is eaſily underſtood, that when I ſay Camphire, I mean a cryſtalline and condenſed Body; nay, condenſed from Oil, and for the moſt Part conſiſting of oily Parts. Beſides there are different Methods in Chymiſtry, by which a dry Body is obtained from a liquid Subſtance, which ought all to be well diſtinguiſhed, and not called promiſcuouſly coagulated, or condenſed; for there is no ſmall Difference between coagulated and cryſtallized, between congealed, condenſed, inſpiſſated, precipitated, ſublimated, and other ſuch like Methods.

Sect. 12. Theſe are my Reaſons for calling theſe Cryſtals, obtained from Oil of Thyme, *Camphire*, and not *Oil*, or by any other Name. As for Mr *Browne*, and other Gentlemen, they may call them *Oil*, or *volatile Salt*, or whatſoever they pleaſe.

Beſides

Beſides I am neither the firſt nor the only one who has given the Name of Camphire to ſuch a Body obtained from the *European* eſſential Oils. To avoid Prolixity, I ſhall mention only two, whom Mr *Browne* himſelf has quoted. Sect. 12.

1. The learned and famous *Leyden* Profeſſor, Dr *Boerhaave*, in his *Chymiae Inſtitutiones & Experimenta*, ſays, that Camphire "is not only "the Produce of the Camphire-Tree, but that all aromatic Plants may "produce a Camphire *ſui generis*." The ſame Author has farther explained his Mind in his Courſes and Lectures, as to the *European* Oils from which Camphire may be obtained. 2. That learned and experienced *Pariſian* Chymiſt, M. *Geoffrey*, junior, ſays *, that "the Oil "of Turpentine, though rectified with Water, depoſits on the Sides "of the Bottle ſome Cryſtals reſembling the Needles of ſublimed Camphire. I have obſerved the ſame Thing in the Eſſences of Feverfew, "Marjoram, *&c.*" And again, "The Oils of Sage and Roſemary, "for Example, acquire almoſt the ſame Smell when they grow old. "Some even approach to the Smell of Camphire. If I had ſome Sage "Water, which being kept above a Year, had acquired a very ſtrong "Smell of Camphire, ſo that one might have taken it for Water, in "which Camphire had been quenched." But as Mr *Browne* refuſes to accept of the Experiments and Relations of theſe great Men, and ſeems to doubt of them, he will much leſs aſſent to others, from which it has appeared, that Camphire has been obtained not only from various Vegetables of the *Eaſt-Indies*, beſides that which is properly called the Camphire-Tree, as from the Root of the Cinnamon-Tree, from Zedoary, the Mint of *Ceylon*, and from the *Schoenanthus*, Southernwood, Yarrow, Cardamom, Juniper, *&c.* of the ſame Country; but alſo from the Sage, Roſemary, Marjoram, Hyſſop, *&c.* of *Europe*, beſides Thyme: For though Mr *Browne* uſes the following Words, "But I do not re-"member to have ſeen any Thing of this Kind in other Oils, except "the Oil of Thyme, only in the upper Part of Oil of Mace ſome-"thing of a cryſtalline Form ſeems to fluctuate, but what Kind of Sub-"ſtance it is, whether Camphire or not, Time will ſhew." Yet other People have often ſeen and obſerved ſuch a Thing, and ſo it is no Argument, that becauſe Mr *Browne* has not yet ſeen it, therefore no-body elſe ever ſaw it, or no ſuch Thing ever did or can happen, much leſs that every Thing is falſe, which Mr *Browne* has not ſeen, or does not like. He confeſſes indeed, in his Poſtſcript, that Mr *Maud* had ſhewn him ſome Camphire of Marjoram; but becauſe this, as well as the Camphire of Thyme, does not agree in every particular with common Camphire, he does not allow it to be Camphire, but a coagulated Oil.

Mr *Browne* ſeems ſometimes to doubt of his Opinion, that the Camphire of Thyme is a coagulated Oil: For he ſays in one Place, "As "for this *Salt*, or coagulated Oil of Thyme, *&c.*" and in another, Sect. 13.

* Mem. de l'Acad. An. 1721.

" It will not be foreign to the Purpoſe, to add ſome Teſtimonies con-
" cerning coagulated Oils, or *Salts* proceeding from Oils." Hence it appears, that, when he calls the Cryſtals in Queſtion *Salt* or *Oil*, *coagulated Oil*, or Salt proceeding from Oil, he is not certain or uniform in his Opinion, that theſe Cryſtals are nothing but Oil, but thinks, perhaps, that they are as much a Salt as an Oil, though not far from the Beginning of his Treatiſe he denies them the Name of Salt, ſaying, they have hitherto been *improperly* called volatile Salt of Thyme. Theſe doubtful Thoughts about Salt occur not only in the 2 Paſſages quoted above, where the Words *Salt or Oil* may ſeem to have ſlipped from him by Chance, but may be more clearly collected, when he quotes 3 learned Men, *Slare*, *Helmont*, and *Boerhaave*; that the venerable Dr *Slare* called the Camphire of Thyme a volatile Salt, (though he allows that it does not diſſolve in Water, by which Characteriſtic alone it is evidently not a Salt) alſo that a Precipitation of Salt had been obſerved in Oil of Cinnamon, which however could be nothing elſe but Camphire, becauſe he himſelf adds, that this Oil had been diſtilled without any Addition or Art to make it take upon itſelf the Form of Salt. The other Examples quoted from *Helmont* and *Boerhaave*, in Confirmation of this native, volatile Salt, reſembling Camphire, do not ſuit his Purpoſe, for theſe two ſpeak of a quite different and real Salt, an artificial, volatile Salt made of Oil, and a fixed alcaline Salt, as Mr *Browne* himſelf quotes them, and he ought to have conſidered it, for he ſays thus: *Helmont* has ſpoken of a Salt prepared by Art from the ſame Oil: " But when Oil of Cinnamon is mixed with it's alcaline Salt, *&c.*" And thus alſo that Salt or Soap (as Dr *Boerhaave* calls it) alledged by *Boerhaave* from *Homberg*'s Experiment, muſt neceſſarily have been ſome volatile Salt, mixed with ſome naked alcaline Salt, if it was really diſſolvable in Water; but if it put itſelf in the Form of Salt, without any Addition, it was certainly nothing but Camphire, and conſequently was not diſſolvable in Water, nor capable of being mixed with it, whence *Boerhaave* adds, we cannot eaſily imitate the Experiment, that is, if we would obtain volatile Salt diſſolvable in Water, or Soap, without any Addition.

Sect. 14. In my former Obſervation I gave a Definition or Deſcription of the Compoſition of Camphire, or of it's conſtituent Parts, that it conſiſted, 1. of an inflammable and fiery Principle, or rarefied *Phlogiſton*, that is, of a ſubtile, ſulphureous Subſtance, which Principle ſome call ſimply *Sulphur*, in a large Senſe, and others, as *Beccher* and *Stahl*, a ſulphureous, inflammable Earth; a ſecond, igneſcible and phlogiſtic Earth, and commonly in one Word φλογιστὸν, where I uſed theſe Words, *conſtat rarefacto phlogiſto*, or as it is in my Manuſcript, *conſtat* ex *rarefacto phlogiſto*; and I put this Conſtituent in the firſt Place, becauſe, as to Quantity, it conſtitutes the greateſt Part in the Proportion of the Compoſition. Though indeed I might have ſaid inſtead of it, Camphire conſiſts in the firſt Place of Oil, or oily Particles, for this I chiefly intended, but

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in this Place, for certain Reaſons, I would not make Uſe of that Expreſſion, becauſe I gave the Deſcription only in a phyſical Senſe, as to the Principles, for Oil conſiſts of an inflammable Principle, Water, and Earth; and therefore never ſo much as dreamed of any equivocal Explanation, being fully perſuaded, that this chymical Form of ſpeaking, *ex quo quid conſtat*, or *what conſtituent Parts any Thing contains*, was well underſtood by every Body, eſpecially by a Chymiſt. If I am not miſtaken, when the *Engliſh* would render *it conſiſts* into *Latin*, they uſe the Verb *conſtat* before an ablative Caſe, either with or without the Preposition *ex*: And this Way of ſpeaking is commonly to be found in all the Books of Chymiſtry. But Mr *Browne* is pleaſed to explain, not to ſay wreſt theſe three Words *conſtat rarefacto phlogiſto* to another Senſe, as if I had ſaid it was *in igne conſtans*, or that it reſiſted the Fire, which never entered into my Imagination. It appears however from this wrong Interpretation, that Mr *Browne* has not yet read the Works of our great and excellent Chymiſt *Stahl*, and therefore has not a right Underſtanding of the Word φλογιστὸν, which is ſo uſual an Expreſſion with him.

At length I come to conſider the Differences obſerved by Mr *Browne* Sect. 15.
between Camphire of Thyme, and common Camphire, of which he produced ſeveral. Theſe no Doubt induced him to believe and to write publickly, that this cryſtalline Subſtance, obtained from the Oil of Thyme, is not Camphire, becauſe, on being mixed with other Things, it would have a quite different Effect.

For my Part, I do not doubt in the leaſt of the Truth of theſe Obſervations, and readily allow, that if the Camphire of Thyme is to be extended ſo far according to other Relations, and with regard to other Bodies, it will differ notably from common Camphire; and ſo in this Point I ſhall join Hands with Mr *Browne*, without any Contradiction. But I had no Intention of extending it ſo far, but only thought of the principal and moſt obvious Properties, by which common Camphire and Camphire of Thyme are diſtinguiſhed from all other Compounds, being not at all ſollicitous about all the other Differences and particular Qualities; nor, as I ſaid before, could I ſet about farther Inquiries, with ſo ſmall a Quantity as I had obtained.

The Reaſons which induced me to rank the Camphire of Thyme Sect. 16.
with the Officinal Camphire, were the following: 1. The Camphire of Thyme proceeds from an eſſential Oil. 2. It is a ſolid Body. 3. It is friable, though Mr *Browne* denies this Property, which I can demonſtrate in my Cryſtals. 4. It is white. 5. It is clear and tranſparent. 6. It conſiſts of divided Cryſtals. 7. It has the Smell of it's proper Oil. 8. It will not diſſolve in Water. 9. It is eaſily diſſolved in rectified Spirit of Wine. 10. It is diſſolved by Spirit of Nitre, in all which Properties it agrees with the Officinal Camphire.

I ſhould have thought, that it's Agreement in ſo many Circumſtances might have been ſufficient, without any farther Conſideration, to give it the Name of Camphire.

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Sect. 17. I mentioned one general Difference, that there was a much greater Quantity of Camphire than of Oil obtained from the Camphire-Tree, whereas on the contrary the *European* Vegetables afford a great deal of Oil, but very little Camphire; to which I now add, becauſe the *European* Camphires conſiſt of much Oil, and a ſmall Portion of Camphire, and ſo theſe Camphires are much more oily in their Compoſition, even with reſpect to the *Eaſt-Indian* Camphire, ſeeing they are ſuperſaturated with oily Parts, and therefore not ſo firmly united with other Parts, but the Officinal Camphire, in Proportion to it's Ingredients, has fewer oily and more terreſtrial Parts, and all it's conſtituent Parts are better and more firmly mixed; and therefore a notable Difference may eaſily be found between them, in their Mixture with other Liquors, with regard alſo to their Sublimation, Solution with Oil of Vitriol, Exhalation, Precipitation, *&c.* But we are not therefore to conclude, that becauſe the Camphire of Thyme does not agree in every individual Reſpect with common Camphire, it is therefore not a Camphire: For if in Chymiſtry we were to have Regard only to particular, different Relations, and not attend to the more general and obſervable Properties, but to look upon them ſuperficially, and draw our Concluſions from the former, very few Things could be brought together, and many of them would often run into a too prolix and incoherent Judgment.

Sect. 18. I ſhall exemplify what I have ſaid only from Metals and Salts.

Every one knows, that Gold, Silver, Copper, Iron, Tin, and Lead, are eſteemed perfect Metals, and Quickſilver a Semi-metal, or imperfect Metal, becauſe theſe Subſtances poſſeſs the chief Properties of the ſame Thing, which is called *Metal*, and therefore cannot be compared to Stones, Earths, Sulphurs, Bitumens, Salts, or to any Thing elſe in the whole World, except Metals; in like Manner as the Camphire of Thyme, according to the above-mentioned Properties, cannot more eaſily be compared to any Thing than to Camphire. But according to Mr *Browne*'s Way of reaſoning, we muſt not give the Name of *Metal* to all the above-mentioned Bodies, becauſe they do not agree in all Reſpects, and Mixtures with other Things, in Solutions, Precipitations, Sublimations, *&c.*

Suppoſe I take Gold to be a Metal, becauſe it is diſſolved in *Aqua regia*; then I muſt not call Silver a Metal, becauſe it is not diſſolved in *Aqua regia.*

On the other Side, if I take Silver and ſome other Metals to be true Metals, which are diſſolved in *Aqua fortis*, I muſt exclude Gold from being a Metal, becauſe it is not diſſolved in *Aqua fortis.* Spirit of Vitriol diſſolves Iron and Copper, but not Gold or Silver, and therefore theſe two moſt noble Metals will not be looked upon as Metals.

This is juſt ſuch another Argument as Mr *Browne* makes uſe of with regard to the Solubility of Camphire of Thyme, when he ſays, that Oil of Vitriol diſſolves common Camphire, but not Camphire of Thyme, and therefore this Preparation is no Camphire.

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He might form an Objection, with regard to the Differences of Colour, and Consistence in Solutions, for Spirit of Nitre dissolves some Metals with a white Colour, and the Solution appears transparent and clear; but because the Solution of Copper is of a bluish Green, that of Iron of a very dark, reddish Brown, that of Tin not quite transparent, and all these different from the Solution of pure Silver, Quicksilver, *&c.* therefore that, as these appear thick, or at least not transparent, they are not Solutions of Metals, or that the dissolved Substances are not Metals.

For so Mr *Browne* determines with regard to the Solution of Camphire of Thyme in Spirit of Nitre: Because the Solution of Camphire of Thyme has not the same Colour, Consistence, and Transparence as the Solution of common Camphire, therefore Camphire of Thyme is not a Camphire; not considering, that there is a Difference also in the different Solutions of Metals in Spirit of Nitre, and that this Camphire of Thyme, proceeding from a dark, red Oil, super-saturated with oily Parts, must therefore necessarily produce a more dark and thick Solution.

Sect. 19. With regard to Precipitation, or other Relations of these Solutions even by themselves, Mr *Browne* might make many Objections, as there are many more Differences between them than between these 2 Camphires.

With regard to a farther Relation of the Solution of Metals, any one might object: The Solution of Silver, Lead, and Quicksilver in Spirit of Nitre affords true Crystals; on the contrary, the Solution of Iron and Tin in Spirit of Nitre makes none; therefore these last are not Metals, but only the first. The Solution of Quicksilver in the concentrated Acid of common Salt by Sublimation affords a crystalline Salt, which other Metals do not; therefore only Quicksilver is a Metal. Some Metals emit a strong Vapour in Solution, and others not. Some make a Precipitation when they are dissolved, and others not; therefore some only are Metals, excluding the rest.

With regard to Precipitation, no small Number of Differences in the Solutions of Metals might be produced; for sometimes we precipitate the dissolved Metal in Form of a pure metallic *Calx*, at other Times the Precipitation is without the least metallic Splendour. But then who would assert, that the last do not proceed from Metals as well as the first? And yet Mr *Browne*, observing that the Solution of Camphire of Thyme does not precipitate in the same Manner as that of common Camphire, concludes, that it is not a Species of Camphire.

Sect. 20. There are innumerable Differences also in the Copulations, Solutions, Precipitations, Sublimations, and Crystallizations of Salts. How greatly do acid Salts differ from one another? and also when they are joined with an alcaline Salt, either fixt or volatile, and reduced to a neutral State? But if any one was to argue from these Differences among Salts, that one or other of them is not a Salt, that Way of reasoning would hardly be admitted.

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Sect. 21. Now Camphire of Thyme poſſeſſes 9 or 10 principal Properties, which agree with common Camphire, as I have mentioned already; and Mr *Browne* neither can nor dares deny it. And moſt certainly I could not compare this white, ſolid, tranſparent, fragrant, inflammable, cryſtalline Body with any one Thing in the World but Camphire. Thus alſo Lead, Iron, Copper, and Tin, cannot be referred to any Thing ſo properly as to Metals; nor can Vitriol, common Salt, Allum, and Nitre be reduced to any Thing ſo well as to Salts, becauſe they agree with them in their moſt remarkable Properties, and with nothing elſe ſo well. But, according to Mr *Browne's* Way of reaſoning, it might be objected, that Lead, Iron, Copper, and Tin, are not Metals, becauſe they do not endure the Fire like Gold and Silver, but are burnt to a *Calx*, partly evaporate, and differ in Solution, Precipitation, Sublimation, *&c.* that Vitriol, common Salt, Allum, and Nitre are not Salts, becauſe they greatly differ from a pure, acid, or alcaline Salt, or a ſublimable, ammoniacal Salt, and ſo on the contrary. I believe Mr *Browne* himſelf would have no Doubt in this Caſe. But if he knows, and firmly believes, that the 4 above-mentioned mineral Subſtances are Metals, though they differ much from Gold and Silver; and that thoſe ſaline Subſtances are true Salts, though they are neither pure, acid, nor alcaline Salts, and differ very much from many other Salts, and from one another alſo; why then does he introduce a new Way of judging in the vegetable Kingdom, and refuſe to acknowledge the Camphire of Thyme to be a Species of Camphire, becauſe of ſome Differences between it and the common Camphire, though it agrees with it in it's principal Properties, as the above-mentioned Metals and Salts do with the other Metals, and the other Salts.

Sect. 22. By Way of Concluſion I repeat once more,

1. That whatſoever deſerves the Name of Oil, ought to be either liquid, or at leaſt unctuous and fat to the Touch.

2. That when any Thing is eſteemed to be a coagulated or condenſed Oil, it muſt neceſſarily be thick, and not liquid, or at moſt of the Conſiſtence of an Ointment or Suet, and that only in the Cold; and then it muſt not greaſe the Fingers, and upon the Application of the leaſt Heat, muſt loſe it's coagulated Form again.

3. But as ſoon as I obtain dry, ſolid, and tranſparent Cryſtals, in Form of fine, clear, cryſtallized, vitriolated Tartar, though they proceeded from Oil; nay, though the Body, which afforded them, conſiſted chiefly of oily Parts, yet the Title of Oil ceaſes immediately, and it can no longer retain the Title of coagulated or condenſed Oil; nor is it neceſſary to make uſe of ſuch Appellations, for if ſuch a cryſtalline Production from eſſential Oil appears to be a dry Body, as we ſee the Subſtance in Queſtion is, the ſingle Word *Camphire* is then ſufficient, and ſo beſt of all expreſſes what Sort of a compound it is, and that it is nothing but a Species of Camphire; and thus our Cryſtal-like Body is CAMPHIRE OF THYME.

Berlin, March 5, 1731.

2. I freely acknowledge, that, in my ſecond Diſſertation concerning *Campbire of Thyme*, I did not intend to affirm any Thing more, than that the Subſtance, which appears in hard Cryſtals, not diſſolvable in Water, obtained from Oil of Thyme, and ſome other eſſential Oils, is not any volatile Salt, much leſs a coagulated Oil, but a particular Subſtance, ſeparated and concreted from thoſe Oils, and, in a few Words, a Body of ſuch a Nature, that I cannot give it a more convenient Name than that of CAMPHIRE.

Extract of a Letter from the ſame Author to the Preſident of the R. S. *Dated* Ap. 11, 1733. *Ibid.* p. 231.

VIII. It is a *Tartarum ſolubile*, compoſed of Cream, or Cryſtals of *Tartar*; and the fixed Salt of the *Kali* of *Alicante* well depurated. This Salt is very ſingular; for though it be a fixed *Alcaline* Salt, it has the peculiar Property of cryſtallizing; nor does it eaſily diſſolve in the open Air, as other fixed Salts do; but, on the contrary, it calcines therein, like *Vitriols* or *Glauber*'s Salt. Another peculiar Property, which I have obſerved to belong to it, is, that if it be ſatiated with a *vitriolick* Acid, and the Liquor be evaporated, there reſults a Salt that has the Form of *Glauber*'s Salt, and all the Properties requiſite to make M. *Seignette*'s Salt. In order to which,

Concerning Mr Seignette's Sal Polychreſtus Rupellenſis, *and ſome other Chemical Salts. By M.* Geoffroy, *Chemiſt, Member of the* R. Acad. *of Sciences at* Paris, *& F R.S. Dated* Pari, May 4, 1732. No. 436. p. 37. Jan. *&c.* 1735.

Take of the Salt of *Kali*, well purified, 1 ℔. diſſolve it in Water, add thereto of *Cryſtals of Tartar* about 1 ℔. ſ ß; boil the whole in order to diſſolve the *Cryſtals of Tartar*: But the exact Proportion of *Cryſtals of Tartar* can be no more determined in this Operation, than in making the *Tartarum ſolubile*; either becauſe the Salt of *Kali* has retained more or leſs Humidity in it's Cryſtallization, or becauſe the *Tartar* has more or leſs Impurities in it. But if there be too much *Tartar* in the alcaline Liquor, after the Fermentation is over, filtrate the Liquor, and as it cools, the ſuperfluous *Tartar* will fall to the Bottom. After the Separation of the *Tartar* from the Liquor, evaporate the *Lixivium* by a gentle Heat, ſet it in a cool Place to cryſtallize, and you will have very fine *Cryſtals*. If the Liquor be evaporated a little too much, there will be no *Cryſtals* of Salt formed, but the Liquor will be converted into a hard, tranſparent Maſs, not unlike Glue. But if you diſſolve this Maſs again, you may make it cryſtallize, as upon diſſolving *Seignette*'s Salt.

This Salt purges very well, from one to two Ounces diſſolved in a Quart of Water.

Such is the Diſcovery of this Salt, which has hitherto paſſed for an *Arcanum*.

We have likewiſe his cryſtallized, alcaline Salt, which is the Salt of *Kali*, that diſſolves not in the Air. I am actually at work in perfecting this Salt, in examining that of *Kali*, and comparing it with *Borax*. From this laſt I extract *Glauber*'s Salt, by mixing it with Oil of *Vitriol*. The Mixture of *Borax* ℥iv, with Oil of *Vitriol*, ℥j ℥j upon Sublimation gives me the *Sal ſedativum* deſcribed by M. *Homberg*; and the Reſidue expoſed to a ſtrong Fire affords *Glauber*'s Salt. I have found

out a Method to ſhorten this Operation; for inſtead of ſubliming this Salt, I get it by Cryſtallization in light, foliated *Laminæ*. This Salt, whether ſublimated or cryſtallized, has the Property of diſſolving in Spirit of Wine; and if you ſet this Spirit of Wine on Fire, it's Flame is green. Spirit of Wine has no Effect on *Borax*; the Oil of *Vitriol*, digeſted with Spirit of Wine, communicates no Greenneſs to it's Flame: Therefore it is requiſite that the *Borax* ſhould be united to an Acid, in order to produce this green Flame.

Poſtſcript. I ſend you a Specimen of Salt made of *Cryſtals of Tartar* and Lime Water, which Meſſ. *Groſſe* and *Duhamel*, two Members of our Academy, have prepared; to which I join *Cryſtals* of *Seignette*'s Salt, that M. *Bolduc* and I have made ſeparately.

You will alſo find ſome *Sal ſedativum* made by Cryſtallization, which cryſtallizes in a peculiar Manner. This Operation is performed with ℥iv of *Borax*, and ℥i ℥i of concentrated *Oil of Vitriol*, the moſt fixed and weighty that can be had. The *Borax* is put into a Glaſs Retort, the Oil of *Vitriol* is poured on it, and then half an Ounce of common Water. This Mixture being expoſed to a Fire gradually increaſed, after the Phlegm has paſſed off, and even while it is paſſing, there riſes Flowers, or a volatile Salt in very beautiful, foliated *Laminæ*; ſome of which melt by the Heat of the Fire. After the Operation, the fineſt of theſe Flowers, which are round the Neck of the Retort, are gathered; and thoſe that are grey, are thrown upon the remaining Maſs; which Maſs is diſſolved in Water, filtrated, and evaporated ſlowly. Sometimes, even without Evaporation, the ſhining talcous *Laminæ* are to be ſeen in the Liquor. In 24 Hours the Liquor is poured off theſe *Laminæ*: They are waſhed in fair Water, ſet to drain, and then to dry in a Stove.

If theſe *Cryſtals* do not calcine in the Stove, or in the Sun, it is a Sign there is nothing cryſtallized but the *Sal neutrum*: If they do calcine, it is a Sign that there is ſome *Glauber*'s Salt mixed. And then this Salt muſt be diſſolved again in hot Water, and recryſtallized. No-body before me has thought of extracting this Salt by Cryſtallization: It was always ſublimed hitherto.

An Account of ſome Oil of Saſſafras cryſtallized, by Mr John Maud, *Chemiſt, F. R. S.* No. 450. p. 378. Oct. *&c.* 1738.

IX. A few Days ago, I obſerved ſome eſſential *Oil of Saſſafras*, which had ſtood expoſed to a froſty Night, in an open Veſſel, was changed, 3 Parts out of 4, into very beautiful, tranſparent Cryſtals, 3 or four Inches in Length, ½ an Inch in Thickneſs, and of an hexagonal Form.

Theſe Cryſtals ſubſided in Water, were indiſſoluble in it, inflammable in the Fire, and when expoſed thereto, melted into their priſtine State. Hence it is evident, that they ſtill retain the natural Qualities of an Oil, although they appear under a different Modification of their conſtituent Parts. What is moſt remarkable herein, conſiſts in a *Metamorphoſis* from a fluid to a ſolid Body, of ſuch a particular Figure, and from a yellowiſh Liquor (not unlike *Madera* Wine) to a very pullucid

pellucid Body, like Ice congealed from the moſt tranſparent Water. This ſeems to afford a new Inſtance of Cryſtallization, which being generally accounted for by the Particles of a Fluid, or thoſe of any other Body, ſuſpended by the Fluid, brought nearer by Cold, and at length coming within the Sphere of each other's Attraction, unite together into an immediate Contact. This Oil being one of the heavieſt Oils, and even heavier than Water, is the more likely thus to unite, as it's Parts are nearer together. This may be a Hint to the Curious, to diſcover wherein conſiſts the Difference of Solidity and Fluidity; and likewiſe ſhews how much the Colour of Bodies depends on the mechanical Situation of their Parts.

An Experiment concerning the Spirit of Coals, by the late Rev. John Clayton, *D.D.* No. 452. P. 59. Jan. &c. 1739.

X. Having ſeen a Ditch within 2 Miles from *Wigan* in *Lancaſhire*, wherein the Water would ſeemingly burn like Brandy, the Flame of which was ſo fierce, that ſeveral Strangers have boiled Eggs over it; the People thereabouts indeed affirm, that about 30 Years ago it would have boiled a Piece of Beef; and that whereas much Rain formerly made it burn much fiercer, now after Rain it would ſcarce burn at all. It was after a long-continued Seaſon of Rain that I came to ſee the Place, and make ſome Experiments, and found accordingly, that though a lighted Paper were waved all over the Ditch, the Water would not take Fire. I then hired a Perſon to make a Dam in the Ditch, and fling out the Water, in order to try whether the Steam, which aroſe from the Ditch, would then take Fire, but found it would not. I ſtill, however, purſued my Experiment, and made him dig deeper; and when he had dug about the Depth of half a Yard, we found a ſhelly Coal, and the Candle being then put down into the Hole, the Air catched Fire, and continued burning.

I obſerved that there had formerly been Coal-pits in the ſame Cloſe of Ground; and I then got ſome Coal from one of the Pits neareſt thereunto, which I diſtilled in a Retort in an open Fire. At firſt there came over only *Phlegm*, afterwards a black *Oil*, and then likewiſe a *Spirit* aroſe, which I could no Ways condenſe, but it forced my Lute, or broke my Glaſſes. Once, when it had forced the Lute, coming cloſe thereto, in order to try to repair it, I obſerved that the Spirit which iſſued out caught Fire at the Flame of the Candle, and continued burning with Violence as it iſſued out, in a Stream, which I blew out, and lighted again, alternately, for ſeveral Times. I then had a Mind to try if I could ſave any of this Spirit, in order to which I took a turbinated Receiver, and putting a Candle to the Pipe of the Receiver whilſt the Spirit aroſe, I obſerved that it catched Flame, and continued burning at the End of the Pipe, though you could not diſcern what fed the Flame: I then blew it out, and lighted it again ſeveral Times; after which I fixed a Bladder, ſqueezed and void of Air, to the Pipe of the Receiver. The *Oil* and *Phlegm* deſcended into the Receiver, but the Spirit, ſtill aſcending, blew up the Bladder. I then filled a good many Bladders therewith, and might have filled an inconceivable Num-

ber more; for the Spirit continued to riſe for ſeveral Hours, and filled the Bladders almoſt as faſt as a Man could have blown them with his Mouth; and yet the Quantity of Coals I diſtilled were inconſiderable.

I kept this Spirit in the Bladders a conſiderable Time, and endeavoured ſeveral Ways to condenſe it, but in vain. And when I had a Mind to divert Strangers or Friends, I have frequently taken one of theſe Bladders, and pricking a Hole therein with a Pin, and compreſſing gently the Bladder near the Flame of a Candle till it once took Fire, it would then continue flaming till all the Spirit was compreſſed out of the Bladder; which was the more ſurpriſing, becauſe no one could diſcern any Difference in the Appearance between theſe Bladders, and thoſe which are filled with common Air.

But then I found, that this Spirit muſt be kept in good thick Bladders, as in thoſe of an Ox, or the like; for if I filled Calves Bladders therewith, it would loſe it's Inflammability in 24 Hours, though the Bladder became not relax at all.

A Chemical Experiment by Mr John Maud, *ſerving to illuſtrate the Phænomenon of the inflammable Air ſhewn to the* Royal Society *by Sir* James Lowther, *Bart.* No. 442. p. 282. July, &c. 1736.

XI. It is very well known to every one verſed in Chemical Affairs, that moſt Metals emit great Quantities of ſulphureous Vapours, during the Effervеſcence which they undergo in their Solutions in their reſpective *Menſtrua*, or *Solvents*. Of theſe Fumes Iron emits a great Quantity whilſt it is diſſolving in Oil of Vitriol, which are very inflammable, and not eaſily to be condenſed. Theſe Fumes I collected into a Bladder with the deſired Succeſs, and having produced before the Society two Bladders of this fictitious Air, at the ſame Time that Sir *James Lowther* was pleaſed to make Trial of his, they both exhibited the ſame Phænomena. I ſhall here give a more particular Account of the Preparation made uſe of, which was as follows:

I took ℥ij of Oil of Vitriol and mixt it with ℥viij of common Water, which I put into a Glaſs with a flat Bottom, about ten Inches wide, and three deep, with a long Neck; to this I added ℥ij of Iron Filings: There inſtantly aroſe a great Heat, with a violent Ebullition, and the Iron was wrought upon very faſt, with Fumes copiouſly exhaling. To the End of the Neck of the Glaſs I luted a Bladder void of Air, the Neck of the Bladder being faſtened to a Tobacco-Pipe; the Fumes ariſing from the diſſolving Metal ſoon puffed up the Bladder to it's full Extent, when that being taken away, the Neck of it being firſt tied cloſe with a String, I applied another in the ſame Manner: Thus you may get as many Bladders full as you can, whilſt the Effervеſcence laſts. Two of theſe Bladders were tried before the Society, and exhibited a Flame like thoſe of Sir *James Lowther*, very like in the Smell, though ſomewhat different in the Colour of the Flame. After I had preſſed Part of the Air out of the Bladder, by drawing back the Hand, the Flame was ſucked into the Bladder, and ſet on Fire what inflammable Air remained, all at once; which went off like a Gun, with a great Exploſion.

What

What is worthy of Notice in this Experiment, is, that all the Air which filled the Bladders was as it were generated *de novo* out of the Mixture, or elſe recovered from being locked up in the Body of the Metal in an unelaſtic State.

This Experiment will eaſily explain a very probable Cauſe of Earthquakes, Vulcanos, and all fiery Eruptions out of the Earth; for nothing more is requiſite than an Intervention of Iron with a vitriolic Acid and Water. Now Iron is generally found accompanied with Sulphur: And common Sulphur may be analyſed into an inflammable Oil, and an acid Liquor like Oil of Vitriol. This Acid therefore in the Bowels of the Earth, by being diluted with a little Water, ſurrounds the Iron, and works upon it in the ſame Manner as deſcribed above; an Effervescence and inteſtine Heat ariſes; the Air which comes from the Mixture is rarefied, and becomes very elaſtic, it's *Impetus*, by how much the more compreſſed by the incumbent Weight of Earth, is increaſed even to an unlimited Degree, and at length, like Gunpowder, will remove all Obſtacles, and will exhibit to the Spectators above Ground the terrible Phænomena of Earthquakes and Eruptions. Theſe inflammable Fumes ſometimes, if very much heated, will, as ſoon as they come to the open Air, catch Fire, and ſo produce thoſe fiery Eruptions, of which there are ſo many Inſtances in the World.

The End of the THIRD PART.

THE

THE
Philosophical Tansactions
ABRIDGED.

PART IV.
CONTAINING THE
Historical and *Miscellaneous* PAPERS.

CHAP. I.
HISTORY and *ANTIQUITIES.*

Proposals for the Improvement of the History of Russia, *by publishing, from Time to Time, separate Pieces to serve for a Collection of all Sorts of Memoirs, relating to the Transactions and State*

I. THE History of the Empire of *Russia* and it's Provinces and Territories incorporate, has, 'till now, laboured under such Difficulties, that it almost seems impossible to produce any System of it under 20 or more Years to come. For this Reason the *Academy of Sciences* have lately taken a Resolution, for the Benefit of Lovers of History, to begin a Collection of all Sorts of short Treatises, and authentick Documents relating to the History of that Empire, and to publish it, from Time to Time, in separate Pieces, both in the *Russian* and the *German* Languages. Their Intention in general is the same with what is aimed at in other Countries, by publishing Collections of Pieces of History and

and Records, *viz.* on one Side to gather Materials for a future compleat Hiſtory, and on the other, to animate ſuch Perſons as have already made Collections with this View, to contribute their Part towards the publick Advantage. But their particular View in this Work is to bring to Light, from Time to Time, all that has hitherto remained unknown to foreign Nations about the *Ruſſian* Hiſtory, or has not yet been ſufficiently inquired into, nor cleared up in printed Hiſtories. For this Reaſon we ſhall take the Hiſtory of the *Ruſſian* Empire in it's largeſt Extent, ſo as to comprehend not only the Hiſtory both Civil and Eccleſiaſtical, Learned and Natural, but alſo the Antiquities, Medals, Chronology, Geography, *&c.* of that Empire, not only with reſpect to the *Ruſſian* Nation, particularly and properly ſo called, but alſo with regard to all the other Kingdoms and Provinces ſubject to the *Ruſſian* Sceptre, nay, even to the neighbouring Parts of South *Tartary*. The firſt Part, which will ſpeedily be publiſhed, ſhall ſerve for a Specimen, how far theſe Endeavours will meet with the Approbation of ſkilful Readers. In caſe this is well received, we will go on with others every Month, or thereabouts, ſo as to make up at the End of the Year a ſizable Volume in *Octavo*, the 12th Part of which ſhall conclude with a compleat Table for the whole Volume. Theſe are therefore to deſire ſuch Perſons as are provided with proper Materials for our Deſign, and are inclined to communicate them to the World, in their own Names, or without mention of them if they had rather, to ſend them either in the *Ruſſian*, or any other Language, into the Secretary's Office of the *Academy of Sciences*, in order to which the following Specification will ſhew in what Manner the different Materials may be ranged and publiſhed.

St Peterſbourgh,
Sept. 9, 1732.

of that Nation: Printed at St Peterſburg, *for the Imperial Academy of Sciences. By* Ger. Fred. Muller, *Prof. Hiſt. Petropol. and F. R. S. Tranſlated from the* German, *by Mr* Zolman. No. 429. p. 136. July, *&c.* 1733.

Specification of the Materials, which are to ſerve for the intended Collection.

1. Extracts and Tranſlations of all the Hiſtorical Manuſcripts and Chronicles of *Ruſſia*, as are either already extant, or may hereafter be diſcovered.

As for Inſtance, out of the *Stepennaia Kniga*, the *Chronicon*, or *Synopſis Kiovienſis*, the Chronicle of the Abbot *Theodoſius* of *Kiow*, the Chronicle of *Barlaam Palizin*, ſome anonymous Chronicles, *&c.*

2. Hiſtories of the Lives of the moſt celebrated Sovereigns of *Ruſſia*, of either Sex, carefully gathered from proper Accounts, printed, as well as Manuſcripts.

For Inſtance, the Lives of *Ruric*, *Igor*, *Olga*, *Wladimir the Great*, *Wladimir Monomachus*, *Alexander* of *Neva*, and all the other Czars, Emperors, and Empreſſes, from *Iwan Baſilowitz* the Firſt, to the preſent Time.

3. Genealogical Accounts and Tables, both ancient and modern, of the Family of the great Dukes, Czars, and Emperors of *Ruſſia*.

For

For this I have prepared and drawn up 12 Tables, repreſenting, moſt diſtinctly, the Succeſſion of the ſeveral great Dukes, Czars, and Emperors, from the great Duke *Ruric*, down to the preſent Empreſs, with their ſeveral collateral Branches, as far as there is any Notice to be had of them; Princes who had only Allowances from the Crown; Princeſſes married, or unmarried; as alſo, the intruded Sovereigns, who filled the Throne during the Troubles of ſeveral Interregnums.

4. A Geographical, Chorographical, and Topographical Deſcription of all the Countries, Territories, and Towns ſubject to the Sceptre of *Ruſſia*.

For Inſtance, a compleat Geography of *Livonia*, *Eſthonia*, *Ingria*, and *Carelia*, and afterwards alſo of other Governments and Territories, taking, at the ſame Time, Notice, in a few Words, of the Hiſtory of each City or Town. Alſo, Deſcriptions of particular Cities, and what is remarkable in them, as *Moſcow*, *St Peterſburg*, &c.

5. An Explanation of all the *Ruſſian* Coins and Medals both ancient and modern.

Under this Head ſuccinct Accounts may be given of the diverſe Tranſactions which occaſioned the coining of them; particularly, the Hiſtory of the Arms of *Ruſſia*, deduced from their Coins and Medals.

6. A Deſcription of all Kinds of *Ruſſian* Antiquities, natural Curioſities, *&c.*

For the firſt, the Imperial Cabinet here will furniſh a ſufficient Store; as for Inſtance, Idols of Gold, Copper, and Iron, Ornaments for Dreſs, Veſſels, and other Antiquities, which were from Time to Time found in *Siberia*. On the other Head, an Account of the Mineral Waters at *Olonitz*; the flying Squirrel, the Aſbeſtus, the Mammot, and other natural Curioſities peculiar to *Ruſſia* and *Siberia*, not to be met with in other Countries.

7. All that relates to the Eccleſiaſtical Hiſtory, or can contribute to the illuſtrating of it.

For Inſtance, of the Idolatry of the ancient Inhabitants of *Ruſſia*; of their Converſion to the Chriſtian Religion; of the Endeavours uſed by the Church of *Rome* for uniting with the *Grecian*, and particularly that of *Ruſſia*; of the Succeſſion of the *Ruſſian* Metropolitans and Patriarchs; of Archiepiſcopal and Epiſcopal Sees, of Convents, *&c.*

8. Diverſe

8. Diverſe Tranſactions relating to the Hiſtory of Learning in *Ruſſia.*

Such are, a Hiſtory of the Schools and Academies of *Ruſſia*; of the Uſe of Characters, and the Introduction of the Art of Writing; of the Riſe and Progreſs of Printing in *Ruſſia*; a Liſt of all the Books printed in *Ruſſia* to this Time.

9. Diverſe Particulars and Miſcellaneous Subjects gathered out of various Parts of their Hiſtory.

For Example; the Conqueſts of the Country of *Siberia*, and Kingdoms of *Caſan* and *Aſtracan*; of the Manners and Cuſtoms of the different Nations of *Siberia*; of their ſeveral Languages; of the planting of *America* from *Siberia*; the Hiſtory of the Commerce of *Ruſſia*; of the Tribute anciently paid to *Ruſſia* by the *Livonians*; the Hiſtory and Deſcription of the Globe of *Gottorp*; the Hiſtory of the Navigation by the North-Eaſt Paſſage; particular Advices concerning the Country of *Kamtſchatka*, &c.

10. Extracts of Books and Papers publiſhed here by the Academy of Sciences, as far as they chiefly relate and contribute to the ancient and modern Hiſtory of *Ruſſia*, Civil or Eccleſiaſtical, or of Literature and Nature.

Under this Article will be ranged, among others, ſome Treatiſes of Profeſſor *Bayer*, relating to the ancient Hiſtory and Geography of *Ruſſia*; as likewiſe, Dr *Duvernoy*'s Anatomical Accounts which relate to Natural Hiſtory, with his Deſcription of ſome Monſters produced in *Ruſſia.*

11. Diſcoveries of Errors committed by foreign Authors in the Hiſtory and Geography of *Ruſſia.*

Under this Head the moſt modern Authors will be chiefly taken Notice of, as they are moſt likely to produce new Miſtakes. Accordingly two Treatiſes lie ready on this Subject, the one containing Obſervations on M. *Strahlenberg*'s Northern and Eaſtern Part of *Europe* and *Aſia*, as alſo on his Map; the other on the *Origines Ruſſicæ* of M. *Schottgen*, Rector of the School at *Dreſden.*

12. Diverſe Hiſtorical and Geographical Accounts of the neighbouring *Tartarian* Kingdoms and Countries, with which *Ruſſia* has a conſtant Intercourſe, but are otherwiſe little known.

Such are the *Coſacks*, the *Tartars* of *Crim*, *Dageſtan*, *Nagaya*, *Chiwa*, *Bucharia*, *Calmucks*, *Mongals*, and others; of the Hiſtory of their Government; of the Deſcription of their ſeveral Countries, as to their Situation, Manners, Cuſtoms, Commerce, Religion, Language, Learning, Arts and Sciences, *&c.*

The Collector and Publisher is to be *Gerhard Frederick Muller*, Member of the Imperial *Academy of Sciences* of *Russia*, and of the *Royal Society* of *England*; as also Professor in Ordinary of History: But in his Absence this Work is carried on by his Collegue in the Professorship of History, *Adolphus Bernardus Cramer*.

*An Extract of a Topographical * Account of* Bridgnorth *in the County of* Salop, *communicated to the* Royal Society *by the Rev. Mr* Stackhouse, *Minister of* St Mary Magdalen *in that Town; containing an Account of the Situation, Soil, Air, Births, and Burials of that Place, and of some* Tumuli Sepulchrales *near it.* No. 464. p. 117. *Read* June 3, 1742.

II. *Bridgnorth* † is pleasantly situated upon the River *Severn*, on the West of the ancient Forest of *Morfe*, and was built, according to *Camden*, by *Edelfleda* ‖, Lady of the *Mercians*; but encompassed with a Wall, and fortified by *Robert de Belesme* ‡, Earl of *Shrewsbury*; and afterwards favoured by King *John*, and other Kings, with many and great Privileges granted in their respective Charters. It is governed by two Bailiffs with the Burgesses in Common Hall assembled: The Bailiffs are annually chosen out of 24 Aldermen upon St *Matthew*'s Day, after the following remarkable Manner: The Court being met, the Names of twelve Aldermen (Seniors of those that are there present, and who have not been Callers for three Years before) being separately written upon small Scrolls of Paper, all of the same Size, and rolled up close by the Town-Clerk, are thrown into a large Purse, which being shut, well shaken and tossed by the two Chamberlains, standing upon the Chequer **, is afterwards held open betwixt them before the Bailiffs; whence each Bailiff, according to Seniority, putting in his Hand, takes a Scroll, by which the Callers are fixed, who immediately mounting the Chequer, alternately call the Jury out of such Persons as are Burgesses, and then present in Court, to the Number of fourteen. These being

* Taken from the original Papers of the Rev. Mr *Richard Cornes*, late Minister of the Parish of *St Mary Magdalen* in *Bridgnorth*.

† A softer Pronunciation only of it's old Name *Brugg*, or *Brugg-north*. In a Charter of King *John*, it is called *Bruges*; in another of *Edward* III. *Brugg* and *Brugg-north*; and in a third of King *Charles* I. *Bridgnorth*, alias *Brugg north*, alias *Bruges*. Both *Brugg* and *Bruges* signify a Bridge, or Bridges, and the Termination *North*, whether it be, as some would have it, a Corruption of the Word *Morfe* or not, was, doubtless, added with regard to the Situation of the Place. *N. B. Bruges* in *Flanders* is so called from it's many Bridges, and *Brugg bote* is an old Word for Pontage, or Bridge-toll.

‖ *Edelfleda*, alias *Elfleda*, eldest Daughter of *Alfred the Great*, said by some to be the first absolute Monarch over the *English*. She married *Ethelred*, to whom *Alfred* gave the Government of the City of *London*, which he had then taken from the *Danes*, and the Title of Earl of *Mercia*, an empty Title, till by his Valour he became Master of a great Part of that Province. After his Death, *Elfleda*, being a Princess of great martial Prowess, took upon her the Government of her Husband, and fortified many Towns, to keep the *Danes* out of *Mercia*: Afterwards she carried her Arms, in Conjunction with her Brother King *Edward*, against the *Welsh*, and obliged them to become tributary. About this Time (913) she is said to have built and repaired several Places, as *Stafford*, *Bridgnorth*, &c. See *Rapin* from *Sax. Ann. Hunting. Hoveud.* Vol. I. pag. 38.

‡ *Robert de Belesme*, a Man outrageously cruel to his own Sons and Hostages, whom he castrated with his own Hands, and plucked out their Eyes; but being deserted by the *Welsh*, was seized, and, being convicted of High-Treason, was afterwards imprisoned, others say, banished for Life; and thus suffered condign Punishment for his notorious Wickedness. See *Camden*, *Baker's Chronicle*, &c.

** A large square Table in the Middle of the Court, encompassed with Seats.

all

all ſworn neither to eat or drink, till they, or 12 of them, have made Choice of two fit Perſons (who have not been Bailiffs for 3 Years before) to ſerve the Office of Bailiffs for the Year enſuing, are locked up together, until agreed; which hath often occaſioned very long and tedious Faſtings, even to the Prejudice of their Healths: However, when they are agreed, they make Report of the Perſons they have elected, and they are ſworn into Office upon *Michaelmas-day**.

This Borough, as others, has a Recorder, Town-Clerk, and two Repreſentatives in Parliament.

The Town is divided by a ſtately Stone Bridge † over the *Severn* into 2 unequal Parts; the leſſer Part, that lies upon the Eaſt of the River, is called the low Town, and conſiſts of 2 Streets, one extending from the Bridge to the very Foot of *Morfe*, and goes by the Name of *St John's-ſtreet*, from a religious Houſe there in Times of Popery, dedicated to St *John* the Baptiſt.

The River abounds with divers Sorts of the moſt excellent Fiſh, as *Salmon*, *Pike*, *Shad*, *Trout*, *Greyling*, *Flounders*, *Eels*, *Chub*, *Gudgeon*, and what goes here by the Name of *Samlet*, a ſmall Fiſh ſpotted with Red, not much unlike the *Trout*, only the Spots lie in a more direct Line on it's Sides. It ſeldom exceeds 4 or 5 Inches in Length, and is of a moſt delicious Taſte, but to be taken only at certain Seaſons of the Year: In Summer, when the Water is low, the Fiſher goes bare legged into the Shallows, and, having on a Pair of old Shoes, ſtirs up the Gravel and Sand, ſo as to diſcolour the Water; and thus, by angling there, uſually takes many of them, together with *Gudgeons* and *Blays*; but they are moſtly taken with an artificial Fly.

The Head of this River is on the Mountain *Plymllymon*, in the County of *Montgomery*, whence it flows through this County, that of *Worceſter*, and *Glouceſter*, diffuſing it's vital Moiſture as it paſſes, till it empties itſelf into the *Severn* Sea below the City of *Briſtol*. It is navigable for about 140 Miles, and has a great Number of Veſſels ‖ continually plying upon it.

The Soil in theſe Parts is of a very different Nature: Eaſtward of the River *Severn* lies a fine, dry, ſandy Soil, fit for bearing *Rye*, *Barley*, &c. and is therefore commonly diſtinguiſhed by the Name of the *Rye-land* from the other Parts of the Country, that lie on the Weſt of the River; where the Soil is much upon a moiſt Clay, fit for *Wheat*, *Peaſe*, &c. yet not ſo peculiarly adapted to theſe Sorts of Grain, but

* The Bailiffs for the Time being are Juſtices of the Peace, and Lords of the Manor for the ſaid Town and Liberties, which are extenſive, being one Way 6 or 7 Miles.

† This Bridge has 7 Arches, and formerly had a Draw, Portcullis, and other Engines of Defence: The old Gate-houſe upon it is ſtill ſtanding, and ſeveral other Houſes have been built upon it's Piers.

‖ Moſt of the Veſſels made uſe of upon this River are built here in ſeveral Dock-yards.

that ſeveral lighter Parts of this Quarter oftentimes bear very plentiful Crops of *Barley*, *Oats*, &c.

The common Fields adjoining to the Town bear Grain of all Kinds, one of them being yearly appropriated for Corn; nay, the very Sides of the Rock upon which the Town ſtands, though the Soil there be but ſhallow, yet, when well manured, produces great and very early Crops of *Peaſe*, *Beans*, *Cucumbers*, *Aſparagus*, and all Sorts of Garden-herbs in Perfection.

The high Town lies upon the Weſtern Bank of the River: That riſes gradually to a conſiderable Height. The Aſcent begins from the End of the Bridge, where what is firſt worth Notice, is a Paſſage * for People on Foot, cut deep in the Rock, aſcending with convenient Flights of Steps at proper Diſtances, much reſembling, as Travellers have obſerved, the Aſcent of Mount *Calvary* in *Jeruſalem*. On the South of this Paſſage opens a large Cave † in the Rock, remarkable here for being the Repoſitory of excellent Beer: At the Entrance of this ſtands a Lion rampant, carved in Stone, and within is a large Tun containing above 5 Hogſheads.

The Air of this Place is exceeding healthy, and, for ought I know, may vie even with that of *Montpelier* itſelf. It is certain we have very few conſumptive People amongſt us, ſo that as it is preſervative to the Natives, in all Probability it might be reſtorative to Strangers. However, we have this Convenience from the Variety of Situation ‖, that if the Air in the upper Part of the Town be too fine and ſharp for our Conſtitutions, we may ſoon remove into the lower, where it is much ſofter, and by that Means poſſibly find Relief, and continue till old Age in it's natural Courſe carries us to the Grave. In ſhort, many of the Inhabitants here live to very advanced Years, there being many Inſtances of thoſe that have exceeded an hundred ‡.

* About 160. Yards in Length.

† In Length 33, in Breadth 27 Feet.

‖ Dr *Hollins*, an eminent Phyſician in *Shrewſbury*, Father to the late Dr *Hollins*, Phyſician to his preſent MAJESTY, made it his Obſervation, that when any epidemical Diſtempers were abroad, *Bridgnorth* was ſooner freed from them than any other Place that he knew. The fame hath been ſince confirmed by the Obſervations of Dr *Anthony Weaver*, now an ingenious Phyſician in this Place.

‡. *N. B.* There are three old Hatters now living (1739) in the Pariſh of *St Mary Magdalen*, and bidding fair for an hundred each, whoſe preſent Ages, being computed together, make ſomewhat more than 257 Years.

A Table *of* Births *and* Burials *for* 12 *Years, in the Pariſh of* St Mary Magdalen, *which contains about* 520 *Families*; *and of* St Leonard, *containing about* 550 *Families*; *which, allowing five to each Family, amounts to* 2600 *Inhabitants in the Pariſh of* St Mary, *and to* 2750 *in the Pariſh of* St Leonard; *in all* 5350.

In the Pariſh of *St Mary Magdalen.* Births.	Burials.		In the Pariſh of *St Leonard.* Births.	Burials.
54.	119.	Small-Pox. 1727.	68.	100. Small-Pox.
72.	77.	- - - 1728.	72.	61.
52.	74.	- - - 1729.	54.	78.
65.	78.	- - - 1730.	84.	65.
75.	36.	- - - 1731.	70.	53.
64.	41.	- - - 1732.	47.	49.
70.	46.	- - - 1733.	79.	65.
69.	77.	- - - 1734.	64.	90.
46.	56.	- - - 1735.	72.	57.
60.	32.	- - - 1736.	79.	39.
67.	22.	- - - 1737.	71.	56.
61.	53.	- - - 1738.	62.	65.
755.	711.		822.	778.

Total Increaſe 88.

In *July* 1740, I obſerved upon *Morſe* the *Tumuli*, repreſented in Fig. 1. Fig. 1. where the Soil is a ſtrong Gravel. *Montfauton* in his Antiquities tells us, that the old *Cimbri* * were wont to throw up Heaps of Gravel upon their Graves; and that the more remarkable the Perſons were, the larger were the *Tumuli* over them. I therefore imagined, that this might poſſibly be a Burying-place of the *Danes*, who, I think, 'tis generally owned, were Deſcendants of thoſe People. For Satisfaction, I cauſed the middle and largeſt *Tumulus* to be dug through from North to South (*a a*) ſuppoſing by that Method I muſt croſs the Site of any Body that might have been laid there. We dug about 7 Feet deep, even to the ſolid Rock, without meeting with any Thing remarkable, but an Iron Shell, in Shape of a ſmall Egg, with a round Hole at one End, but ſo cankered and decayed, that it eaſily broke into ſmall Pieces; this we judged to have been the Boſs of a Sword. However, upon viewing the Trench that we had dug, we perceived upon the Weſt Side a Hollow in the Gravel, which, upon Trial, extended horizontally 4 or 5 Feet; and under this Hollow (*b b*) we found one of the large *Vertebræ* of the Loins, with it's Proceſſes pretty perfect, but thoroughly petrified; and, upon further Search, ſeveral Portions of Bones, all alike

* Old Inhabitants of *Denmark*.

petrified,

petrified, but so disguised, that we could not discover to what Part of the Body they belonged. We afterwards opened one of the lesser *Tumuli* (*c t*) and found what is thought to be the *Os Sacrum*, and many other small Pieces of Bones, in a petrified State. It was great Odds that we had found nothing at all; but Nature favoured us, by preserving some few Tokens of Antiquity. During this Search, the People were much alarmed, and flocked to the Place in great Numbers, expecting, I presume, to have seen Wonders; but being disappointed, they soon spread a Report over the Country, that by a Discovery made by some ancient Writings, we dug there for Treasure, by which we were greatly enriched: To prevent the further Concourse of the People, *&c.* we were glad to fill up the Trenches, and leave the other *Tumuli* unexamined.

N. B. The middle *Tumulus* is about 9 Yards in Diameter, and the lesser about 8 Yards each at the Plain.

An Account of a Book presented to the Royal Society, *and intituled*, Notitia Hungariæ novæ Historico-Geographica, *&c.* Auctore Matth. Belio. *By the Rev.* Zachary Pearce, *D.D. F. R. S.* &c. No. 450. p. 398 Oct. *&c.* 1738.

III. The Author of this Work is the Rev. *Matthias Bell*, a Pastor among the *Lutherans* at *Presburg* in *Hungary*. About 12 Years ago he published an Account of what he intended to execute; and by the Encouragement of his present Imperial Majesty, and some of the Nobility, he went on with it, notwithstanding many Difficulties, which (as he tells us) he met with in the Undertaking, and published the first Volume last Year.

This first Volume is to be followed by several others; for the Kingdom of *Hungary* includes 48 Districts or Counties, and this Volume gives an Account of only one of them, and indeed is chiefly taken up with the History of the City of *Presburg* (or *Pisonium*, as he calls it); which, though inferior in other Respects to the City of *Buda*, is the Place where the Emperors (as Kings of *Hungary*) are crowned, where the States of the Kingdom assemble, and the Courts of Justice are held.

This Volume consists of two Parts: The first is general, and gives an Account of the physical and political State of the whole District or County of *Pisonium*, describing it's Soil, Produce, Rivers, the Temperature of it's Air, the Nature of it's Inhabitants; it's ancient Inhabitants, and present ones, it's Nobility, Magistrates, and whatsoever belongs to the Natural and Political History of the District.

The second Part (which is much the largest) is taken up with the Description of the City of *Presburg*; where the Author is very copious and elaborate in setting forth every Thing that relates to it: Particularly it's ancient State under the several Nations who possessed it, and it's present State under the *Austrian* Family; all it's Privileges and Prerogatives, especially of the Inauguration of their Kings, which he describes in all it's Parts, even to a most minute Exactness. He then enters into a Detail of the present State of the City, it's Churches, and other publick Buildings, it's Magistrates, Islands adjoining, and the Country round about it's Walls; leaving to the next Volume the Description of the

four

four other Cities, or principal Towns, which are situated in the same District.

The Work is printed after a most beautiful and expensive Manner, with all the Ornaments of Engravings that may set it off to the best Advantage. There are two different Prospects of the City of *Presburg*, and a Map of the whole District, which seems to be very accurately taken, and is made by *Samuel Mikovinius*, a noble *Hungarian*, and Member of the *Royal Society* of *Berlin*. Every other District is to have a Map of it placed before the Description of it: And the Maps are made in an Astronomico-Geometrical Method, upon a careful Survey of each District; for which laborious Work the States of the Kingdom of *Hungary*, by Order of the Emperor, were pleased to give him all Manner of Encouragement and Assistance: As they have likewise to Mr *Matthias Bell*, the Author of the Description, to which the Maps are prefixed.

Upon the whole, should this Author live long enough (if any Life be long enough) for the finishing of so very extensive a Design, the Libraries of the Learned will receive a great Addition, which may not only gratify their Curiosity, but afford Matter of Improvement in the History of *Hungary*.

IV. M. *Fourmont* is well known to the learned World for some curious Pieces which he has already published, and for very many others in almost all Languages, which he has prepared for the Press, and the Titles of which he has given us in a Catalogue of his Works printed at *Amsterdam* 1731, in 8vo.

An Account by the Rev. Zachary Pearce, *D. D. F. R. S. of a Book intituled,* Reflexions Critiques sur les Histoires des Anciens Peuples, *&c.* No. 456. p. 313. Jan. *&c.* 1740.

This Work of his is intituled, *Reflexions Critiques sur les Histoires des Anciens Peuples*, &c. lately printed at *Paris*, in 2 Vols. in 4to, at the Expence of some *French* Gentlemen of his Acquaintance, as he tells us in the *Advertisement* placed before his *Preface*.

His general Design is to set right the History of the most ancient Nations, particularly the *Chaldeans*, *Hebrews*, *Phœnicians*, *Egyptians*, *Greeks*, &c. down to the Time of *Cyrus*, the Founder of the *Persian* Empire.

The Work consists of three Books.

In the first of which he gives us at Length the famous Fragment of *Sanchoniathon* the *Phœnician*, as translated by *Philo Byblius*, and preserved by *Eusebius* in his *Præparatio Evangelica*, Lib. I. cap. 9.

With this Fragment he has published a *French* Version of it, in which he endeavours to distinguish between the Account given by *Sanchoniathon* the Author, and what he supposes to be the Additions of *Philo* the *Greek* Translator.

After this he examines into the Reasons brought by several of the Learned *for* and *against* the Genuineness of the Fragment, and determines in Favour of it with as much Weight of Argument as the Question will admit. He then takes Notice of a Treatise, written on the same Subject as his own, by our learned Countryman Bishop *Cumberland*;

land; and having examined and declared his Dislike of the Bishop's Scheme in the main, he prepares his Reader to expect full Satisfaction from his own, which makes the Subject of his second Book.

In his second Book, he undertakes to reconcile the Generations of Men set forth in *Sanchoniathon*'s Fragment, with those which are recorded by *Moses* of the Patriarchs before and for some Time after the Flood.

By the Help of *Hebrew*, *Phœnician*, and *Egyptian* Etymologies, he often makes the Names, which at first Sight are almost all quite unlike, to be the same in Sound, or at least in Sense. And by this Application of his Skill in the ancient Languages, he readily finds out a Coincidence between *Moses*'s and *Sanchoniathon*'s earliest Generations.

But his main Work, and what he appears most pleased with, is his Discovery of *Abraham* and his Family among the later Generations recorded by *Sanchoniathon*. Having laid down (upon good Grounds, as he assures us) that *Ouranos* is *Terah*, the Father of *Abraham*, he undertakes to prove, that *Abraham* is the *Cronus* of *Sanchoniathon* and the *Saturnus* of the *Latins*; that *Sarah* (his Wife) is the same with the Goddess *Rhea*; that *Ishmael* (*Abraham*'s Son) is the *Mûth* of *Sanchoniathon*, and the *Dis* or *Pluto* of the *Greeks* and *Romans*: That *Isaac* (*Abraham*'s other Son) is the same with the *Sadid* of *Sanchoniathon*, with *Jupiter* among the *Latins*, and Ζεὺς among the *Greeks*, his Wife *Rebecca* being *Juno*; that *Esau* (*Isaac*'s eldest Son) is *Osiris* and *Bacchus*, and that *Jacob* (the youngest) is *Typhon*. And, in like Manner, he finds a very great Part of the *Grecian* Theology in *Abraham*'s Family.

In the mean while his Readers will, perhaps, make two very material Observations on this extraordinary Discovery of his: The one, that *Cronus*'s Character in *Sanchoniathon*'s Fragment, is the most immoral and tyrannous of any recorded there: And how to reconcile this with the Character given in Scripture to *Abraham*, as *the Friend of God*, the *Father of the Faithful*, &c. is no easy Task: It requires (to be sure) more than a Resemblance of two or three Circumstances, common to *Cronus* and *Abraham*, when their Historians in 50 other Circumstances make their Characters essentially different. The other Consideration which occurs, when we read this Treatise, is, that *Abraham* had ill Luck indeed, if, when he left his native Country because of the Rise of Idolatry there, all the grosser Idolatry of the Heathen Nations after his Time took it's Rise from him and his Family: The very Crime which he took Pains to avoid, he was the accidental Occasion of, if he and his are to be thus placed at the Head of the Heathen Theology.

The Author having finished this remarkable Part of his Work, enters into a very learned Detail of the particular Gods of the several Heathen Nations, who are most celebrated in History; and he has shewn a great Compass of Reading upon this Occasion. Hardly any Writer has been more copious on the Subject, or has given better Hints for clearing up many Passages of sacred and profane Story.

In

In his third Book he has treated at large about the Dynaſties of *Egypt*, and the Shepherd Kings who reigned there: Both of them, perhaps, the darkeſt Spots in the whole Face of Antiquity. He has taken great Pains to fix the Epochs of the Kings of *Sicyon*, *Sidon*, and *Tyre*, of *Arabia*, *Aſſyria*, *Lydia*, of the *Medes* and *Babylonians*; concerning all which he has laid together the moſt remarkable Teſtimonies of the Ancients. At length he comes to his favourite Point, the *Chineſe* Hiſtory, and gives us (as he ſays) a complete Liſt of their Kings, from the Flood down to the preſent Monarch of that Empire, and ſhews that the Chronology of the *Chineſe* may be made pretty nearly conſiſtent with the true Chronology of the *Old Teſtament*.

And for this Part of the Work the Author ſeems well fitted, being ſkilled (as he tells us in his *Preface*) in the learned Characters of that Country, which he has ſtudied for near 20 Years, and has for ſome Time taught in the Royal College at *Paris*; and having compoſed 5 Dictionaries, and a Grammar of that Language, together with a Tranſlation, almoſt entire, of the Geography of *Tamim*, which contains no leſs than the whole Hiſtory of that Empire: On which Occaſion he applies to himſelf, and the Progreſs which he has made in the *Chineſe* Learning, thoſe expreſſive Verſes of *Virgil* in his ſixth Book of the *Æneid*:

——*Pauci, quos æquus amavit*
Jupiter, aut ardens evexit ad æthera virtus,
Diis geniti, potuere.

V. *The Title Page is as follows*: A Deſcription of *Old* and *New Greenland*, or a Natural Hiſtory of *Old Greenland*'s Situation, Air, Habitude, and Circumſtances.

The Beginning and End of the *Old* and *New Norwegian* Colonies. The preſent Inhabitants, their Original, Manners, Living, and Employments.

The Products, as Beaſts, Birds, Fiſh, *&c.* With a new Chart, and ſeveral Copper Plates. By *Hans Egedius*, formerly Miſſionary in *Greenland*, and now Superintendant and Profeſſor in that Language.

It is dedicated to the Prince Royal of *Denmark*, &c. *Imprimatur* Marc Woldike.

An Abſtract of a Natural Hiſtory of Greenland, *by* Hans Egedius, *intituled*, Det gamle Gronlands Perluſtration, eller Naturel-Hiſtorie, af Hans Egede. Kiobenhabn, 1741, 4to. *Communicated by* John Green, *M. D. Secretary of the Gentlemens Society at* Spalding. No. 471. p. 607. *Read* Dec. 8, 1743.

CAP. I. *Situation, Climate, and Soil*, to p. 4.

Greenland lies about 160 *Engliſh* Miles Weſt from *Iceland*, begins at 59° 40′ N. Latitude.

It's Eaſt Side ſtretches to *Spitzbergen* 78 to 80° Lat. and believed to be an Iſland ſeparate from *Greenland*.

It's Weſt Side is known to 70° Lat. If *Greenland* is an Iſland, or joined to other Countries, it is not known for a Certainty, but probably joins to *America* on the N W Side: For between *America* and *Greenland*,

ſtretches the *Fretum*, or Bay, called in the Sea-Charts *Davis's Streights*, which is navigated by them and other Nations on Account of the Whale-fiſhery, but to the Bottom of this Sound no Ship has ever been.

Greenland is a high rocky Country, which is always covered with Ice and Snow, which never thaws except near the Sea. The higheſt Land can be ſeen 80 *Engliſh* Miles from the Sea. The whole Coaſt is fortified with large and ſmall Iſlands. It has ſeveral Firths or Rivers, which run a long Way within Land; amongſt which is *Baal*'s River, where the firſt *Daniſh* Colony was fixed in 1721, which runs 80 Miles within Land. That in all Sea-Charts called *Forbiſher's Streight*, alſo *Baer-Sound*, which are ſaid to make 2 large Iſlands at a Diſtance from the main Land; but, in Reality, I did not find them ſo.

Cap. II. *Colonies and Converſion*, to p. 23.

Greenland was firſt diſcovered by the *Norwegians* and *Icelanders*; and the brave *Raude*, who firſt diſcovered it in 982, praiſed it, and perſuaded ſeveral of his Countrymen to inhabit it; and at the Inſtance of *Oluf Tryggeſon*, firſt Chriſtian King in *Norway*, carried a Prieſt with him, who taught and baptized all the Inhabitants; and from Time to Time *Greenland* multiplied into new Colonies, many Churches and Abbeys were built, Biſhops and other Teachers provided for: But the *Norwegians* were not the firſt Inhabitants; for they found wild People on the Weſt Side, who without Doubt were originally *Americans*. The preſent Inhabitants probably are a Race of the *Schrellingers*. In 1545, *Dithmar Bleſken* reports a Monk, with his Biſhop, ſailed to *Norway*, lived to 45 Years in *Iceland*: And he reports, that a *Dominican* Cloiſter was in *Greenland*, called *St Thomas*. But this is proved falſe by *Arngrim*.

Mogens Heinſon was ſent to find out *Greenland*, and was obliged to return, becauſe his Ship was ſtopped (as he imagined) by magnetical Rocks under Water, although the Wind was favourable; but the real Magnets probably was the Current, which is ſo ſtrong at *Staton Point*, a Ship under full Sail with the faireſt Wind ſails ſlow.

In 1721, a Company of Traders was ſet up in *Bergen*, with a Royal Privilege, when King *Frederic* reſolved to begin a Colony at 64°, wherewith I and my Family went, and continued 15 Years. Our Deſign was to find the Eaſtern Diſtrict, as the beſt: A *Hollander* affirmed ſome of their Ships had been there, and found the Land free from Ice in 62°. This I found to be true in 1736, on paſſing *Staton*, *Huck*, and *Cape Farewel*, near the Land, then free from Ice on the Coaſt, which was not uſual: But as it is ſeldom that Ships can come with Safety to the Eaſt Side, it is moſt convenient with ſmall Boats through the Openings near the Main, where the Current ſetting S W prevents the Ice from fixing.

CAP. III. *Natural Products*, to p. 27.

In the Bay of *Hope* there are many good Places for feeding of Cattle, with proper Ground for Tillage, and good Water: No Trees, except within the Rivers, only Bruſh-wood: Juniper-buſhes abound here, whoſe Berries are the Size of the largeſt Peaſe. There are divers Plants here, as *Angelica*, *Roſemary*, *Scurvy-graſs*; and a Graſs with yellow Flowers, whoſe Root ſmells like Roſes in the Spring.

In 60 and 65°, the Country is beſt, and *Barley* will ripen there: *Turneps* and *Colworts* grow well; eſpecially the firſt, which are large, and of a ſweet Taſte.

There are Rocks which produce *Verdegriſe*, as alſo *Sulphur* or *Brimſtone*, *Marcaſite*; and I found on an Iſland one of a yellow brown Sand, having *Cinnabarine* red Veins. There are whole Mountains of the *Aſbeſtos*. There is found a grey Stone, or Baſtard Marble, of different Colours. The Sea produces ſeveral Sorts of *Conchs* and *Muſſels*, alſo divers Sorts of *Corallines*.

CAP. IV. *Air and Weather*, to p. 32.

The Summer here laſts from *May* to *Sept.* The Cold at 64° is moderate, but at 68, *&c.* extreme, and will freeze Brandy.

The Land is conſtantly covered with Ice and Snow, except near the Sea, and in the Rivers. Although the Summer oft-times is warm in *Greenland*, it ſeldom or never thunders, *&c.* The *Aurora Borealis* is ſo ſtrong here towards new Moon in clear Weather, as you may read by it.

CAP. V. *Beaſts and Birds, Hunting and Fowling*, to p. 36.

Greenland produces *Bears*, which live on the Ice, and are dextrous at catching *Otters*, *Seals*, &c. *Rein Deer* are in great Plenty. *Hares* are very large, good, and white all the Year. There are Plenty of *Foxes*. They have *Dogs*, none of which can bark, only howl.

Their Birds are the *Ryper*, or *Wood-Partridge*, *Ravens*, *Eagles*, *Falcons*, *Sparrows*, *Goldfinches*, &c.

The *Moſquitoes* are very troubleſome in *July* and *Auguſt*.

CAP. VI. *Fiſhes and Amphibious Animals, and Fiſhing; Whales, Narval, or Sea-Unicorn, and Sea-Birds*, to p. 55.

The Sea produces *Whales*, the *Fin-fiſh*, which live on a Kind of *Louſe*, brown-coloured, who moves ſo ſlow, that he may be taken by Hand. This Creature is oily, and, when rubbed with the Fingers, produces *Train*.

There is another Sort of *Whale* in theſe Seas, called *North-Capers*, which feed on *Herrings*; as alſo the *Sword-fiſh*, who is the *Whale*'s greateſt Enemy; and when he kills one, eats nothing but his Tongue, leaving the reſt to the *Shark*, *Walroſs*, and Birds of Prey. In theſe Seas

are *Cachelots*, or *Pot-fiſh*, a Sort of *Whales*, their Length 50 to 70 Feet. The *White-fiſh* are likewiſe in theſe Seas, like a *Whale*, but without Fins on the Back. There is likewiſe a ſmall *Whale* produced here, called *Butts-kops*; as alſo *Unicorns* of the *Whale* Kind, which they call *Narval*: Their Horn, as ſome Authors affirm, are not Teeth, becauſe it's Root is not in the Jaws, but goes a long Way into the Head. The *Niſer*, or *Porpoiſe*, are alſo in theſe Seas; as alſo the *Walroſs*, ſhaped like a *Seal*, but much larger; his Fleſh is like fat Pork: His irreconcilable Enemy is the white *Bear*. There are ſeveral Sizes of *Seals*, but of the ſame Shape, except the *Klap-myſs*, which has a cartilaginous Hood, which covers his Eyes. There are other Fiſh, as *Sharks*, *Holly-butts*, *Red-fiſh*, *Trout*, *Salmon*, *Bull-heads*, *Stone-biters*, *Smelts*, *Whitings*, *Herrings*, and a Fiſh like a *Bream*, with Pricks on it's whole Body. There are *Muſſels*, and ſome large ones that produce the Pearl. Here alſo are *Shrimps*, *Crabs*, &c.

Amongſt the Sea-birds are the *Edder*, *Ducks* of three Kinds; as likewiſe the *Alker*, and the *Tornauviarſuk*, which has beautiful Feathers, and the Size of a *Lark*: There alſo are *Geeſe* here. *Greenland* produces *Maws*, *Redſhanks*, *Cormorants*, *Lunders*, *Parrots*, *Sharvers*, *Terſters*, *Angle-taſters*, *Snipes*, &c.

Cap. VII. *Imployments and Utenſils*, to p. 63.

The Imployments of the *Greenlanders* on Shore, are to ſhoot *Rein-Deer*; and at Sea to catch *Whales*, *Seals*, *Birds*, &c. The Bow is about 6 Feet long, of tough *Fir*, which they bind round with *Deer* Sinews: The Point of the Arrow is pointed with Iron or Bone. All the Sort of Fiſh they catch, and cannot eat freſh, they dry againſt Winter.

The Boats are of two Sorts; one uſed only by the Men, about three Fathom in Length, their Breadth about 19 Inches, with an Hole in the Middle, not larger than one Man, cloſe-laced, can thruſt himſelf into; with theſe Boats they are able to row 72 Miles a Day, uſing only one Oar.

Cap. VIII. *Manners and Habitations*, to p. 66.

Their Houſes are of two Sorts, Winter and Summer: The former are made of Turf and Stone, from 4 to 6 Feet high, flat-rooſed; on one Side are the Windows, made of bleeched *Seal-guts*, *Holly-butt Maws*, ſown together, and are ſufficiently tranſparent: Their Doors are very low, they creep in on their Hands and Knees. Their Summer-houſes are made by raiſing Poles, which they cover with young *Seal-ſkins*.

Cap. IX. *Shape, Conſtitutions, and Tempers*, to p. 68.

The Inhabitants of the Northern Parts are troubled with Dyſenteries, Bloody-fluxes, *&c.* They have ſeldom any contagious Diſtempers: They uſe no Medicines; and, inſtead of Remedies, their Conjurers

jurers mumble over their Bodies ſome ſtrange Jargon. Wounds they ſew up; Cataracts on the Eyes they take off as follows: They inſert a crooked Needle under the Skin, and with a Knife raiſe it up, and draw it off ſafely. When their Children are troubled with Worms, the Mother puts her Tongue up the Fundament to kill them.

CAP. X. XI. and XII. *Of their Cuſtoms, Capacities, Cloathing, Diet, and Cookery*, to p. 77.

CAP. XIII. *Marriages and Education*, to p. 82.

They have riotous Aſſemblies, in which it is reckoned good Breeding, when a Man lends his Wife to a Friend. None come to theſe but married People. The Women eſteem it a Piece of Fortune when they have to do with their Prophet, and the Huſbands pay them for the Honour; eſpecially if they prove with Child, their own Endeavours having been fruitleſs.

The Women, as ſoon as delivered, go immediately about their uſual Work. The Navel-ſtring muſt not be cut by a Knife, but a *Muſſel-ſhell*, or bit off; when dried, it is uſed as a Charm. They hold a Piſs-pot over the Womens Heads whilſt in Labour, thinking it to promote haſty Delivery: They ſeldom bring Twins, but often Monſters.

CAP. XIV. *Manner of burying their Dead, and preſerving their Corpſes under* Tumuli *of Stones.*

CAP. XV. *Games, Poetry, Muſic, and Dancing*, to p. 93.

They have ſeveral Diverſions amongſt them, as Singing, Dancing, in which they challenge one another. They play likewiſe at Foot-ball: Thus, they ſay, the deceaſed Souls play in Heaven with a *Walroſs*'s Head, which is performed when the *Aurora Borealis* appears.

CAP. XVI. and XVII. *Language and Vocabulary*, to p. 105.

At Page 86, the Author preſents his Reader with a *Greenland* Ode, much like *Lapland* Poetry.

Their Language has no Affinity with any known *European* one: Few Words are like the *Old Norwegian*. It is difficult of Pronunciation, as moſt of their Words are Gutturals. It has not the Letters c, d, f, g, x.

CAP. XVIII. and XIX. *Preſent State of Trade in* Greenland, *and of Religion there*, to p. 120.

Their Religion conſiſts in nothing more than ſuperſtitious Ceremonies.

CAP.

CAP. XX. *Astronomy*, to p. 125.

The Sun, Moon, Planets, and other Stars, they imagine had their Beginning from their Forefathers, and were formerly People by a singular Manner taken up to Heaven. They are of Opinion, that when the Moon does not appear, or is dark, it is seeking her Sustenance on the Earth: And they say farther, that it sometimes comes down, and makes Whores of their Women; for which Reason none dare lie on their Backs, before they spit on their Fingers, and stroke it over their Bellies; and young Girls dare not stare at the Moon, for fear of conceiving by her.

CAP. XXI. *Considerations of the Author, for promoting the Success of his Mission, and the Salvation of the* Greenlanders, to the End.

Antiquities of Prussia, *by* J. Theod. Klein, *Sec to the Republick of* Dantzick, *and F. R. S.* No. 457. p. 384. July, *&c.* 1740.

VI. Among the various Monuments of the Utensils, Luxury, or Ornaments of the ancient *Prussians*, which had been buried with them, there are sometimes digged out of the Earth triple Lines of ductile Copper, artfully turned and twisted, representing either a loosened Girdle, consisting of one, two, or three Circles, or else a truncated Cone, rising in a Spire from it's Base, with it's Spires so curiously elastic, that it may be easily pressed down, and will be above four Minutes in resuming it's former Shape. *Helwingius* calls the former *Funiculi metallici*, and judges rightly that they were used for Girdles: The latter he calls *Coronae Sepulchrales*. They are often found in Sepulchres, but very seldom entire.

Fig. 2. One of these, perfect and free from Rust, measuring 6 $\frac{7}{8}$ Rhinland Inches at the Base, was sent to me in 1726, by a very reverend Gentleman, who at the same Time wrote to me his Opinion, that these spiral Cones were formed in Imitation of the brazen Serpent of the *Israelites*, with whom the ancient *Prussians* agreed in many Things with regard to their idolatrous Rites; and that these Images were laid in their Sepulchres by way of Charm; that the Serpents, which the ancient *Prussians* worshipped for Gods, being treated with such Reverence after Death, might not hurt their Bodies.

Without Doubt this learned Gentleman favoured the Opinion of those who derive the Origin of the ancient *Prussians* from the *Israelites*, whom *Salmanassar* carried into Captivity, which Opinion however has been weakened by *Christoph. Hartknoch* *.

But though it is true, that the Pagan *Prussians* worshipped not only the greater *Diostres*, *Perkunus*, *Pikollus*, and *Potrimpus*, and the Sun, Moon, Stars, Groves, Fountains, Elks, Toads, and other Animals, but also Serpents, offering Milk to them, chiefly in hollow Oaks, of a

* Dissert. iii. p. 48. §. v.

vast

vaſt Bigneſs * ; and though I have ſeen myſelf in *Lithuania* ſome Serpents ſo familiar with Children, as to overturn their Porringers of Milk ; and when the Parents have come, upon the crying of the Children, they have done nothing to theſe troubleſome Gueſts but drive them away, as they would their Poultry, from their Children's Victuals: Yet it can no Way be thence inferred, that the ancient *Pruſſians*, in their Copper Spire, had any Regard to the brazen Serpent of *Moſes*, unleſs we would perſuade ourſelves, that they alſo worſhipped Toads and Frogs, and ſeveral Sorts of Inſects, and provided Images of them, with regard to the Plagues of *Egypt*.

Nor is it probable, from their Veneration to Serpents, which perhaps they kept without Numbers in Jarrs, and rendered very familiar to them, that they made Idols of them, much leſs Charms in their Shape, to keep their buried Bodies from Serpents, when it is paſt all Doubt, that the ancient *Pruſſians* did not bury their Dead till after they were burnt, which Cuſtom could not be quite aboliſhed even in the Time of Duke *Albert*, and therefore their Carcaſes could have no Need of Charms againſt the Injuries of Serpents. Beſides, it is well known, that the ancient *Pruſſians* were very rude for many Ages †, not knowing the Uſe of Wool or Iron, much leſs of Veſſels ſerving for Luxury ; but uſing horrible Clubs inſtead of Spears and Swords, and inſtead of Iron Hammers and Wedges, provided themſelves with Stones, which have been a long Time ſhewn for *ceraunia*, though not without ſome Degree of Induſtry. Therefore this Piece of Antiquity ſeems to belong rather to the middle Age of the *Pruſſians*.

But how *Helwingius* came to call this ancient Monument a *Corona Sepulchralis*, I cannot imagine ; for it has not the leaſt Reſemblance of a Crown, unleſs any one will fancy, that the Philoſophy of the *Pruſſians*, on Occaſion of a Funeral, which is ſometimes a very mournful Affair, as Death is the moſt terrible Thing to natural Men, invented ſuch a trembling Spire in the Room of a Crown. But there is not the leaſt Hint in any Author, that the ancient *Pruſſians* carried their Dead to their Funerals, with ſuch Ceremonies as are now in Uſe among us, ſo as to adorn the Coffins of Maids or Bachelors with Crowns: For there is no Mention any where of a ſepulchral Crown being laid in Honour of the Deceaſed, at the Side, or at the Head, or even at the Feet, as the Manner now is, for thoſe who have died in Celibacy.

It will be ſufficient to quote a Summary of the Funeral Rites from our *Hartknoch* ‖ : " When the Deceaſed was to be interred, he was firſt " laid on a Funeral Pile and burnt, and then his beſt Garments were " thrown into the Fire, and his Hounds, Horſes, Arms, and other

* In what Manner and with what Ceremonies the Banquets were prepared for Serpents, ſee *Hartkn.* in *Ant. & Nova Pruſſia*, p. 63. *Conf. Diſſert. ejus* viii.

† See *Henneberger* in *lib. de vet. Pruſſ.* fol. 5.

‖ Diſſert xiii. *de Funeribus vet. Pruſſ.* p. 193, &c.

" Things,

" Things, in which he moſt delighted when alive. —— They caſt in " alſo his Copper Rings and Bracelets, eſpecially if he was a Chriſtian." And a little after from *Eraſmus Stella*: " They buried their Dead in " their Arms and Cloaths, with a great Part of their Furniture." Laſtly from *Jacobus Leodinenſis*: " The *Pruſſians* promiſed, that they " and their Poſterity ſhould not for the future burn or bury their Dead " with Horſes or Slaves, or with Arms or Garments, or with other " Things of Value, or obſerve any other Rites of the *Gentiles*, but " bury their Dead in Cemeteries, according to the Cuſtom of the " Chriſtians."

Theſe Things being duly weighed, we may venture to affirm, that the Monument in Queſtion belonged to the ancient *Pruſſians*, and to ſome of high Rank among them, and that it is nothing but a BRACELET, which the deceaſed Perſon wore either as a Mark of ſome ſingular Service done to his Country, or of his Nobility; or elſe was uſed as a grand Ornament, and was buried with him among other Things, and lay in the Ground till it was now accidentally brought to Light.

This Opinion is confirmed by the learned *Bartholin*, who * gives a Figure of a Bracelet, compoſed of ſeveral Rings connected together, from the *Muſeum* of *Olaus Wormius*, never obſerved by others; and calls it a Monument of ſtupendous Antiquity, worthy of the Memory of Poſterity. If we compare this with our Curioſity, I know not what ſhould hinder us from pronouncing it to be a BRACELET of the ancient *Pruſſians*, and no leſs than *Wormius*'s Bracelet, a Monument of ſtupendous Antiquity, never obſerved by others, and worthy of the Memory of Poſterity.

It is of a looſer Structure than *Wormius*'s Bracelet, ſo that being worn over the Sleeve, it would embrace the Arms both above and below the Elbow. Nor is it to be looked upon as a vulgar Ornament, becauſe it is made of Copper; for I have not heard of any Gold or Silver ones, that have been digged up amongſt us.

Fig. 3, 4. On account of it's Affinity with this Bracelet, I ſhall add a Silver Ring, which was found about a Year ago in a *Pruſſian* Urn, and given me by the Hon. M. *Lilienthal*. It had Threads twiſted together in like Manner, to form the Jewel, the reſt running out into two Ends, not joined, but lying cloſe together, and forming a Circle, ſo that it would fit either a larger or ſmaller Finger.

Concerning a golden Torques found in England, *by Sir* Tho. Moſtyn, *Bart.* No 462. p. 24. *Read* Jan. 28, 1741-2.

VII. It is a Wreath of Gold, weighing, as near as I can judge, 9 oz. I believe it is without Alloy, being very pliable; it anſwers exactly *Virgil*'s Deſcription, *Æn.* V. 558 and 559.

Pars leves humero pharetras: it pectore ſummo
Flexilis obtorti per collum circulus auri.

* In *Schedio de Armillis veterum*, p. 48, 49.

It

It being joined here with the *Pharetra*, and being very proper for carrying a Quiver, inclines me to think, that the *Gauls*, from whom the *Romans* took it, uſed it for that purpoſe; but among the latter it ſeems to have been worn as an Ornament, rather than a thing of Uſe. There are ſeveral Paſſages in the Hiſtorians, which mention it's being given as a Reward for military Service. It is ſometimes deſcribed as a Chain conſiſting of ſeveral Links; but mine is all one Piece, without any Link or Joints, and takes it's Flexibility from the Pareneſs of the Metal.

Deſcription of an Antique Metal Stamp, in the Collection of his Grace CHARLES *Duke of* Richmond, *&c. being one of the Inſtances, how near the* Romans *had arrived to the Art of Printing; with ſome Remarks by* C. Mortimer, *M. D. R. S. Sec.* No. 450. p. 388. Oct. *&c.* 1738.

VIII. Since Arts and Sciences, eſpecially Statuary and Sculpture, were arrived at ſo great Perfection, when the *Roman* Empire was in it's Glory, as the many beautiful Statues, the exquiſite *Intaglia's*, and fine Medals, which Time hath handed down to us, do ſufficiently evince; it is much to be wondered at, that they never hit upon the Method of printing Books.

The Dies they made for their Coins, and their ſtamping them on the Metal, was in reality Printing on Metal; their Seals cut in Cornelians and Agats, and their preſſing them on Dough and ſoft Wax, was another ſort of Printing; and a third ſort was the marking their earthen Veſſels, while the Clay was ſoft, with the Name of the Potter, or the Owner the Veſſel was made for. Theſe being of a larger Size, were properly called *Signa*; the Seals cut in Stone were called *Sigilla*; *Sigillum* being a Diminutive of *Signum*, as *Tigillum* is of *Tignum*: But the later and more barbarous *Latiniſts* have formed the Diminutive of *Signum* into *Signetum*; and if a very ſmall Pocket-Seal, they have called it *Signaculum* *.

Montfaucon in his *Antiquité expliquée*, *Tom.* III. *Partie* 2^de^. *Chap.* 12. gives us the Figures and Deſcriptions of ſeveral of theſe larger *Sigilla* or *Signa*, whereon, he ſaith, the Names were all cut in hollow in capital Letters, *Domini Patronique nomen majuſculis literis* inſculptum, which he expreſſes in *French*, *imprimé en creux*; and he imagines their Uſe to have been to mark earthen Veſſels, particularly thoſe great earthen Jars, wherein the *Romans* uſed to keep their Wines. If any of them had occurred to him with the Letters *exciſæ*, *exſculptæ*, protuberant or ſtanding out, as the Types in our modern way of Printing are made, ſo accurate a Deſcriber of Antiquities could not have paſſed ſuch an one over without having mentioned it, and that the rather becauſe of it's being a greater Rarity: tho' ſeveral Lamps of *Terra cocta* are ſtamped with Letters impreſſed or hollow, from ſuch protuberant Letters as in this Stamp, but the greater Number have the Letters raiſed, or ſtanding out.

You have here the Figure of one of theſe laſt ſort of Stamps, where- Fig. 5, 6.
on the Letters are *exſculptæ* or protuberant, as is likewiſe the Edge or Border round the whole Stamp. This Stamp is made of the true

* See *Joh. Mich. Heinecius de Sigillis. Francof.* 1709. Fol. *p.* 16, *& ſeq.*

ancient Braſs, and is covered over with a green Scale or Coat, ſuch as is uſually ſeen on ancient Medals. It was found in or near *Rome*. On the Back is faſtened a Ring, whereof the Hole is $\frac{2}{10}$ of an *Engliſh* Inch one way, and $\frac{3}{10}$ the other way; the Plate itſelf is two Inches long, wanting $\frac{1}{10}$, and it's Breadth exactly $\frac{11}{10}$ of an Inch: The Sides are parallel to one another, and the Ends are likewiſe parallel to each other, but they are not upon an exact Square with the Sides, varying about one Degree and an half from an exact Rectangle. On the under Side ſtand two Lines or Rows of Letters $\frac{1}{10}$ of an Inch in Height, and well formed *Roman* Capitals: The Faces of them ſtand up all upon an exact Level with one another, and with the Edge or Border of the Stamp; their Protuberance or Height above the Ground is different, the Ground being cut uneven; for cloſe to moſt of the Letters the Ground is cut away only $\frac{2}{10}$, cloſe to ſome near $\frac{3}{10}$, and cloſe to the Edges full $\frac{3}{10}$. The firſt Line contains theſe Letters, CICAECILIN, with a Stop or Leaf to fill up the Line; in the ſecond Line, HERMIAE.SN. Which I judge is to be read *Caii Julii* Cæcili, Hermiæ *Signum*. Who this *Caius Julius Cæcilus* was, I cannot find, he being probably a Man in a private Station, and ſo his Name hath not been handed down to us in any Monuments, but only accidentally in this Stamp. In *Gruter* occur two of the Name of *Hermias*, and ſeveral of the *Cæcilii*, but none with theſe two Names joined together.

The Uſe of this Stamp ſeems to have been for the Signature of the above-mentioned private Man, to ſave him the Trouble of writing his Name, as ſome People have now-a-days. It was certainly uſed on Paper or Membranes, being firſt dipt into Ink, or ſome ſort of Paint, becauſe of the Protuberance of the Letters, the hollow Letters being fitter for ſoft Subſtances, on which they leave the Impreſſion ſtanding up, and conſequently more legible. Another Argument to me, that this Stamp was not to be uſed on any ſoft Subſtance into which it might be preſſed quite down to the Ground, is the Unevenneſs and Roughneſs with which the Ground is finiſhed, which, was it to have made part of the Impreſſion, the Workman would have finiſhed with more Accuracy; but he, knowing that the Surface of the Letters was to perform the whole Work required, was only attentive to finiſh them with that accurate Evenneſs that theſe have.

Mr *Mattaire*, in his *Annales Typographici*, *Hagæ* 1719. in 4^to^. *p.* 4. concludes from the beſt Authors, that our modern Art of Printing was firſt thought of about the Year 1440. A Copy of the Book he mentions, *ib. p.* 13. called *Speculum noſtræ Salutis*, being Pictures of Stories out of the Bible, with Verſes underneath, in *Dutch*, I have ſeen in the *Stad-houſe* at *Harlem*. Each Page was printed from a Block of Wood, like a ſorry wooden Cut; and this was the firſt Eſſay of Printing, which Hint was taken from Engraving, and is what he means *p.* 4. by *Typi fixi*; after which they ſoon improved to uſe ſeparate Types, as we now do, which he terms, *ibid. Typi mobiles*. This Stamp is, in Reality, a ſmall

Frame

Frame of fixt Types, and prints with our modern Printer's Ink, which is only a ſort of black Paint, as readily as any Set of Letters, cut in the rude manner theſe are, can be expected to perform.

We ſee by this Stamp of two Lines, that the very Eſſence of Printing was known to the *Romans*, and they had nothing to do but to have made a Stamp with Lines 3 or 4 times as long, and containing 20 inſtead of 2 Lines, to have formed a Frame of Types that would have printed a whole Page, as well as *Coſter*'s wooden Blocks, which he uſed in printing the *Speculum Salutis*.

In the firſt Volume of a Collection of ſeveral Pieces of Mr *John Toland*, printed *Lond.* 1726. in 8vo. *p.* 297. is a ſmall Tract of his intituled, *Conjectura veroſimilis de prima Typographiæ Inventione*, which is founded upon the following Paſſage in *Cicero*, in *cap.* 20. *Lib.* II. *de Natura Deorum*; where *Balbus* the *Stoic* uſes the following Words in an Argument againſt *Velleius* an *Epicurean*:

Hic ego non mirer eſſe aliquem, qui ſibi perſuadeat, corpora quædam ſolida atque individua vi & gravitate ferri; mundumque effici ornatiſſimum & pulcherrimum, ex eorum concurſione fortuita? Hoc qui exiſtimet fieri potuiſſe, non intelligo cur non idem putet, ſi innumerabiles unius & viginti formæ literarum (vel aureæ vel quales libet) aliquo conjiciantur; poſſe ex his in terram excuſſis annales Ennii, ut deinceps legi poſſint, effici; quod neſcio anne in uno quidem verſu poſſit tantum valere fortuna.

He conjectures that this very Paſſage gave the firſt Hint to the Inventors of Printing about the Year 1445, becauſe they retained even *Cicero*'s Name for their Types, calling them *Formæ Literarum*, and made them of Metal, as he ſays, *aureæ vel quales libet*. Moreover, in *Cap.* 10. *Lib.* III. *de Divinatione*, *Cicero* hath the very Phraſe *imprimere literas*.

Brands for marking Cattle were in Uſe in *Virgil*'s Time, *Georg. Lib.* III. *ver.* 158. where he ſays,

Continuoque notas, & nomina gentis inurunt.

Procopius, in his *Hiſtoria Arcana*, ſays, the Emperor *Juſtinus*, not being able to write his Name, had a thin ſmooth Piece of Board, through which were cut Holes in form of the four Letters IVST. which, laid on the Paper, ſerved to direct the Point of his Pen; which being dipt in red Ink, and put in his Hand, his Hand was guided by another. Poſſibly this may likewiſe have given the Hint to the firſt of our Card-makers, who paint their Cards in the ſame manner, by Plates of Pewter or Copper, or only Paſteboards, with Slits in them in form of the Figures that are to be painted on the Cards.

Concerning two Pigs of Lead, found near Ripley, *with a Roman Inſcription on them, by the Rev. Mr* Kir-

IX. Two Pieces of Lead are now in the Poſſeſſion of Sir *John Ingilby*, Bart. of this Place, which were found, in *January* laſt, on *Hayſhaw-Moore*, 2 Miles S. of *Patley-Bridge*, a ſmall Market-Town in this Neighbourhood, by a Countryman, whoſe Horſe's Foot ſlipping into a Hole covered with Ling, he diſmounted, and thruſting his Stick into the Hole, perceived ſomething hard, and of the Sound of Metal; and, by

Shaw. No. 459. p. 560. Jan. &c. 1741. *dated* Ripley *near* Burrowbridge, *Dec.* 15. 1735 Fig. 7.

by digging, found theſe 2 Pieces of Lead, ſtanding upright, and near each other, about 2 Foot under-ground. They are of the ſame Shape and Dimenſions, and have the ſame Inſcription. One of them weighs 11 Stone, the other 11 Stone and one Pound. The Draught is as juſt a one, as any Perſon I could meet with in the Country, and at this Time of Year, could take. The Inſcription is ſuch as is upon the Leads, to a great Exactneſs, inſomuch that every Irregularity of the Letters is noted: Only it may not be amiſs to add, that the Letters are raiſed, and very bold. There have been 4 other Letters on the Side of each of them, whereabouts I have made the Four Dots in the Draught, but they are grown ſo obſcure, that I cannot diſcover them with any Certainty. ——— They ſeem to have been B. N. I. G. . . . The great *Roman* Cauſeway leading from *Aldborough*, in this Neighbourhood, into *Lancaſhire*, paſſes within a little Way of the Place where the Leads were found. There have been no Lead-Mines, as far as can be known, within ſome Miles of it: But a Countryman informs me of a large Rock, about ½ a Mile from it, on the Top of which there is an Impreſſion ſimilar to either of the Leads, only ſo much larger as to admit of a Pan, wherein they might be ſmelted, if in ſo early Time they knew the Modern Art of ſmelting by the Air. As yet, I have not had an Opportunity of viewing this Rock; ſo that this I have only from hearſay, though I believe it is credible enough.

Camden mentions 20 Pieces of Lead of this Kind, found in *Cheſhire*, Part of them with this Inſcription, IMP. DOMIT. AUG. GER. DE. CEANG. . . . . *Camden*'s *Britan.* Fol. Edit. p. 679. ——And moreover, that among the Duke of *Parma*'s Medals, publiſhed by *Paolo Pedruſi*, I do not find any ſtruck in the ſeventh Conſulate of *Domitian*, but what have the Addition of *Divi Filius*, or the like. That Author too ſays, that the firſt Year of *Domitian*'s being Emperor was the eighth of his Conſulate; neither of which agree with the Inſcription on the Leads. ——

The Dimenſions of the Piece of Lead. Fig. 7.

From *a* to *b.* ———	21	Inches.
d to *e.* ———	2	½.
a to *c.* ———	3	½.
e to *f.* ———	5	½.
Perpendicular Depth	4.	

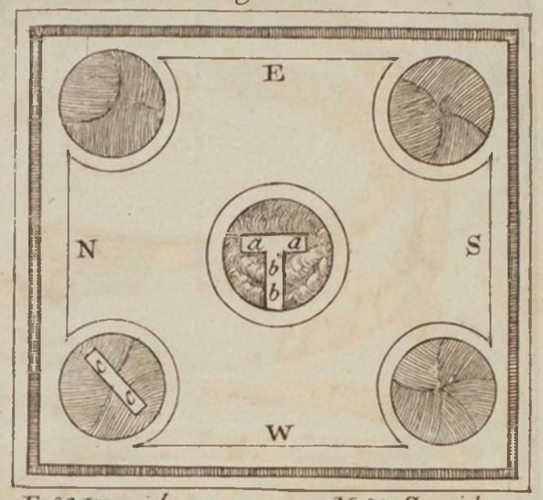
Concerning an Ancient Date found at Widgel Hall *in* Hertfordſhire, *by Mr* John Cope. No. 439. p. 119. Oct. &c. 1735. Fig. 8.

X. 1. I ſend you a Draught of an ancient Chimney-piece (as I was informed it was) found on pulling down Part of *Widgel-Hall* in *Hertfordſhire*: There is cut upon it a Date expreſſed Part in *Roman* Numerals, Part in *Indian* Figures; which is the earlieſt Inſtance I have met with of the *Indian* Figures being uſed here in *England*, viz. ℳ. 16. or 1016. that at *Colcheſter* being in the Year 1090. The Carving is very fair, the Letter ℳ and Figures project out above a quarter of an Inch. The whole Chimney-piece is of *Engliſh* Oak Plank, and is now very firm, though 718 Years old, and was never painted over; it is

4 Feet

Pla. I *Vol. IX part IV. pa. 420.*

Fig. 1.



E. & W. sides 36 Yds long.

N. & S. sides 33 Yds long.

Fig. 2.

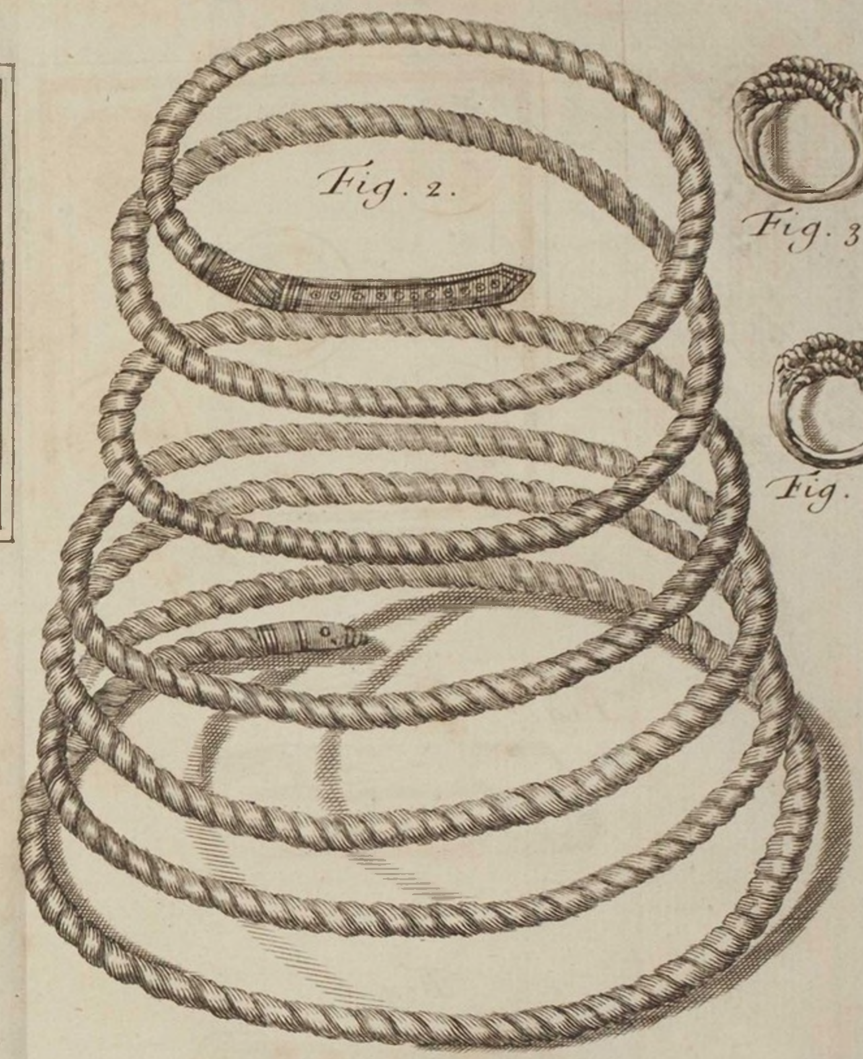
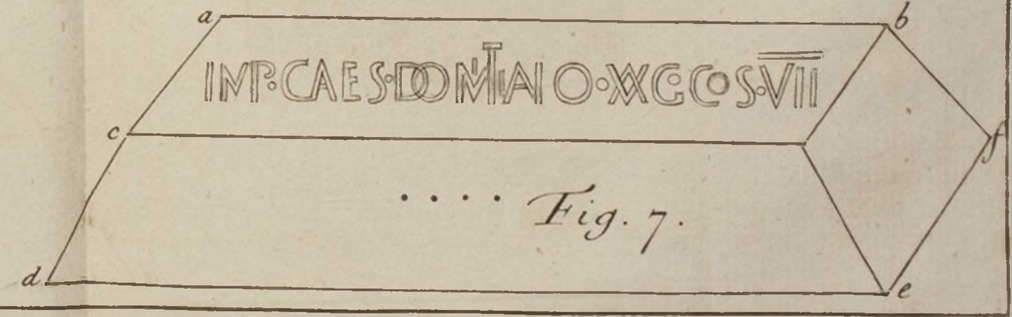


Fig. 3.

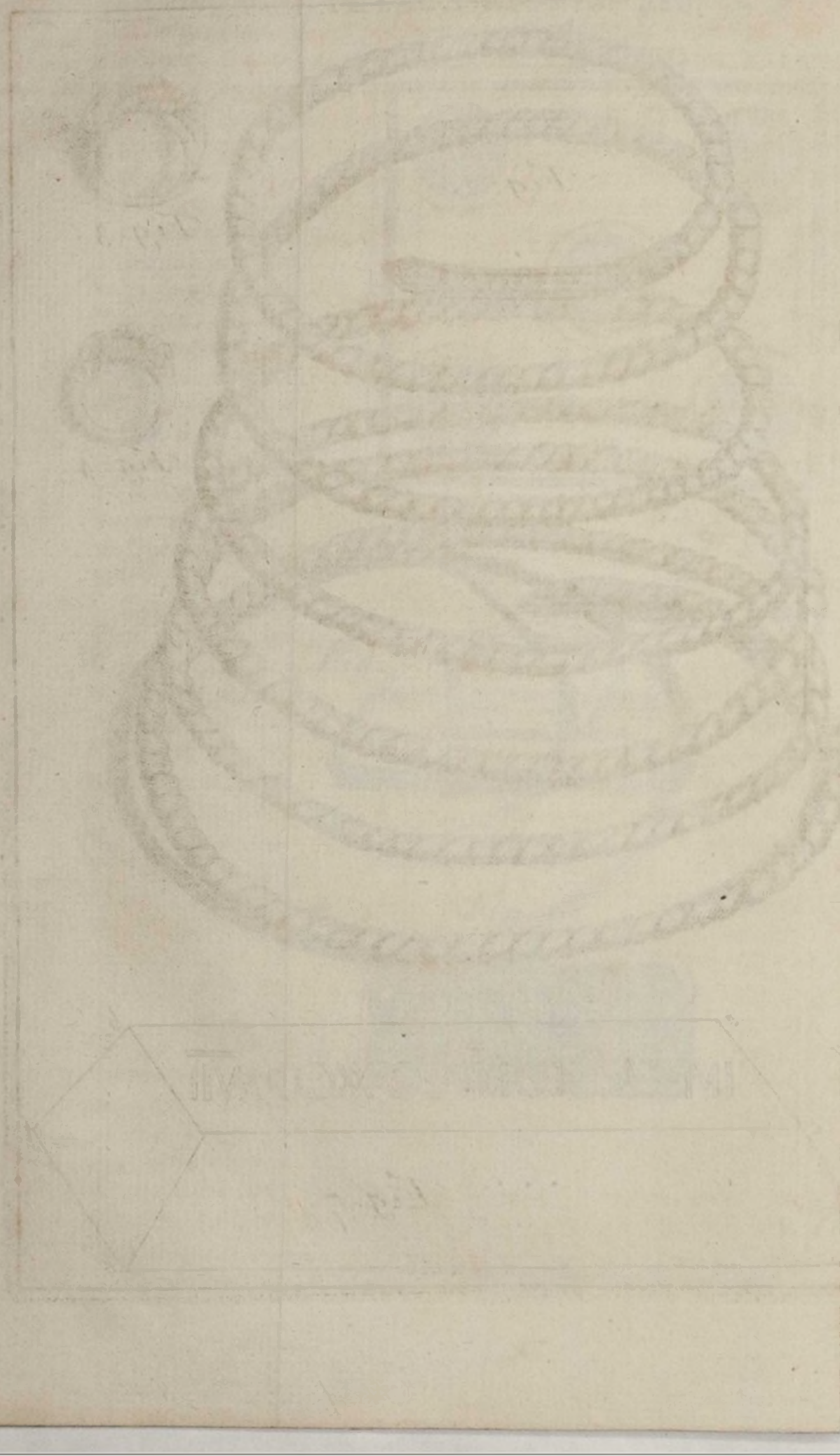
Fig. 4.

Fig. 5.

Fig. 6.



. . . . *Fig. 7.*



4 Feet 3 ½ Inches long; the Part under the 16 was broken off in taking it down in *Auguſt*, 1733, when the Houſe was on fire.

2. Upon the fourth of *April*, 1734, a curious Draught of an ancient Date carved in an Oaken Plank, at *Widgel-Hall*, the Seat of *Francis Gulſton*, Eſq; was laid before an Aſſembly of the Royal Society, as the moſt early Inſtance of our common Figures, uſually called *Arabian*, which had ever been obſerved in *England*. It was read ↀ 16, and thought to expreſs the Year 1016, the ↀ being taken for a *Roman* Numeral, and the 16 for *Arabian* Figures. *Remarks upon the ſame, by* John Ward, *Rhet. Pr. Greſh. and F. R. S. Ibid.* p. 120.

Dr *Wallis* had, in the Year 1683, communicated to that learned Body the Draught of a Mantletree, ſomewhat like this, which he ſaw at the Parſonage-houſe at *Helmdon* in *Northamptonſhire*, and got it delineated. The Date, which was likewiſe carved in mixed Characters, expreſſed the Year ↀ 133, as the Doctor read it. This being the oldeſt Monument of that Sort, which had then been diſcovered among us, was publiſhed firſt in the *Philoſ. Tranſact.* and afterwards in the Doctor's *Algebra*. Fig 9.

And in the Year 1700 another Draught of a Date at *Colcheſter*, which had been ſent to Dr *Wallis* by Mr *Luffkin*, who copied it from the under Cell of a wooden Window, and read the Figures 1090, being all *Arabian*, was printed likewiſe in the *Tranſactions*, as more ancient than the former.

None earlier than theſe two laſt had ſince appeared, till that from *Widgel-Hall*. Upon the Sight of which, I thought the Reading given to it looked very plauſible. The mixed Characters were no juſt Objection, which Dr *Wallis* had accounted for in the *Helmdon* Date, and I have myſelf obſerved in ſome Manuſcripts. But yet one Difficulty ſeemed to remain, which was the want of ſome Character in the Place of Hundreds. And therefore ſoon after going into *Hertfordſhire*, I took that Opportunity to wait upon Mr *Gulſton*, in order to ſee the Original; who was ſo obliging, as not only to ſhew it me, but alſo to ſay, if it would be acceptable to the Royal Society, it ſhould very readily be at their Service. I thanked him for the Offer; and promiſed, that if he pleaſed to ſend it to me, I would deliver it, as from him. Accordingly ſome Time after it came to my Hands, together with a Letter, giving an Account of the Antiquity of the Building in which it ſtood. And as that Letter may afford ſome Light to the Enquiry about the Date cut in the Plank, I take leave to ſend them both together.

S I R,

I Can give you no further Account of the Antiquity of the Building, than that in general 'twas eſteemed ancient. Before the Houſe was burnt, on the Timbers there were ſeveral old Coats of Arms; ſome we looked on as belonging to the Family of the *Scalers*; theſe were Poſſeſſors of *Part of a Letter from* Francis Gulſton, *Eſq; to Mr* John Ward.

of *Widdihale*[a], with other Eſtates, ſoon after the Conqueſt. The Houſe, in all Probability, might have been of greater Antiquity, and I believe really was; for at the Time of the Conqueſt 'twas in the Poſſeſſion of a conſiderable Follower of *Harold*.

The Piece of Timber I ſend you, was the Top of a Door-way, in a Timber-built Houſe, and plaſtered over with Mortar. From the Date on the plaſtered Wall, the Door had not been uſed at leaſt 343 Years; for on the Outſide was plainly to be ſeen the Date 1390. Part of the Room this was found in, was burnt too much to repair again. And in taking down the burnt Timbers, being preſent myſelf, I accidentally ſaw it, and obſerving the Date, thought it a Curioſity, that might give to the Curious ſome Speculation. And as ſuch I ſend it you, and am glad it will be acceptable to ſo learned a Body of Gentlemen, as the Royal Society. I am,

SIR,

Your moſt obedient

humble Servant,

Francis Gulſton.

Woodbridge in *Suffolk*,
July the 14th, 1734.

Upon conſidering the Characters on this Plank, and thoſe of the other two Dates mentioned above, together with the Accounts given by learned Men of the Time when the *Arabian* Figures were firſt introduced into theſe Parts of the World, and the various Forms they have
Fig. 10. ſince received, I was at laſt ſatisfied, that none of theſe 3 Dates prove they were ever uſed among us, in leſs than 100 Years after the Reading given to the lateſt of them. And the Reaſons which led me into this Opinion, I now beg Leave to offer, when I have firſt briefly inquired into their Origin and Antiquity.

Moſt Writers, who have treated of the Riſe of theſe Figures, have thought they came firſt from the *Perſians* or *Indians* to the *Arabians*, and from them to the *Moors*, and ſo to the *Spaniards*, from whom the other *Europeans* received them. This was the Opinion of *John Gerard Voſſius*,

[a] "*Widihale* in *Hertfordſhire*, in the Time of the Conqueror, was Parcel of the Eſtate of *Hardwin de Scalers*, as appears by *Domeſdei Book*, fol. 141.

"It continued in that Family for ſeveral Generations, till it came to *Anthony Widvile*, by the Marriage of the Daughter and Heir of *Scalers*. But when he would not comply with *Richard* the Third to deſtroy the young Princes, all his Lands were ſeized, and the Manor continued in the Crown, till *Henry* the Eighth granted it to *George Canon* and *John Gill*: *George Gill*, the Son of *John*, marrying the Daughter of *George Canon*, obtained the whole.

"In this Family it continued till the Beginning of the Reign of *James* the Firſt, when it was ſold to *John Goulſton*, Eſq; whoſe Deſcendants now hold it." *See Sir* Henry Chauncy's *Hiſtory and Antiquities of* Hertfordſhire, *p.* 111.

Voſſius [b], Mr *John Greaves* [c], Biſhop *Beverege* [d], Dr *Wallis* [e], and many others. And the *Arabians* themſelves own they had them from the *Indians*, as both Dr *Wallis* [f] and Mr *Greaves* [g] have ſhewn from their Writers.

But *Iſaac Voſſius* thought the ancient *Greeks* and *Romans* were acquainted with theſe Figures, and that the *Arabians* took them from the *Greeks*, and the *Indians* from the *Arabians* [h]. For the Proof of this he refers to *Tyro* and *Seneca*'s *Notes* [i], and the Treatiſe of *Boëthius De Geometria* [k]. But as to the Notes of *Tyro* and *Seneca*, they ſeem to have no Affinity with theſe Figures, either in the Number or Nature of them; for they are not limited to 9, but are many Times that Number, and all different in Form. Nor are they ſimple Signs of Numbers, but complex Characters of ſeveral Letters of thoſe numeral Words which they ſtand for in the *Roman* Language, like our Short-hands; and therefore vary in their Shape, as they are deſigned to expreſs Cardinals, Ordinals, or Adverbs of Number. This will appear by the *Table of Characters*, in which I have given the firſt ten of each. But as to what *Voſſius* ſays concerning *Boëthius*, I obſerved in a curious Manuſcript of that Writer, now in the Library of Dr *Mead*, nine Characters, which he tells us were invented and uſed by ſome of the *Pythagoreans* in their Calculations; while others of them made uſe of the Letters of the Alphabet for the ſame purpoſe. *Boëthius* calls them *Apices vel Characteres* [l]. I have inſerted theſe alſo in the *Table* to ſhew the great Affinity between them and the *Arabian* Figures, as theſe latter were written two or three Centuries ago. Fig. 10.

The Opinion of *Daniel Huetius* differed from either of the former; for he imagined, the *Arabian* Figures were only the Letters of the *Greek* Alphabet corrupted and altered by ignorant Librarians [m].

From this ſummary Account of the Riſe and Antiquity of theſe Figures, it ſeems probable to me, they might owe their Original to the *Greeks* (thoſe common Maſters of all Science) and paſſing from them firſt to the Eaſtern Nations, come round to theſe Weſtern Parts, in the Manner before deſcribed. We have no other Author, who ſpeaks of this matter, near ſo ancient as *Boëthius*, whoſe Words are very expreſs, and much ſtrengthened by the Similitude of his Characters with the *Arabian* Figures. And therefore we may rather ſuppoſe, they took their Riſe from theſe, than from the ſmall *Greek* Letters, with which *Huetius* compared them; ſince theſe latter are neither ſo like them, nor ſo old as the Time of *Boëthius*. And though what the *Arabians* ſay may be true, that they had them from the *Indians*, and not the *Indians*

[b] De Natura Art. lib. III. cap. 8. §. 6.
[c] De Siglis Arabum & Perſarum Aſtronomicis, p. 2. *where the Edition of them may be ſeen.*
[d] Arithmet. Chronolog. lib. I. cap. 15.
[e] De Algebra, cap. 3.
[f] Ibid. p. 19.
[g] De Siglis Arabum, &c.
[h] Obſervat. ad Pomp. Mel. p. 64.
[i] Vid. Gruter. Inſcript. Vol. II. ad fin.
[k] Lib. I. ſub. fin.
[l] Ubi ſupra.
[m] Demonſtrat. Evangel. Prop. IV. cap. 13. p. 172.

Indians from them, as *Iſaac Voſſius* conjectured; yet it may be equally true, that the *Indians* had them firſt from the *Greeks*, and thoſe *Arabian* Writers (who are not very ancient) not have known it; nor are there any *Indian* Monuments of ſufficient Antiquity to render this Opinion queſtionable.

But which ſoever of theſe Sentiments may be eſteemed the moſt credible, with reſpect to the Origin of theſe Figures; *Joſeph Scaliger* thought they were not received by the *Europeans*, as they came of later Ages from the *Arabians*, long before the Year 1300 [n].

But *John Gerard Voſſius* was of the Opinion they began to uſe them about the Middle of the thirteenth Century, or the Year 1250 [o].

Father *Mabillon*, in his Treatiſe *De Re Diplomatica*, was neceſſarily led to attend to the Uſe of theſe Figures, particularly in Dates. And he informs us, that they were rarely uſed before the XIVth Century, except in ſome few Books of Geometry and Arithmetic. And preſently after he ſays, it was not much to his Purpoſe to treat of them, ſince he did not deſign to carry his Work lower than the XIIIth Century [p]. By which he ſeems to intimate, that he had met with very few, if any, Inſtances of *Arabian* Figures, in ſuch Inſtruments at leaſt, before the Year 1300.

But no one appears to have examined this Subject more carefully than Dr *Wallis*; who has offered ſome Arguments to prove, that *Gerbertus*, a Monk, who was afterwards advanced to the Papal See, and took the Name of *Sylveſter* II, had before the Year 1000 learned the Art of Arithmetic, as now practiſed, with the Uſe only of 9 Characters (whatſoever their Form then was) from the *Saracens* in *Spain*, which he afterwards carried into *France* [q]. But the Doctor thinks thoſe Characters or Figures were known for a long time after only to ſuch Artiſts, and principally uſed by them in aſtronomical Calculations; the *Roman* Numerals being ſtill retained in common Uſe to expreſs ſmaller Numbers [r]. Nor has he given us the Figures uſed by any of thoſe Writers, before *Johannes de Sacro Boſco*, who died in the Year 1256; and *Maximus Planudes*, a *Greek*, who flouriſhed after him; which I have copied from him, and inſerted in *Fig.* 10.

Mr *David Caſley*, in his *Catalogue of the Manuſcripts of the King's Library*, &c. has publiſhed a Specimen of a Manuſcript from the *Cottonian Library*, called *Calendarium Rogeri Bacon* [s], and dated 1292. The Figures in this Book are *Arabian*, and, as Mr *Caſley* informed me, the oldeſt that he remembers to have met with in either of thoſe Libraries: For which Reaſon I have given them a Place in the *Table*.

It appeared to me exceeding difficult, how to reconcile the Opinions and Obſervations of theſe ſeveral Writers, concerning the firſt Uſe of

[n] Lib. III. Ep. 223. [o] De Natur. Art. Lib. III. cap. 8. §. 7 [p] Lib. II. cap. 28. §. 10. [q] De Algebra, cap. 4. p. 17. [r] Ib. p. 11, 15, 16. [s] Plate xv.

the

the *Arabian* Figures in theſe Weſtern Countries, with the Time aſſigned even to the lateſt of the Dates above-mentioned. And it could not but ſeem very ſtrange that no Date of any Writing ſhould have been produced in thoſe Figures, or any other Uſe of them diſcovered (except perhaps in ſome mathematical Calculations, or Books of Arithmetic) long before the XIVth Century; and yet that a Date ſhould be found, ſo carved in a Piece of Wood, before the Middle of the XIIth Century, for ſo common a Purpoſe as the Mantle-Tree of a Chimney.

But upon a cloſer Examination of the Characters, I found Reaſon to think, this was not really the Caſe; and that inſtead of 1133, they ought to be read 1233, what has been taken for a 1, being deſigned for a 2. This Reading ſeems to be confirmed by the Shape of the two 33 that follow it, from which, if the bottom Curve towards the right Hand (as it was often made formerly) was taken off, the upper Part would make the 2. Which Agreement between thoſe Figures is not only uſual at preſent, but often found in Manuſcripts of the XIVth and XVth Centuries. Though ſometimes indeed 'tis otherwiſe; and the 2 has an Angle at the Top, when the 3 is round, which would not ſo well have ſuited this ſquare Hand. The Reaſon which occaſioned the carrying this Date ſo high, muſt, I preſume, have been the Similitude between the ſmall *i* over the preceding abbreviated Word *Domini* and this 2. But though they appear to have ſome Likeneſs, yet there is a manifeſt Difference between them; for the 2 is much larger at the Top, where it has an Angle, and a Curve downward, that plainly diſtinguiſh it from the former. Could it be taken for a 1, I ſhould much rather ſuppoſe it was deſigned for a Letter than a Figure, and the two following Characters for a double *ll*; and ſo the whole to be only an Abbreviation of the Word *milleſimo*. But as I think it muſt be a 2, for the Reaſons given already, and do not remember ever to have met with ſuch a double *ll*, I can't but eſteem the other the true reading. And yet ſtill, I believe, this Date may claim the Preference of being the oldeſt of the Sort that has hitherto been diſcovered.

The Antiquity aſcribed to the *Colcheſter* Date, namely 1090, has, it ſeems, been occaſioned by a Miſtake in the Copy; for the 0 in the Place of Hundreds ſhould have been made a 4, by drawing down an oblique Stroke on each Side from the Bottom, which makes it 1490, before which Time the 4 had long received that Shape. I am obliged for this information to *James Weſt*, Eſq; a worthy Member of this Society, and well ſkilled in our *Britiſh* Antiquities, who himſelf perceived the Miſtake in viewing the Original.

As to the Date from *Widgel-Hall*, which gave Occaſion to this Enquiry, it ſeems to me plainly intended to expreſs the Year 1000, and no more, by the *Roman* M in the Eſcutcheon on the right Side. For the Characters in the other Eſcutcheon cannot, I think, ſtand for Figures, but muſt be the initial Letters of two Names I. G. as W. R. in the *Helmdon* Date; and were very probably deſigned in both to denote the

Perſons who erected thoſe Buildings. The Omiſſion of a Character in the Place of Hundreds, is ſtill an Argument with me, that theſe two laſt were not made for Figures. But what I imagine puts the Matter paſt all Doubt, is the want of Evidence that the Figure 6 had received that Form till ſome Ages afterward: And when it was introduced, the upper Part was not at firſt made ſo erect, as it is here, but carried in a ſmall Arch juſt over the Top of the Circle. On the other hand, what looks here like the modern 6, was at that Time the uſual Form of the Capital G. This I found fully confirmed by a large Collection of original Grants, made by our ancient Kings and others, and preſerved in the *Cottonian* Library *. Upon conſulting theſe for half a Century at leaſt, both before and after the Year 1016, I found the G ſo written in a great Number of them, of which the following are ſome few Inſtances: *N.* 37. *anno* DCCCCLX. *N.* 35. *anno* DCCCCXCIII. *N.* 53. *anno* MXLV. *N.* 49. *anno* MLXXXI, For theſe Reaſons therefore I can make no Queſtion, but that Character was deſigned for a G, and not a 6. And it is plain from other Circumſtances in Mr *Gulſton*'s Letter, that the Building might very probably be as ancient as the Year 1000; which renders this Relic of it, conſidering how firm and ſound it ſtill is, a remarkable Curioſity.

The Uſe which I think may be made of theſe Obſervations is this: That ſo far as yet appears, any Coin, Inſcription, or Manuſcript, with a ſuppoſed Date before the XIIIth Century, expreſſed in *Arabian* Figures, may be juſtly ſuſpected either not to be genuine, or not truly read; unleſs the Antiquity of it be certain from other clear and undoubted Circumſtances, and the Date will bear no other Reading; and if it be a Copy, that it has been taken with Exactneſs.

Fig. 10. *Fig.* 10. *contains the ſeveral different Characters and Figures referred to in the* REMARKS, *together with the modern* Indian *and* European *Figures.*

Fig. 9. *Fig.* 9. *is the* Helmdon *Date.*

Fig. 11. *Fig.* 11. *is the* Colcheſter *Date.*

Some Conſiderations on the Antiquity and Uſe of the Indian Characters *or* Figures; *by Mr* John Cope, *Ibid.* p. 131.

XI. 1. The moſt ingenious Invention of Figures by the ſagacious *Indians*, is of ſuch vaſt Importance in Numbering, that it can never be ſufficiently enough admired, although now-a-days the Uſe of them is become ſo familiar among us, that very few conſider what a Loſs the want of them would be to People of every Degree and Station in Life: For to conſider only, that ſuch a Number as not long before the Conqueſt would take up a good Arithmetician whole Days to count by the literal Characters, is now by the Help of Figures commonly expreſſed by a Child in a few Minutes. This Conſideration of the vaſt Uſe of Figures, put the Learned Dr *Wallis*, and others ſince him, upon en-

* Auguſtus II.

quiring

quiring at what Time they were firſt happily introduced into this Iſland.

Dr *Wallis* informs us, that we had the Figures from *Spain*, into which Nation they were brought by the *Moors*; the *Moors* had them from the *Arabians*; and the *Arabians* from the *Indians*. And it was the Doctor's Opinion, that they were firſt brought into *England* about the Year 1130; for that the firſt Inſtance of their Uſe which he had met with, was a Date upon a Chimney-Piece, which Date was ſſt 133, the Character ſſt, which the *Romans* made uſe of to expreſs 1000, being mixed with Figures, as Dr *Wallis* obſerves, was often done at their firſt coming in; ſince that, is mentioned a Date 1090. all in Figures. About twelve Months ago I produced a Date upon a Chimney-Piece at *Widgel-Hall* in *Herſfordſhire*, which was M 16, the M for the 1000, being here again mixed with Figures. And I now produce a ſtill earlier Inſtance of the Uſe of Figures in *England*, which is a Draught of an Inſcription over a Gate-way at *Worceſter*, built, as 'tis believed, in the Reign of King Edgar, and is this 9ꝑꝑ. (nine Hundred Seventy-five) which is 158 Years before the Date of Dr *Wallis*'s, 41 Years before that I produced laſt Year, and is now 760 Years ſtanding. It is a great pity (I think) but it ſo happened, that the Shape of the Figures in this Date were altered from what they are here ſhewn to be of, about two Years ago, when the Gate was new chipped and beautified; and at the ſame Time the modern ones 975 were then painted in their Room, as they are now to be ſeen; the Ground is Gold, and the Figures black. The Account of this Date I had given me lately by Mr *Joſeph Dougharty* of *Worceſter*, who is an ingenious and reputable Perſon, and lives in the Houſe over the Gate-way on which this Inſcription is: He likewiſe informed me, that his Houſe goes by the Name of *The oldeſt Houſe in five Counties*; and it is the current Opinion thereabouts, and reported by the ancient People in that Place, That the Houſe was built by King *Edgar*, wherein they ſay,——he ſometimes kept his Court. I confeſs I am not ſo well acquainted with the Hiſtory of thoſe Times, as to ſay whether King *Edgar* either built, or kept his Court there; but all Hiſtorians agree that *Worceſter* was then a very conſiderable Biſhoprick; and that *Dunſtan* and *Oſwald*, who were both ſucceſſively Biſhops there in *Edgar*'s Time, were both his great Favourites, eſpecially *Dunſtan*, for whom King *Edgar* had a very great Regard: For it appears that the firſt Thing *Edgar* did after he came to the Crown, was to re-call *Dunſtan* from *Flanders*, where he had been 3 Years in Exile, and was immediately thereupon made Prime-Miniſter, Favourite, and Confeſſor, at firſt Biſhop of *Worceſter*, and afterwards Archbiſhop of *Canterbury*; upon which laſt Promotion his great Friend *Oſwald* ſucceeded him in the See of *Worceſter*: And 'tis very likely that either *Dunſtan* or *Oſwald*, as having ſo much Power, Intereſt, and Riches, might erect a Building there, of which this Gate-way might have been a Part; for as *Edgar*

Fig. 12.

died in the ſame Year 975, if we ſuppoſe the Date to be fixed upon the Building the Year it was finiſhed, as is now commonly done, *Edgar* could not live or keep his Court there, unleſs it was in ſome Part of that Year in which we ſuppoſe it to be finiſhed.

I ſhall next mention ſome Obſervations upon the different Shape the Figures have been altered to ſince their coming into theſe Weſtern Parts; for our Anceſtors wrote them different from the *Indians*, and we again make ſome of them different from what our Anceſtors did, as by the Table will appear.

Fig. 13. In this Table the Left-hand Column contains the *Indian* Characters; the Middle thoſe uſed by our Fore-fathers, as appears by old Weſtern Manuſcripts; the third are the Characters we now uſe.

We may now obſerve that the Figure 1, is the ſame as the *Indian*; the Figures 2 and 3, are the ſame with the *Indian*, only placed in a different Poſition, for the ſake of writing them more readily, for only the Daſh from the *Indian* ⳾ is taken away; they are only, as we may ſay, both ſet upright. So the Character ⳾ of the *Indians* is much the ſame with ours, only we cloſe the Head, and ſet it upright, thus 4. Again, our Anceſtors transferred the Figure ⳾ (5) from the Place of 5, to that of 8, and with very little Alteration is our 8 made from it. As the Figure Five was moved into the Place of Eight, ſo the old Eight ⅄ 7 was moved into the Place of Seven, the firſt of theſe is the 7 of our Anceſtors, the laſt 7 is our own; and as they put the Five for an Eight, they put the ſix *y* into the Place of five; which *y* was at length altered to ⳾, and laſt of all to 5. The two Characters 9 and 0 are without any Alteration, except that our Anceſtors ſtruck a Line croſs the Cypher, as thus ⳾, which we now leave out, and by that means 'tis reſtored to it's ancient Form. And now we have no Figure left but the *Indian* ✓ (7) to derive the modern 6 from, to which it ſeems to have no manner of relation: I ſhall only obſerve, that it ſeems not unlikely to be compounded of the *Indian* 0 (5) and the 1, as thus, 6; for of the two ancient Characters 0 ⳾ (for five) the 0 is *Indian*, and the ⳾ is *Arabian*; this laſt being nothing more than the *Arabian* Letter ⳾ inverted, which in the *Arabian* Alphabet denotes the ſame Number, and is, as 'tis ſuppoſed, uſed by the *Arabians* only.

The *Roman* Characters have likewiſe undergone Alterations; for it is found that 1000 was repreſented by the Antients by this Character ⳾, as likewiſe by ⳾; whence is derived the modern M. for that Number: Alſo 5000 was repreſented by ⳾, and 50000 by ⳾; and hence the modern Characters IↃ and IↃↃ for the ſame Number. We find alſo in ancient Inſcriptions ⳾ or ⳾ ſtand for 20, and ⳾ for 30, the Letter X being twice expreſſed in the one, and three times in the other,

other, which the Moderns write ſingle, as XX and XXX, only the Timber-Merchants uſe the ancient Characters ⋋ and ⋋⋋ to this Day.

2. Upon the 27th of *February* laſt, I had the Honour to lay before this Society a Paper, containing ſome Remarks upon an ancient Date, carved in Wood, that was found at *Widgel-Hall* near *Buntingford* in *Hertfordſhire*, with the Characters ℳ 16; which had been read 1016, ſuppoſed to be mixed Numbers, the ℳ *Roman*, and the two others *Arabian* or *Indian*, as they are indifferently called. This led me to conſider two other Dates of the like Kind, formerly publiſhed in the *Philoſophical Tranſactions*; one found at *Helmdon* in *Northamptonſhire*, in mixed Characters expreſſing, as was thought, ℳ 133; and the other at *Colcheſter*, ſaid to denote the Year 1090, wholly in *Arabian* Figures. But upon ſearching into the Origin of thoſe Figures, and the Time when they were firſt brought into theſe Parts of the World, I could meet with no Examples of them in any Manuſcripts, before ſome Copies of *Johannes de Sacro Boſco* (mentioned by Dr *Wallis*) who died in the Year 1256, which was 123 Years after the lateſt of the 3 Dates above-mentioned. As it could not therefore but ſeem very ſtrange, that Workmen ſhould have made Uſe of thoſe Figures for ſuch common Purpoſes, ſo long before they appear in the Writings of the Learned; ſo upon a cloſer Examination, and further Inquiry, I found there was no Reaſon from any of theſe Dates to ſuppoſe, it was really true in Fact. For the *Helmdon* Date inſtead of ℳ 133, ſhould, as I then ſhewed, be read ℳ 233; the *Colcheſter* Date 1490, inſtead of 1090; and that at *Widgel-Hall* has no *Arabian* Figures in it, the Characters 1 and 6 not being Numbers, but the initial Letters of two proper Names I G, in the uſual Form of thoſe Letters in that Age.

Remarks upon the ſame, by John Ward, *Rhet. Prof. Greſh. F.R.S. Ibid.* p. 142.

But there has been very lately read before this Society, an Account of a Date at *Worceſter*, more ancient than any of the three former; namely, ℳℳ, or 97v, in which the Unit is a *Roman* Numeral, and the other two are taken for *Indian* Figures. I obſerved in my former Paper, that ſuch Mixtures were ſometimes found in ancient Numbers; though in what Manner they were ſo uſed, I did not then explain, but for Brevity contented myſelf with referring to the *Algebra* of Dr *Wallis*, a Book ſo very well known. The Doctor thought it neceſſary to take Notice of this, in order to account for his Way of reading the *Helmdon* Date, in which the ℳ only is a *Roman* Numeral. And I had myſelf met with a few Inſtances of it in Dr *Mead's* Manuſcript of *Boëthius*, as ccc29 and Dcc68, where the Hundreds are numeral Letters, and both the Decimals and Units *Arabian* Figures *. But it is obſervable, this is not done promiſcuouſly, but the largeſt Numbers are always Letters, and the leſſer, Figures; as in the *Helmdon* Date. And *Mabillon* has obſerved, that in a curious manuſcript Copy of *Thomas à Kempis*, written

* De Arith. Lib. II.

in

in the fifteenth Century, ſome of the Pages are ſo numbered *. Which Method, ſo far as appears, was always attended to, and never in any one Inſtance inverted. So that this *Worceſter* Date, which has a *Roman* Numeral in the Place of Units, and the two preceding Characters are ſuppoſed to be *Indian* Figures, is not only without Example, but directly contrary to all other Inſtances of ſuch mixed Numbers. Which Conſideration alone might be a ſufficient Ground to think, there muſt be ſome Miſtake in the reading.

But the middle Figure, taken for a Seven, is as remarkable; which turning towards the Left hand, forms two obtuſe Angles, one above, and the other below. This Shape of the Seven, I believe, was never ſeen before, and ſeems by no Means to ſuit that Age. In the Speci-
Fig. 10. men of the Figures taken from *Johannes de Sacro Boſco*, by Dr *Wallis*, which may be ſeen in the Table annexed to my former Paper, the Figure Seven is made in this Form ʌ, like the two Legs of an iſoſceles Triangle. And in *Roger Bacon*'s *Calendar*, dated 1292, there is only this Variation; that the Leg to the Left-hand is ſomewhat ſhortened, as will appear likewiſe by the ſame Table. And this Form continued till Printing was introduced among us; as is evident from *Caxton*'s *Polychronicon*, and other Books printed about that Time. Nor do I find it till later Times in any other Shape; unleſs that in Biſhop *Beveridge*'s Table of *Indian* Figures, the two Legs of our ancient Seven are drawn parallel, and arched at the Top, in this Manner ∩, inſtead of meeting in an Angle †; and *Planudes*, a *Greek* Writer, has kept the true *Arabian* Form V, like the *Roman* Five, which the *Europeans* inverted. The laſt Alteration this Figure received among us, was by raiſing the ſhorter Leg horizontally. But no Inſtance of it parallel to this in the *Worceſter* Date, or any Thing like it, has before appeared. As there ſeems therefore no Reaſon to ſuppoſe it a Seven, ſo I think a probable Conjecture may be offered, what it was deſigned for, and that is, the the *Roman* Numeral Ten, which was made in this Form, like an X; to which Character, in our old ſquare Hand, this ſuppoſed Seven ϒ would very well agree, by ſupplying only the two extreme Parts to the Right-hand, in this Manner ϒ, which may eaſily be thought to have been decayed, and worn away by Length of Time.

As there is no Reaſon to take the middle Character for a Seven, ſo neither is there any to ſuppoſe the firſt was intended for a Nine, being thus placed before two *Roman* Numerals, as I take them both to be. It has indeed ſome Similitude with that Figure; but that is nothing more, than what was anciently, and ſtill is, common to the Letter ⟨O⟩ in that Hand, which reſembles a double ⟨O⟩, with an oblique Stroke turned inwards from the Bottom of that to the Right-hand; ſo that if the other to the Left be taken away, that which remains will appear in

* De Re Diplom. Tab. XV. † Arith. Chron. Lib. I. Cap. 4.

this

this Form ⵔ, like what is here called a Nine. And every one knows, who has any Acquaintance with ancient Inſcriptions, that Letters frequently periſh in this Manner, one Part before another.

Upon theſe Suppoſitions the true Reading would be MXV. But ſince the old Date is now deſtroyed, and modern Figures put in it's Place, this muſt remain uncertain. And I cannot but think, the former Characters muſt have been very dark and obſcure, for the following Reaſons: There is, as I am informed, a Tower over this Gate, of which a curious and learned Gentleman, who lives very near it *, has lately given ſome Account, in a Treatiſe intituled, *A Survey of the Cathedral Church of* Worceſter. He ſays, it is "commonly called King "*John*'s Tower, and ſaid by ſome to be built by him; but it was much "more ancient, having in the Front of it the Statues of King *Edgar*, "and his two Queens, *Ethelfleda* and *Ethelfrida*; and the Street it "leads into, is called in ſeveral Writings *Edgar-ſtreet* †." Could there be any Room for it's being ever ſuppoſed to have been built by King *John*, while this Date was plain and clear? Or would the Author of the *Survey* have contented himſelf with only ſaying, *it was much more ancient*; when he could ſo eaſily have given us the Year, had he been ſatisfied with the Reading? King *Edgar* had been a great Benefactor to the Cathedral Church at *Worceſter*, and is ſaid to have given to it 300 Hides of Land ‖; which ſome compute at ſo many 100 Acres, but my Lord *Coke* ſays, an Hide contains no certain Number. *Edgar* died in 975, but his Queen *Ethelfrida* ſurvived him ſeveral Years. And as it is not unuſual, in order to perpetuate the Memory of publick Benefactors, to erect Statues and other Monuments of them, after they are dead; it might be ſo in this Caſe, and the Street receive it's Name (for ſome Time at leaſt) from this Building, like our *Ludgate-ſtreet*. But though the preciſe Year of this Date cannot, I fear, now be determined with Certainty, it is ſufficient to have ſhewn, that neither the Order of the Characters, their Shape, nor the oldeſt Examples of *Arabian* or *Indian* Figures, any where found, do in the leaſt countenance the Reading given to it; but, on the contrary, all of them afford the higheſt Probability, that it cannot be genuine.

I beg Leave only to add, that two learned and ingenious Gentlemen of this Society, *Roger Gale* and *James Weſt*, Eſquires, to whoſe Judgment I would pay a due Regard, were pleaſed to tell me, they thought the two firſt Characters, taken for a Nine and a Seven, might probably have been nothing but an ⵔⵔ; which will bring the Date to 1005, ten Years nearer the Time of *Edgar*. My only Difficulty as to that Reading, is, that the ⵔⵔ would then have two oblique Strokes prolonged from the Bottom, one in the Middle, beſides the other uſual one to-

* Dr *William Thomas*. † Page 7. See likewiſe *Hearne*'s Preface to *Heming*'s *Chartularium*, in the Frontiſpiece of which Treatiſe is a Draught of thoſe three Figures.
‖ Account of the Biſhops of *Worceſter*; by Dr *William Thomas*.

wards

wards the Right-hand, which I do not remember ever to have met with. But as this Inaccuracy might ariſe from the Obſcurity of the Character, or the Imagination of it's being two *Arabian* Figures; I leave it to the Curious to judge either Way, as they pleaſe, both Sentiments equally ſuppoſing the original Characters of this Date muſt have been *Roman* Numerals.

I ſhould not have enquired farther into this Subject upon the preſent Occaſion, but that I apprehend it to be a Matter of ſome Conſequence, eſpecially with Relation to Manuſcripts. A Copy, for Inſtance, of ſome ancient Author, written in the Year 1375, and dated in *Arabian* Figures, by changing only the 3 into a Cypher, may be carried back three hundred Years; or by making it a Nine, and taking out the 1, may be raiſed ſtill a Century higher, to 975, the ſuppoſed Year of the *Worceſter* Date. And thoſe, who are converſant with Manuſcripts, are ſenſible, that the Age of them cannot always be determined barely by the Hand. Since therefore *Arabian* Figures are in moſt Caſes much more eaſily falſified, than *Roman* Numerals; I humbly preſume, too great Caution cannot be uſed, in admitting any Inſtances of them more early, than have been yet diſcovered, but upon very clear and ſufficient Evidence.

An Account of an ancient Date in Arabian *Figures, upon the North Front of the Pariſh-Church of* Rumſey *in* Hampſhire. *By the Rev. Mr* William Barlow. No. 459. p. 652. Jan. *&c.* 1741. Fig. 14.

XII. As the knowing how long the *Arabian* or *Indian* Figures have been uſed in the Weſt, may ſometimes be a Means for diſtinguiſhing ſpurious from genuine Dates; ſo a wrong Hypotheſis, fixing the Time later than it ought to be, may poſſibly induce us to ſuſpect genuine Dates to be doubtful or ſpurious. To give ſome Light to this Subject, I have here ſent a Draught of Part of the North Front of the Abbey (now Pariſh) Church of *Rumſey*, in the County of *Southampton*, with an Inſcription on the ſame. That this Inſcription is a Date, 1011, is evident from the Figures. That it is a genuine Date, the apparent Antiquity of the Building plainly demonſtrates. A ſpurious Date in this Place would have expreſſed the Time when the Abbey was founded by King *Edward*, Grandfather of *Edgar*, above a 100 Years before the Time here mentioned.

There is ſomething very remarkable with relation to the Time when this Church was built. Not only during the Year of this Date, 1011, but for ſeveral Years before, many Parts of *England* were laid waſte by the revenging *Danes*, juſtly incenſed againſt the *Engliſh* by the inhuman Maſſacre of their Countrymen in the Year 1002. The *Saxon* Chronicle, *p.* 141, acquaints us, that the County of *Hants*, Hamtun-ſcire, among others, was miſerably harraſſed by theſe cruel Invaders this Year of the Date *. It is therefore very extraordinary, that ſo fine a Pile (according to the Age when it was built) ſhould be raiſed at a Time when every Thing elſe, ſacred and civil, was plundered and deſtroyed

* *Florence* of *Worceſter* alſo obſerves the ſame. . . *Suthamtonenſi, Wiltunenſi . . . provinciis . à Danorum exercitu ferro flammaque demolitis. Ad An.* 1011. p. 613.

by

Pla. II. Vol. IX. part 4. page 432.

THE HELMDON DATE.

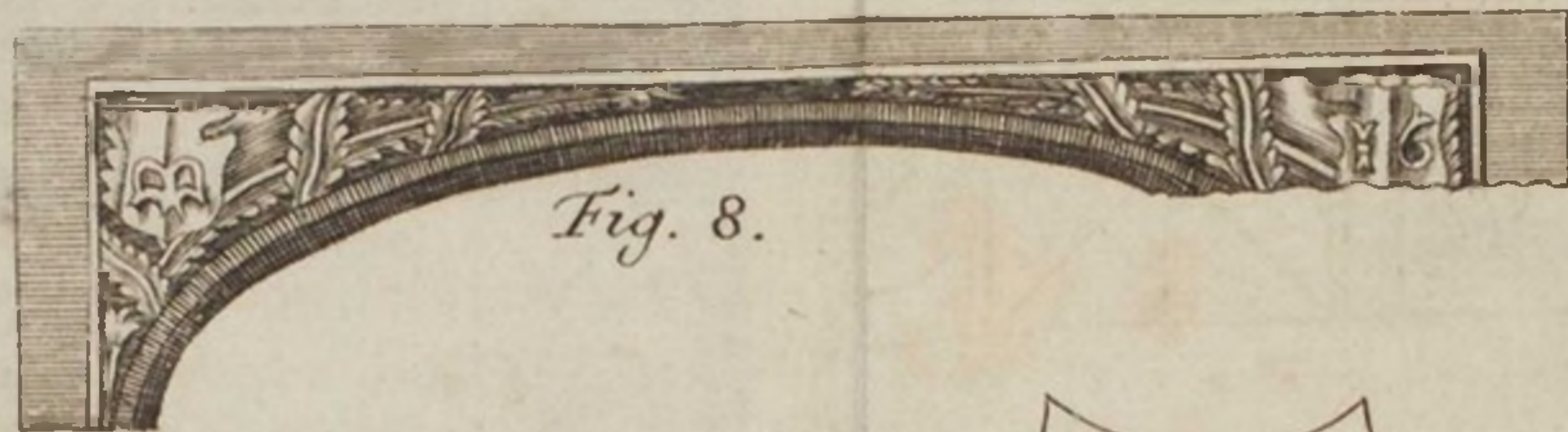


Fig. 8.

Fig. 9.

Fig. 11.

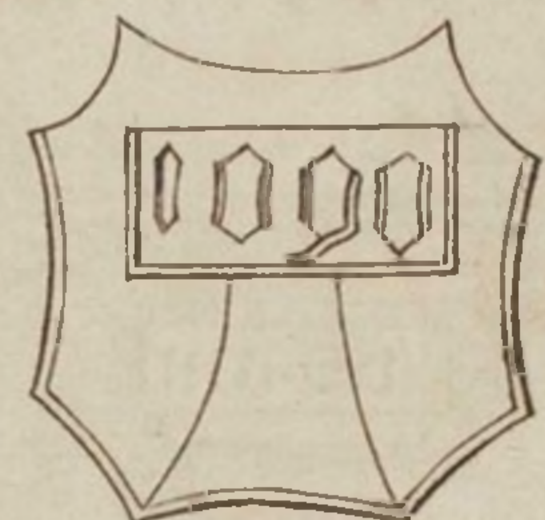
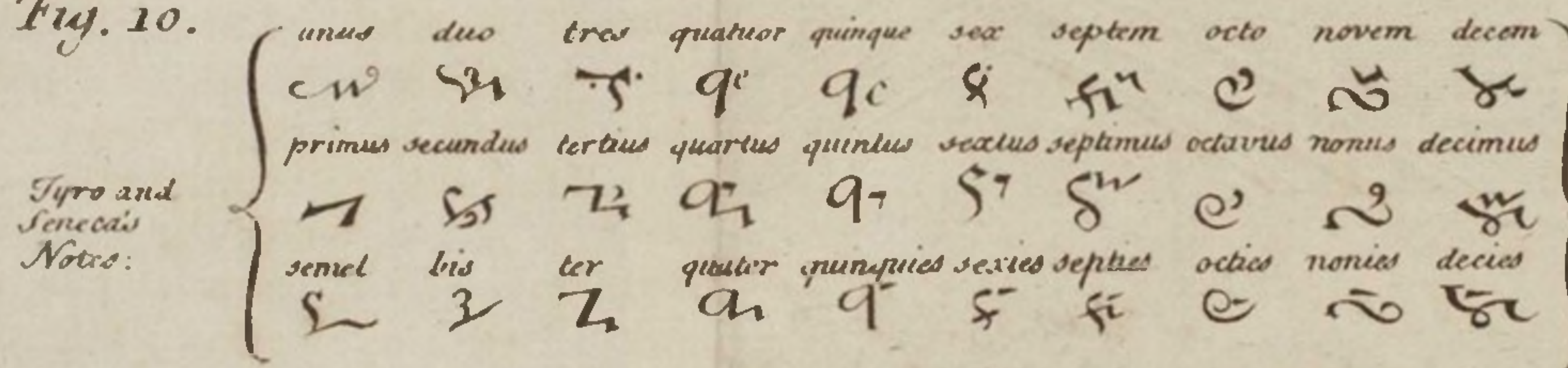
THE COL  CHESTER DATE.

Fig. 14.

A TABLE OF CHARACTERS.

Fig. 10.

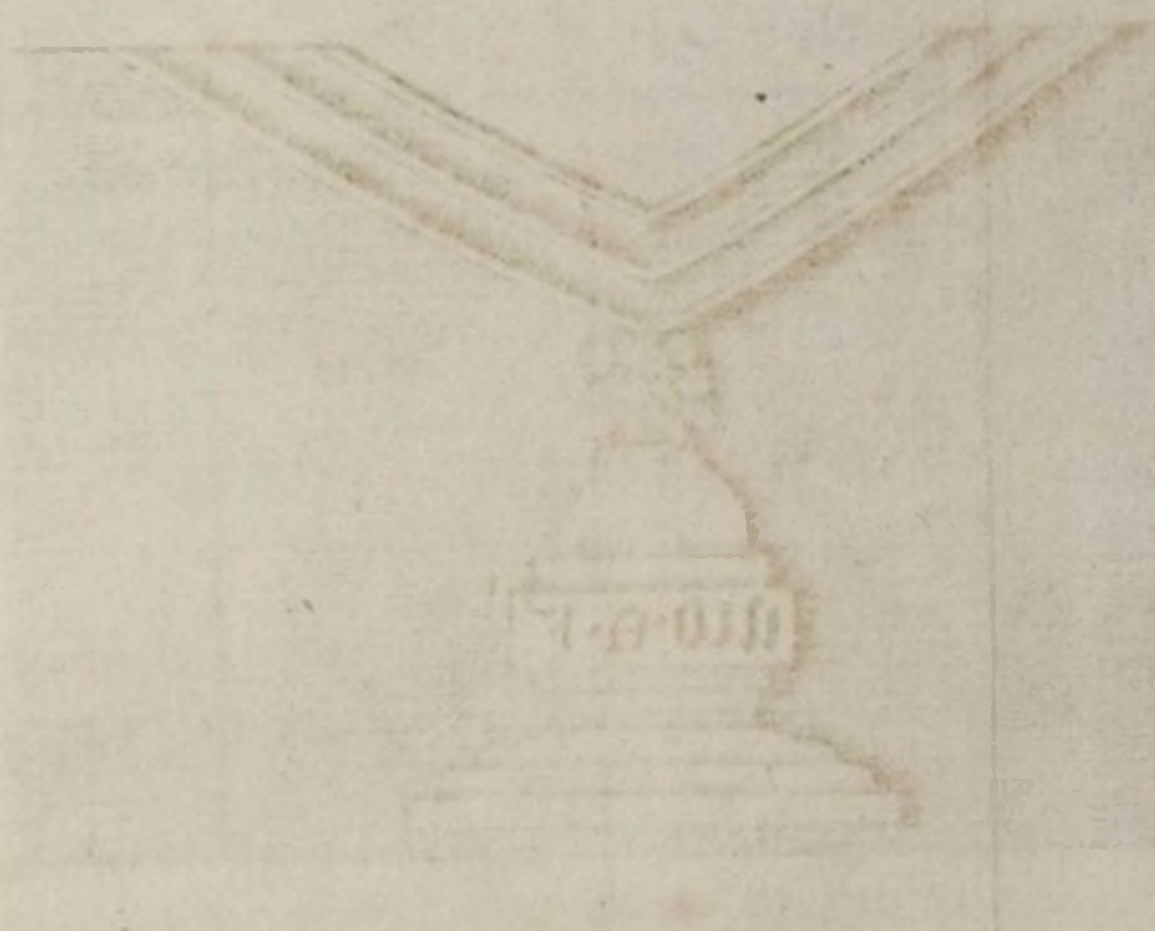


Tyro and Seneca's Notæ: From, Gruter's Antiquitat Vol. II. in fin.

Boethius's apices.	I	ᘔ	[illegible]	[illegible]	[illegible]	[illegible]	Λ	8	9	[illegible]	Doctor Mead's Manuscript
Small Greek letters.	α	β	γ	δ	ε	ϛ	ζ	η	θ	ι	
Modern Indian figures.	9	Ƨ	ε	8	Y	3	9	τ	[illegible]	9	Tavernier Liv. 1. chap. 2.
Arabic figures.	ι	μ	ω	ع	0	ч	v	ʌ	9	ι	Manuscripts.
Figures of Jo. de sacro Bosco.	ι	ᘔ	3	ℓ	ɥ	6	ʌ	8	9	10	Doctor Wallis.
Figures of Max. Planudes	ι	μ	ω	ع	ɤ	ч	v	ʌ	9	10	Doctor Wallis.
Figures in Rog. Bacon's Calendar	ι	7	3	ℓ	ɥ	6	ʌ	8	9	10	The Cotton library.
Modern fig	ι	2	3	4	5	6	7	8	9	10	

Fig. 13.

Indian	Antient	Modern
1	1	1
ʋ	2	2
ɯ	3	3
≡	8	4
o8	4ɥ	5
47	6	6
V	1	7
17	8	8
9	9	9
0	θ	0



by theſe mercileſs Ravagers. But probably the Devaſtation was not quite ſo general as repreſented.

If this be a genuine Date, (and I ſee no Reaſon to queſtion it) it is, I believe, the ancienteſt, *Indian*, or other, that has yet been taken Notice of in *England*, perhaps in *Europe*; and quite deſtroys the Opinions advanced by *Scaliger*, *Voſſius*, *F. Mabillon*, Dr *Wallis*, and other learned Men, concerning this Matter.

Now I have mentioned this Abbey of *Rumſey*, I take Leave to correct an Error in Sir *H. Savil*'s (the only extant) Edition of *Roger Howeden*, *Frankf.* 1601, *p.* 426, *Anno* 967, *Rex . . Edgarus in Monaſterio* Rameſeie, *quod Avus ſuus Edvardus ſenior conſtruxerat.*—Here it is called *Rameſeie*, by Miſtake, for *Rumeſeie*; and again in the ſame Page. But *Rameſeie* was *Ramſey* in the County of *Huntington*, a Monaſtery founded by *Oſwald* * Biſhop of *Worceſter*, afterwards Archbiſhop of *York*, conſecrated by the ſaid *Oſwald*, *An.* 991 †. This Identity of Name, unobſerved, may occaſion great Confuſion in the Hiſtory of theſe two Places. I find *F. Creſſy* (*p.* 860.) or the Authors he tranſcribed from, miſled by this typographical Error. Poſſibly others may fall into the ſame Miſtake, by the ſame Means. It is Pity there is not a more correct Edition of that Author.

XIII. 1 Dijs Manibus
2 Marci Herennij
3 Proti, vixit annos viginti duos
4 Menſes duos, Dies quinque, fecerunt Parentes
5 Marcus Herennius Agricola et
6 Herennia Lacena Filio.
7 Chirographum. Ollaria numero quatuor
8 Cineraria quinquaginta tria intrantibus par-
9 te læva quæ ſunt in monumento
10 Titi Flavij Artemidori, quod eſt Viâ
11 Salariâ in agro Voluſi Baſilides
12 Ientibus ab Urbe parte ſiniſtra, Do-
13 nationis cauſa Mancipio accepit
14 Marcus Herennius Agricola de Tito Flavio
15 Artemidoro Seſtertio nummo Uno, Libripende Marco
16 Herennio Juſto, Anteſtatus eſt Tiberium
17 Julium Erotem: Inque vacuam
18 Poſſeſſionem earum ollarum
19 Et Cinerariorum Titus Flavius Arte-
20 midorus Herennio Agricolæ ire
21 Aut mittere, oſſaque inferre per-
22 miſit, ſacrumque quotiens face-
23 re vellit Herennius Agricola
24 Heredeſve ejus permiſit, Claviſve

A Copy of an ancient Chirograph, or Conveyance of Part of a Sepulchre, cut in Marble, lately brought from Rome, *and now in the Poſſeſſion of Sir* Hans Sloane, *Bart. R. S. Pr. with ſome Obſervations upon it by* Roger Gale, *Eſq*; *V. P. R. & Tr. R. S.* No. 441. p. 211. Apr. &c. 1736. Fig. 15.

* Will. Malmeſb. de Geſt. Reg. Ang. *p.* 56. 291. † Simeon Dunelm. ad An. 991.

25 Ejus monumenti poteſtatem factu-
26 rum ſe dixit, dolumque malum
27 Huic rei abeſſe afuturumque :
28 Se hæc rectè Dari, fieri præſtari-
29 que ſtipulatus eſt Marcus Herennius
30 Agricola, ſpepondit Titus Flavius
31 Artemidorus. Actum 18° Kalendas Januarij
32 Caio Calpurnio Flacco, Lucio Trebio
33 Germano COS.

This Marble, lately arrived from *Rome*, and now repoſited in the noble Muſeum of Sir *Hans Sloane*, is a moſt valuable Piece of Antiquity, as exhibiting a compleat *Formula* of a *Chirograph*, or Conveyance of one Part of a Burying-Place from one Family to another, but neither of them of any Note, ſeeming by their *Agnomina* to have been only *Liberti*, or deſcended from ſuch. *Agricola* indeed is a *Roman* Name, but thoſe of his Wife *Lacena*, and his Son *Protus*, are both *Greek*.

By this *Chirograph* (Line 7th, 8th, *&c.*) *Herennius Agricola* obtains from *Titus Flavius Artemidorus*, a Right to four *Ollaria*, which were *Niches* or *Repoſitories*, wherein they placed *Cineraria*, *Urns*, or *Veſſels* of *Stone*, or *Earth*, containing the Aſhes of the Dead, and were here in Number fifty-three.

Fabretti * indeed takes the *Cineraria* to have been Niches for receiving and keeping *Urnas lapideas*; but *Gutherius de Jure Manium* (Lib. II. c. 24.) tells us, that *Oſſuariæ ollæ à* Cinerarijs *in eo differunt, quod hæ Cineres, illæ oſſa exciperent.* Beſides, if they were Niches, or the ſame as *Ollaria*, the mentioning of them, as in this Inſcription, would be an unintelligible Tautology; and *Spon* (in his *Miſcell. Antiq. Erudit.* p. 290.) gives us the following Inſcription, which ſeems to put the Matter out of Diſpute.

Romæ, in Operculo Vaſis.

CINERARIVM
GEMELL. III. AELI
MARCI. ET PHILIPPI.

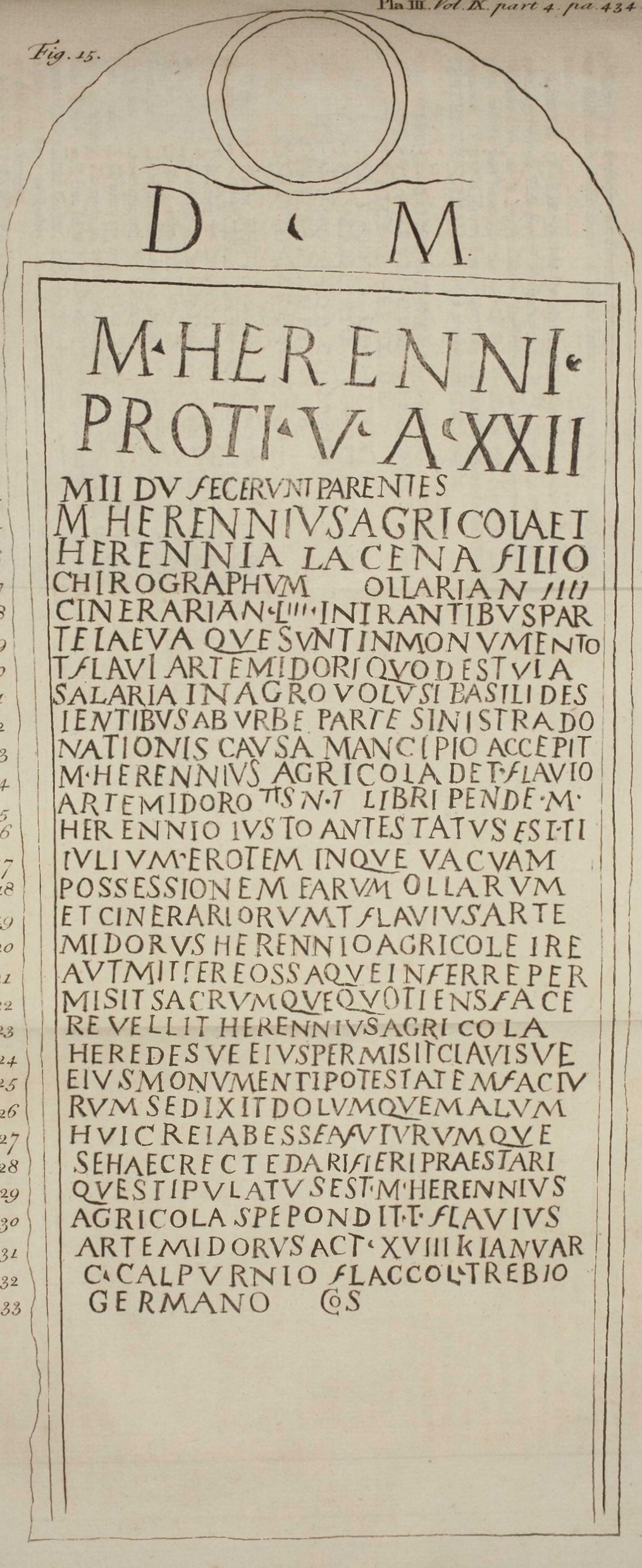
From both which Authorities it is evident, that the *Cineraria* were *Vaſa*, and not Repoſitories for them.

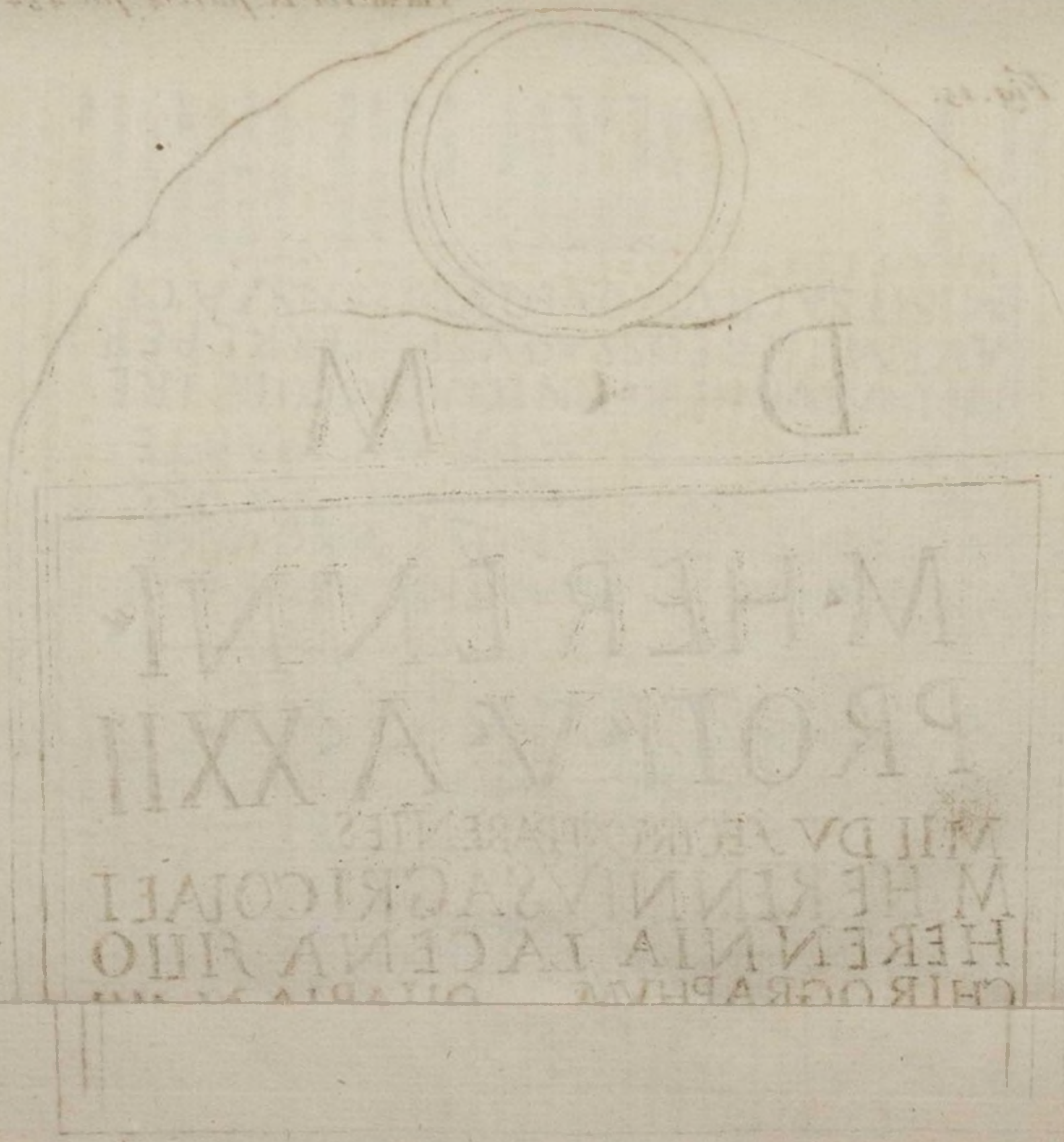
This Monument was ſituated on the left Side of the *Via Salaria*, which ran to the N W of *Rome* from the *Porta Collina*. It ſtood in the Ground of *Voluſius Baſilides*, and the Conſideration for the Conveyance of it is one *Seſterce*. It is very uſual in ſepulchral Inſcriptions to find the Monument of one Family in the Field of another, the Proprietor of the Monument reſerving the Right of that to himſelf when he ſold the Ground; or purchaſing ſo much Ground from the Owner as

* Inſcript. ant. in ædibus pat. p. 16, 17.

was

Fig. 15.


D M
M·HERENNI·
PROTI·V·A·XXII
MII DV FECERVNT PARENTES
M HERENNIVS AGRICOLAE T
HERENNIA LACENA FILIO
CHIROGRAPHVM OLLARIA N IIII
CINERARIAN·LIIII·INI RANTIBVS PAR
TE LAEVA QVE SVNT IN MONVMENTO
T FLAVI ARTEMIDORI QVO D EST VI A
SALARIA IN AGRO VOLVSI BASILI DES
IENTIBVS AB VRBE PARTE SINISTRA DO
NATIONIS CAVSA MANCIPIO ACCEPIT
M·HERENNIVS AGRICOLA DE T·FLAVIO
ARTEMIDORO TIS N·I LIBRI PENDE·M·
HERENNIO IVSTO ANTESTATVS EST·TI
IVLIVM·EROTEM INQVE VACVAM
POSSESSIONEM EARVM OLLARVM
ET CINERARIORVM T FLAVIVS ARTE
MIDORVS HERENNIO AGRICOLE IRE
AVT MITTERE OSSA QVE INFERRE PER
MISIT SACRVMQVE QVOTIENS FACE
RE VELLIT HERENNIVS AGRICOLA
HEREDES VE EIVS PERMISIT CLAVIS VE
EIVS MONVMENTI POTESTATEM FACIV
RVM SEDIXIT DOLVMQVE MALVM
HVIC REI ABESSE A FVTVRVMQVE
SE HAEC RECTE DARI FIERI PRAESTARI
QVE STIPVLATVS EST·M·HERENNIVS
AGRICOLA SPEPONDIT·T·FLAVIVS
ARTEMIDORVS ACT·XVIII KIANVAR
C·CALPVRNIO FLACCO·L·TREBIO
GERMANO COS



was ſufficient for erecting the Monument. All Sepulchres, when once a Body was interred therein, were eſteemed as religious and ſacred, and were not to follow the Poſſeſſion of the Field.

Mille pedes in fronte, trecentos cippus in agrum
Hic dabat, Hæredes monumentum ne ſequeretur.
Hor. 1. Sat. 8.

Line 11. *Baſilides* is a Blunder for *Baſilidis* in the Genitive Caſe; and we ſhall meet with more of them before we get through this Inſcription.

Line 11, 12. The Words *Donationis cauſa mancipio accepit M. Herennius Agricola de Tito Flavio Artimedoro* IIS N. I. are to be read *Seſtertio Nummo Uno*, as is evidently demonſtrated from the following Inſcription, where you have alſo the reſt of the Words of this Form of Conveyance. There is likewiſe in *Gruter* * an Inſcription, wherein the Words SESTERTIO NUMMO UNO are expreſſed at Length.

HOC. MONVMENTVM. SIVE
SEPVLCHRVM. CVM. AREA. SVA
T. FVFICIVS. FELIX. DE
IVLIA. RVFINA. DONATIONIS
CAVSA. MANCIPIO. ACCEPIT
IIS. N. VNO. QVOD. COMPARAVIT
FVFICIAE. AMPLIATAE
CONIVGI CARISSIMAE, &c.

They were *Verba ſolennia Donationis vel Alienationis cauſâ quæ fiebat per Mancipium.* This *Mancipation* was often a fictitious Sale of a Thing to make the Donation of it valid, as in this Caſe: And the Mention of one Seſterce given for it, is only *Dicis gratiâ*, much like our Form in Leaſes for putting into Poſſeſſion, *In Conſideration of five Shillings in Hand paid.* Frequent Examples occur of this Practice, as in the Inſcription juſt now quoted from *Fabretti* †, and others in the ſame Author; and in *Gruter* (p. DCCCCLVI. 4. and MLXXXI. 1.) which latter is a compleat *Formula* of a like ſepulchral Conveyance as this, but of a later Time, and not ſo well preſerved; it being executed when the Emperor *Trebonianus Gallus*, and his Son *Volucianus*, were Conſuls, A. D. 252; and ours probably, as will be ſhewn hereafter, during the Reign of *Septimius Severus.*

Line 15.) LIBRJ PENDE is cut in our Marble as two diſtinct Words, as here repreſented, though in Reality it ſhould be but one, and ſignifies the Perſon that weighed or counted over the Money to the Seller: It ſhould be read LIBRIPENDE, than whom there could not

* P. DCCCCLVI. 4. † Inſcript. ant. in æd. pat. p. 50.

be a more proper Witneſs to the Purchaſe. At the Beginning of the *Roman* State, their Money was uncoined, and called *Æs rude*, or *grave*, therefore paid by *Weight*; whence comes the Word *Libripens*. Under *Servius Tullius*, their ſixth King, it begun to be coined, and paid by *Tale*; but the Perſon who counted it over to the Receiver, ſtill retained his primitive Appellation. Almoſt every conſiderable Town had it's *Libripendes*, Perſons of Skill in Money-Affairs, to determine Controverſies about the Value of it.

An Inſcription in *Gruter* (p. MCXV. 1.) is a ſtrong Evidence of this: It was found at *Nola* in *Campania*, and ſhows they had two *Libripendes* there appointed by publick Authority.

T. VEDIVS. T. F.
T. VITORIVS. CN. F
II. VIRI
LIBRIPENDES
EX. DD.

This Name they had, *Quia libram æneam tenebant quâ nummos penderent.*

——*Libra mercatus & Ære.* Hor. Epiſt. II. 2.

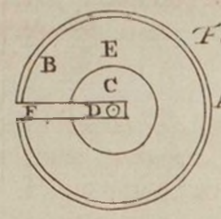
And hence we have the Words *Stipendium*, *Diſpendium*, *Expenſæ*, and the like. In *Apuleius*'s *Metamorph.* Book Xth, is the following Paſſage: ——*Sed ne fortè aliquis, inquam, iſtorum quos offers Aureorum, Nequam vel Adulter reperiatur, in hoc ipſo ſacculo conditos eos annulo tuo prænota, donec altero die* Nummulario *præſente comprobentur*, where this *Nummularius* ſeems to be the ſame as the *Libripens*, who was generally called in to count over and examine the Money at Payments for Purchaſes, though ſometimes a private Perſon or Friend to the Parties might probably perform this Office for them, and be an Evidence, upon Occaſion, to the Facts: To which End alſo they uſed to adhibit another Witneſs, as *Herennius Agricola* does here, who was one *Tiberius Julius Erotes*, and ſometimes they added five more. The Form and Manner of doing it, was by aſking a By-ſtander, *Licetne anteſtari?* If he conſented, the Demandant touched, or pulled, the lower Part of his Ear, as a Memorandum of what paſſed; whence *Horace* in his IXth Satire,

—— —— *caſu venit obvius illi*
Adverſarius, & quo tu turpiſſime? magnâ
Exclamat voce, & Licet Anteſtari? *ego verò*
Oppono Auriculam ——

By the Law of the XII Tables, if he that was called to teſtify in this Manner, or the *Libripens* refuſed afterwards to give his Evidence in the Caſe, they were adjudged infamous. *A. Gel.* l. xv. c. 14.

Barrow N.° III.

Fig. 25.



Barrow N.° IV.

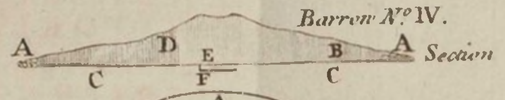
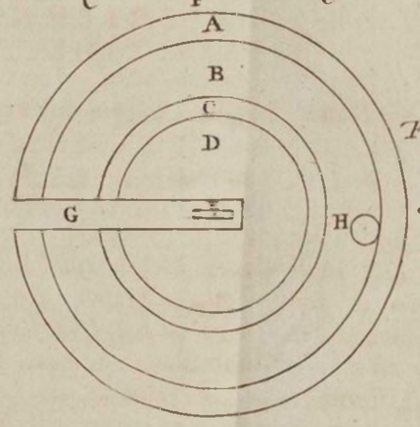


Fig. 26.



Plan of Castle Gotha

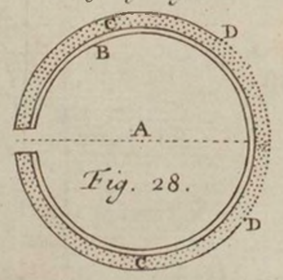


Fig. 28.

The Urn.

Fig. 27.

A Scale of feet for Barrow N.° III & IV.

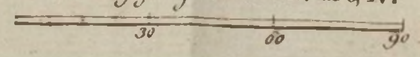


Fig. 30.

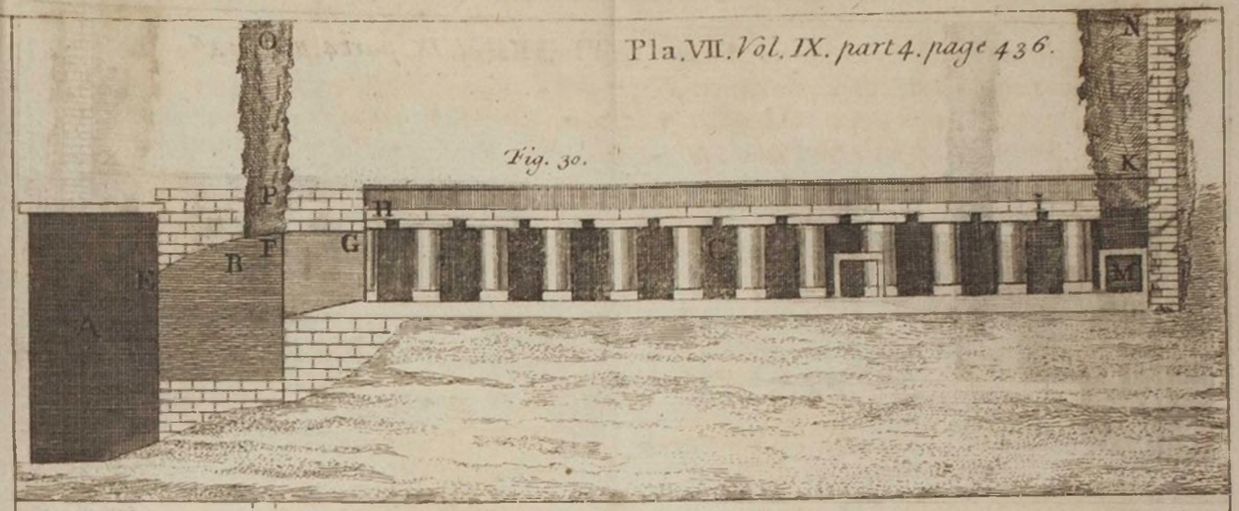
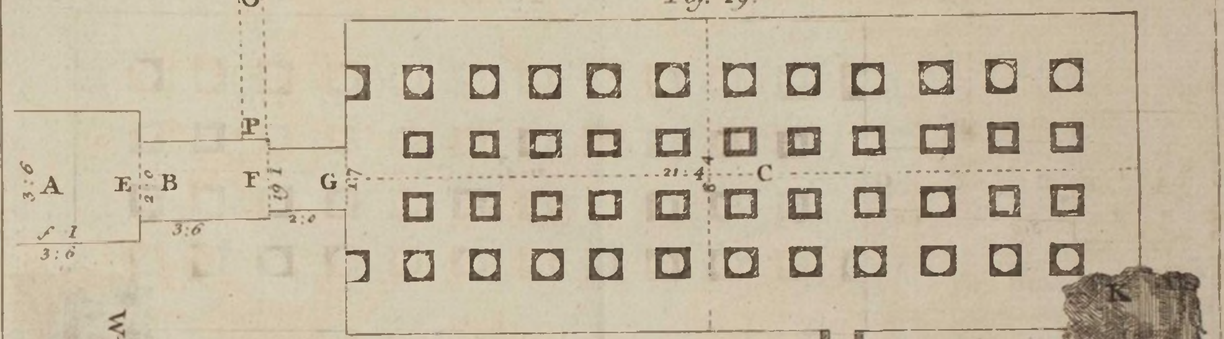


Fig. 29.



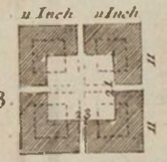


Fig. 33.

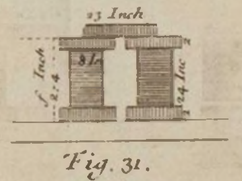


Fig. 31.

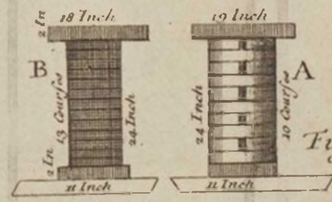
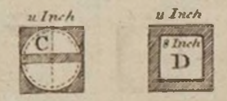
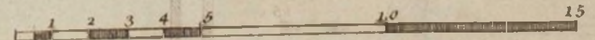


Fig. 32.





A Scale of 15 feet.

Line 18.) EARVM OLLARVM ſeems to be a Miſtake for EORVM OLLARIORVM.

Line 20 to 27.) are Covenants uſual upon this Occaſion, as may be ſeen in the like ſepulchral Contracts, particularly the before-mentioned in *Gruter* (p. MLXXXI. 1.) and many other Donations and Orders about Monuments in his voluminous Collection; as alſo in *Fabretti*, and *Reineſius*.

Line 28.) SE ſeems to have been a Blunder of the *Marmorarius* for SIBI, SE DARI being perfectly ungrammatical. But in the Contract aforeſaid, given us by *Gruter*, the Words run, *De ea re dolum malum abeſſe, afuturumque a te, Hærede tuo, & ab his omnibus ad quos ea res pertinebit, hæc* SIC *rectè dari, fieri, præſtarique ſtipulatus eſt*; which inclines me rather to believe, that SE in ours ought likewiſe to have been SIC. There are many palpable Miſtakes in it, as I have before obſerved, as in Line the 23d VELLIT for VELIT, and CLAVISVE for CLAVISQVE, in the 24th.

The *Roman* Lawyers tell us, that *Stipulatio erat Interrogatio certis, ſolennibuſque verbis concepta; & apta, conſentaneaque reſponſio, veluti* ſpondes? ſpondeo. Dabis? Do. This is fully confirmed both in ours, and the *Gruterian* Contract, (p. MLXXXI. 1.) *Stipulatus eſt Marcus Herennius Agricola: Spepondit T. Flavius Artemidorus:* In the latter. *Stipulatus eſt Licinius Timotheus: Spepondit Statia Irene.* The learned Mr *Mattaire* obſerves from *Aulus Gellius* (Lib. vii. c. 9.) that ancient Authors uſed *e* inſtead of *o*, in thoſe Verbs which have a Reduplication [*in præterito tempore*] as *memordi, pepoſci, ſpepondi*, for *momordi, popoſci, ſpopondi*, uſed by more modern Writers; ſo that SPEPONDIT is no Miſtake, but an Archaiſmus, as may be the Word IENTIBVS in the 12th Line; though it has not had the good Fortune to have been remarked, as the latter. *Iens* in the Nominative Caſe was uſed more than once by *Cicero*; and though he declines it, like all other Authors now in being, *Euntis, Eunti*, &c. yet it might originally have been declined *Ientis, Ienti*; but as there is now no Authority extant to warrant it, this muſt paſs as meer Conjecture.

Line 32.) There are no ſuch Names to be found in any of the *Faſti Conſulares* as *C. Calpurnius Flaccus* and *Lucius Trebius Germanus*; ſo they muſt have been not the *Conſules Ordinarij* of the Year, but *Suffecti*. It is very ſtrange that the *Romans* ſhould ſo long adhere to this troubleſome and uncertain Method of Computation by Years of their Conſuls, ſince they had frequently ſeveral Pairs of them in the ſame Year, eſpecially after they fell under the Imperial Government. Some reckoned by the ordinary Conſuls, who came into their Office upon the firſt of *January*, about 600 Years after the building of *Rome*; for 'till that Time the Month of their entring upon that Dignity was not fixed; and others computed by the *Suffecti*, who might come in ſeveral Months after, as Vacancies happened, or as they were appointed by the Emperor, tho' their Names were ſeldom inſerted in the *Faſti*. Beſides this, it was impoſſible

impoſſible for any Man to remember how many Years were elapſed from the preſent Time upwards, to ſuch and ſuch Conſuls, without Tables of their Succeſſion, or having Recourſe to ſome other Æra, as the A. V. C. *anno Urbis conditæ*, which they do not ſeem to have much regarded.

In *Gruter* (p. XLVI. 9) is a long Inſcription, mentioning TREBIVS GERMANVS, (though not as Conſul,) in the Reign of *Septimius Severus*; and another (p. CCCLXXXII. 7.) of C. CALPVRNIVS FLACCVS: If theſe Men were the Conſuls here referred to, as they might be, the Age of our Marble will be aſcertained within a few Years.

The Stone is turned with an Arch at Top; the whole Length of it is 27 Inches and a half; the Breadth at the Bottom of it is 10 ½ Inches, and at the Baſe of the Arch 12 ¼ Inches, it widening gradually upwards. The Letters are cut in a ſmall indifferent Character; that of the E and the F are remarkable, being always formed in this manner E. *f.** It was probably placed over or between the 4 *Niches*, or OLLARIA granted to *M. Herennius Agricola* in this Monument by *T. Flavius Artemidorus*, in order to declare and aſſert the Right and Poſſeſſion of them to the former, and his Family, 'till they were all filled.

An Explanation of the Runic Characters of Helſingland, *by Mr* Andrew Celſius, *R. S. Suec. Secr. F. R. S. and Prof. Aſtron. at* Upſal. No. 445. p. 7. Jan. &c. 1737. Fig. 16.

XIV. 'Tis well known, that there are Stones found in the ſeveral Parts of *Sweden*, which were formerly ſet up as Obeliſks in Memory of the Dead. Theſe Monuments are marked with the ancient Northern Letters, called *Runor* (or *Runic Characters*). But there is one Province of North *Sweden*, namely *Helſingland*, where five of thoſe Stones occur, which have Characters cut into them, that ſeem to differ from the common *Runic*. Upon the Introduction of our modern Letters, theſe *Runic Characters* became ſo little regarded, that their Interpretation was loſt even to the Antiquarians of our Country till the Year 1674; when my Grandfather *Magnus Celſius*, then Profeſſor of Aſtronomy in the Univerſity of *Upſal*, revived their Reading, and drew up an Alphabet of them, ranged after the manner of the Ancients. There are but 16 Letters, and the Words are frequently diſtinguiſhed either by 3 Points ſet perpendicularly over one another, or by two at ſome Diſtance aſunder.

Among the ſeveral Alphabets hitherto known, it would be a hard Matter to find one like the above-mentioned; if we may not perhaps except the Characters of the *Perſepolis* Inſcriptions, which have not as yet been decyphered. For the Letters generally made uſe of ſignify different Sounds, according to their various Shapes: Whereas in this Alphabet the ſame Character often denotes a different Sound, according to the Diverſity of it's Place and Attitude between the two Parallels. Thus a ſtrait Stroke, ſtanding perpendicular to the parallel Lines, ſignifies I, F, D and S. For when it joins theſe Parallels, it ſignifies I; when it reſts on the lower Parallel, it ſignifies F; on the upper S; and D, when it touches neither of them. The ſmall Wedge leaning to

* As will appear by examining the engraven Copy of it Fig. 15. which is taken very exactly to all the Dimenſions by a Scale of half the original Size.

the Right, and placed near the upper Parallel, denotes L; in the middle, N; and O, near the lower. A Line deſcending from the upper Parallel, and making a Curve downward to the left, ſtands for K; the ſame placed contrarywiſe, from the lower Parallel upward, expreſſes R: And ſo of the reſt.

The Intention of the firſt Inventor of theſe Letters ſeems to have been, to form all the Characters of ſmall Wedges, ſtrait and crooked Lines, and two Points, variouſly placed between the two Parallels. For the Wedges may be placed 15 different ways; as in Fig. 17. The ſtrait Line may alſo have 15 different Situations, as in Fig. 18. The crooked Lines can likewiſe be varied 14 different ways, as in Fig. 19. In fine, the two Points admit 12 Variations, as in Fig. 20. But as the ancient *Sueo-Gothi* had but 16 Letters in their Alphabet, they did not want all theſe Variations of the Wedges, Lines, and Points: Wherefore they employed 6 Variations of the Wedges; of the ſtrait Lines, 5; of the crooked, 3; and but 2 of the Points. Fig. 17. Fig. 18. Fig. 19. Fig. 20.

If we now ſuppoſe theſe *Helſingic Characters* to be older than the common *Runics*, the greateſt Part of the common *Runics* can eaſily be derived from the *Helſingics*, by adding a perpendicular Line to the ſmall Wedges and Curves; as appears in Fig. 21. Fig. 21.

But if we ſuppoſe the common *Runics* to be older, and to be derived, as it is very probable, from the ancient *Greek* and *Roman* Letters; we muſt, in the contrary way, deduce the *Helſingic Characters* from the common *Runics*, by ſubtracting the perpendicular Line.

As a Specimen, I beg Leave to lay before this Society a Stone found at *Malſtad*, a View of which is repreſented in Fig. 22, and the Reading in Fig. 23. I took an exact Copy of it in the Year 1725, in Company with my Uncle, the Rev. Dr *Olave Celſius*, of whom we expect a compleat Account of all theſe *Helſingic* Inſcriptions; the Reading in *Engliſh* is thus: Fig. 22, 23.

Frumunt *erected this Stone to* Fiſiulfi *the Son of* Briſi: *But* Briſi *was the Son of* Lini. *But* Lini *was the Son of* Un. *But* Un *was the Son of* Fah. *But* Fah *the Son of* Duri. *But he (the Son) of* Barlaf. *But he the Son of* Drun: *But he (the Son) of* Lanas: *But he (the Son) of* Fidraſiv. Frumunt *the Son of* Fiſiulfi *made theſe* Runic [*Letters.*] *We have placed this Stone to the North of* Bala Stone. Arva *was the Mother of* Fiſiulfi. Siulfir (*or* Fiſiulfir) *was the Governor of this Province. His Place of Abode was in* Rimbium.

That this Monument was erected ſince Chriſtanity began to flouriſh in *Sweden*, ſufficiently appears by the Figure of the Croſs. Moreover, 'tis probable that *Fiſiulfi*, as the Governor of the Province, was deſcended of a very noble Family; ſeeing his Genealogy is traced 10 Generations backward. Now if we ſuppoſe *Frumunt* to have been 30 Years of Age when he erected this Monument for his Father, and, with

Sir

Sir *I. Newton*, allow 30 Years for each Generation; we ſhall find 330 Years from the Death of *Fiſtulfi* to the Birth of *Fidraſtu*, who is the Stock of theſe Generations.

This Stone is publiſhed in M. *de la Motraye*'s Travels; but with conſiderable Errors in the Windings of the Snakes, and in the Letters, as well as in the Explanation given to them.

An Account of the Diſcovery of the Remains of a City under-ground, near Naples; *communicated to the* Royal Society *by* William Sloane, *Eſq; F. R. S.* No 456. p. 345. *dated* Naples *March* 7. 1731-2.

XV. At *Reſina*, about 4 Miles from *Naples*, under the Mountain, within half a Mile of the Sea-ſide, there is a Well in a poor Man's Yard, down which about 30 Yards there is a Hole, which ſome People have the Curioſity to creep into, and may afterwards creep a good way under-ground, and with Lights find Foundations of Houſes and Streets, which, by ſome it is ſaid, was in the Time of the *Romans* a City called *Aretina*, others ſay *Port Hercules*, where the *Romans* uſually embarked from for *Africa*. I have ſeen the Well, which is deep, and a good Depth of Water at the Bottom, that I never cared to venture down, being heavy, and the Ropes bad. This City, it is thought, was overwhelmed by an Eruption of the Mountain *Veſuvius*, not ſunk by Earthquakes as were *Cuma*, *Baia*, *Trepergola*, &c. Signed,

William Hammond.

Rome, Nov. 20. 1739.

Extracts of two Letters from Sig^r Camillo Paderni *at* Rome, *to Mr* Allan Ramſay, *Painter, in* Covent-Garden, *concerning ſome ancient Statues, Pictures, and other Curioſities, found in a ſubterraneous Town, lately diſcovered near* Naples. *Tranſlated from the Italian by Mr* Ramſay, No. 458. p. 484. Sept. &c. 1740.

XVI. 1. I told you in one of my former Letters, that the King of *Naples* had made a Diſcovery of a ſubterraneous Town at *Portici*, a ſmall Village at the Foot of Mount *Veſuvius*; and that our old Friend Sig^r *Gioſeppe Conart*, as Sculptor to the King, had the Care of the Statues found there, with Orders to reſtore them, where they are damaged. Within theſe few Days he is returned hither to ſettle his Affairs, and has informed me of ſome of the Particulars, in ſuch a manner as very much incites my Curioſity, and Deſire of communicating them to the Publick, by making Deſigns of them on the Spot, He tells me, they enter into this Place by a Pit, like a Well, to the Depth of 88 *Neapolitan* Palms *; and then dig their Way (after the Manner of our *Catacombs*) under the bituminous Matter, thrown out of the Mountain in the Time of great Eruptions, and called by the People of the Country, the *Lava*, which is as hard as a Flint. And when they meet with any thing that ſeems valuable, they pick it out, and leave the reſt. But I am afraid, that after they have ſearched, they throw the Earth in again; by which means many Curioſities may be loſt, not being underſtood by theſe Labourers. They have already found the following Things:

An Amphitheatre, with it's Steps.
An Equeſtrian Statue, but all broken to Pieces.
A Chariot and Horſes of Braſs, which have had the ſame Fate.
A large braſen Diſh, ſaid to be found in a Temple.

* A *Neapolitan* Palm contains near 9 Inches.

They

Fig 16

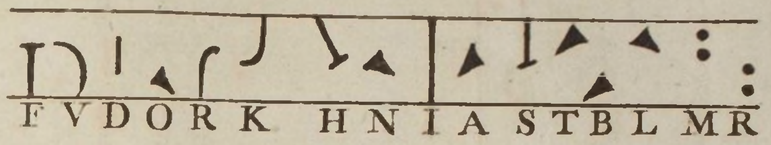


Fig. 17.

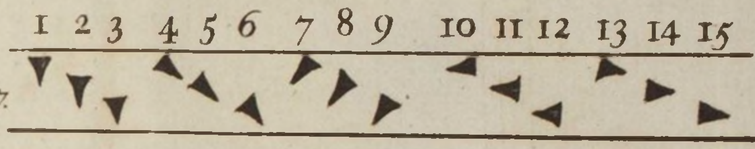


Fig. 18.

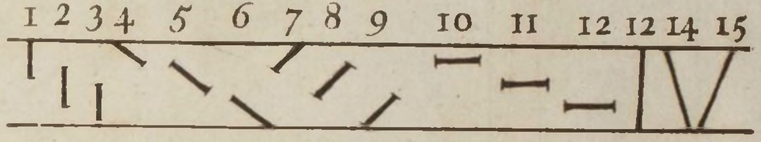


Fig. 19.

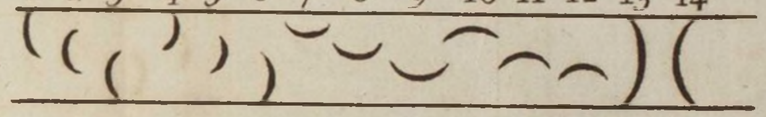


Fig. 20.

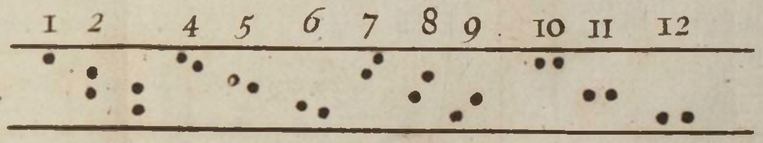
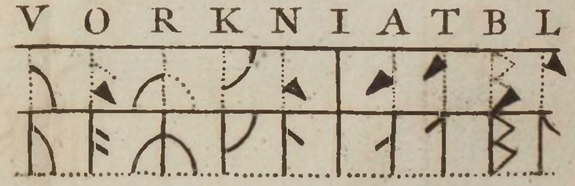


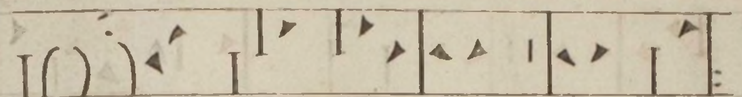
Fig. 21.



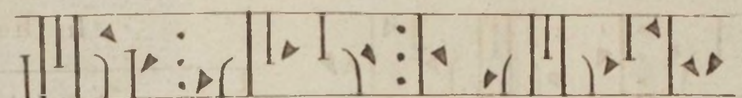
Pla. V. *Vol. IX. part 4. page 440.*

Fig. 22.

On the outward Limb or Border.



FRUMUNT FST STAINA DINA FTIR

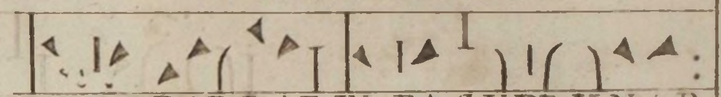


FISIULFA BRISA SUN IN BRISIVASLINA

SUN·IN LINI VAS UNAR SUN; INUNVAS

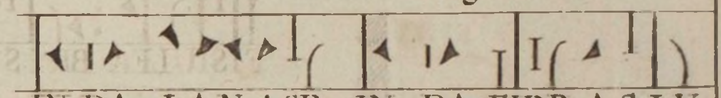
FAH SUN; IN FAHA DURI SUN.

In the firſt Curvature.



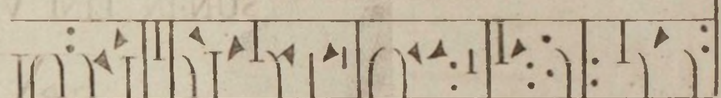
IN DA BARLAF; IN DA SUDRUNAR

In the ſecond Snake. Dragon.



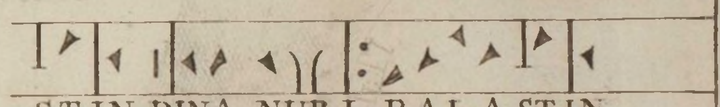
IN DA LANASR; IN DA FIDRASIV

In the inner Limb.



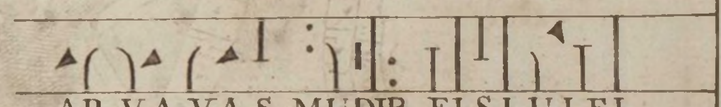
FRUMUNTFISIULFA SUN FADIRUNARDISAR VIRSUTUM

Fig. 23.



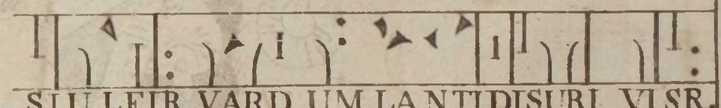
ST IN DINA NURI BAL A STIN

In the ſecond Curvature.



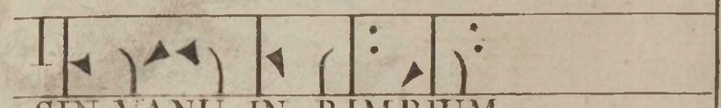
AR VA VAS MUDIR FISI ULFI

In the firſt Snake.



SIU LFIR VARD UM LANTIDISURI VISR.

In the Heads of the Snakes.



SIN VANU IN RIMBIUM

They have alſo dug out many other Bronzes, with ſeveral Statues and Baſ-relieves, which Sig *Gioſeppe* is now reſtoring.

There have been found likewiſe 8 Rings with their Cornelians engraven, and a Bracelet of Gold.

And they have already taken up about 30 or more Pieces of ancient Painting, ſome of which are exceeding beautiful.

Sig. *Gioſeppe* gave me a Note of the Pictures, but as it is in *Spaniſh*, and writ in a very bad Hand, I cannot pretend to tranſmit it to you; but chooſe rather to defer it, till I have ſeen them myſelf, which ſhall be as ſoon as I have finiſhed a Piece of Work I am now about, *&c.*

Rome, Feb. 20, 1740.

2. As ſoon as I arrived at *Naples*, Sig. *Gioſeppe* met me, and carried me to *Portici*. The firſt Thing he ſhewed me was the Pictures they had dug out, ſuch as never were ſeen in our Days; and were you to ſee them, you would be ſurpriſed as much as I was; for you would ſee Paintings finiſhed to the higheſt Pitch, coloured to Perfection, and as freſh as if they had been done a Month ago. *The ſecond Letter*, Ibid. 486.

Particularly one Piece, 8 Palms broad by 9 high, the Figures as big as the Life, repreſenting *Theſeus* after having killed the *Minotaur*, which is wonderfully fine. You ſee the Figure of *Theſeus* naked and ſtanding, which, in my Opinion, cannot be more properly reſembled to any other Thing, than the *Antinous* of the *Belvidera*, both for the Attitude and Air of the Head. It is drawn and coloured with prodigious Elegance. The *Greek* Boys, who are repreſented as returning him Thanks for their Deliverance, ſeem, for their noble Simplicity, the Work of *Dominichino*; and the Compoſition of the whole is worthy of *Raphael*.

Another Piece repreſents *Chiron* teaching *Achilles* to touch the Lyre.

Another large one, like that of *Theſeus*, the Figures as big as the Life; but we could not comprehend the Deſign of it. You ſee a Woman dreſſed in White ſitting, with one Hand reſting on her Head, adorned with a Garland of Flowers, and ſeveral Deities (as they appear to me) in the Air, with a black Figure of *Hercules* leaning upon his Club. This Figure is not of a Piece with the reſt, which are really Prodigies of the Pencil; but yet it is a fine Picture. Under the Woman is a Deer, which gives Suck to a Child. But was you to ſee this ſitting Figure, and the Heads of thoſe whom I take to be Divinities, how finely they are drawn and coloured, you would be aſtoniſhed.

Two other Pieces of greater Height than Breadth, in which there are two Figures, half human and half Fiſh, which fly in the Air.

Four Landſkips, with Temples and other Buildings.

Another Figure, which we think to be *Mercury*, with a Child in his Hand, delivering it to a Woman ſitting.

A *Tyger*, with a Boy upon it; and another Boy, who plays on a *Tympanum*: With many others.

After having viewed all these Things, which are already taken out, I went down into the Pit. The Part where they are at work, must have been a stupendous Building; and without Doubt one may conjecture it to have been an Amphitheatre, by the Circumference of the Walls, and the large Steps, which are still preserved. But it is impossible to see the Symmetry of the whole, because one must travel through streight Passages, like our *Catacombs* in *Rome*. After having gone a good Way under-ground, I arrived at the Place in which the Paintings had been discovered, and where they are daily discovering more. The first Mistake those Men they call Intendants have committed, is, their having dug out the Pictures, without drawing the Situation of the Place, that is, the Niches, where they stood: For they were all adorned with Grotesques, composed of most elegant Masques, Figures, and Animals; which, not being copied, are gone to Destruction, and the like will happen to the rest. Then, if they meet with any Pieces of Painting not so well preserved as the rest, they leave them where they found them. Besides, there are Pillars of *Stucco* extremely curious, consisting of many Sides, all variously painted, of which they do not preserve the least Memory. But what is most curious, is to see these Paintings all covered with Earth, which when taken off, they appear to have suffered nothing by it. I believe this may be accounted for, by there being no Damp or Moisture in the Place; and that the dry Earth has been rather preservative than hurtful to them. The ancient Beams are yet discernible, but they are become like Charcoal. And I have seen there a Place where anciently they kept Lime for building; a great Quantity of which yet remains as fresh as if made but yesterday. In a Word, perceiving all those who are called Superintendants of this Affair, wholly ignorant of what they are about, I began to suffer in a very sensible Manner; so that every Day appeared a Month, till I should deliver my Letter, and see what Success it would meet with. For had it succeeded, I should have gone immediately, and drawn those Things, which, not being taken care of, though of great Curiosity and Erudition, will soon be destroyed.——However, as I could do nothing more, and having a great Concern for those fine Things in a perishing Condition, I left them a Paper of Directions how to manage. If they do not observe them, the greater Misfortune will be ours, to hear that what Time, Earthquakes, and the Ravages of the Volcano, have spared, are now destroyed by those who pretend to have the Care of them, *&c.*

Extract of a Letter from Mr George Knapton, *upon the same Subject.* Ibid. p. 489.

3. I shall not trouble you with any Account of the Curiosities of *Naples*, they being so well known, only of one which is something out of the common Way, the ancient City of *Herculaneum*, which was swallowed up by an Earthquake. It is now under a Town called *Portici*, a Quarter of a Mile from the Sea, at the Foot of *Vesuvius*; and has no other Road to it, but that of the Town-well, which is none of the most agreeable, being in some Parts very streight, in others wide, and cut in a most rude Manner. Toward the Bottom, where you go into the City,

City, it is very broad, which they have made ſo, to turn the Columns, which were brought up: For I ſpoke to an old Man, living next Door to the Well, who told me, he was one of thoſe employed in digging there; and that they began 27 Years ago, and worked 5 Years: That the beſt Part of the Duke *di Beloſi*'s preſent Eſtate was found there; the moſt principal Things were, two Columns of Oriental Alabaſter, which were ſold for 50,000 Ducats: That they had found alſo many fine Statues, the beſt of which were ſold, and ſome he had ſent to *Lorraine*. I ſaw 5 which they have put up in the Market-place, all clothed Figures, one in a Conſular Habit, the others Women: They are all well dreſt, and in a fine Taſte, but want the Heads. In the Duke's *Villa*, which is near and by the Sea-ſide, are two others entire, both Women; one ſeems to be a *Livia*: Alſo the Fragments of a naked Figure, which wants the Head and Arms, of a good Style. Theſe, with ſome Ornaments and Fragments of various Sorts of Marbles, are all that is to be ſeen there, of what has been dug up.

Having given you ſome Account of what is taken out of this ſubterraneous City, I ſhall now proceed to what remains in it, and our Journey down to it. At our coming to the Well, which is in a ſmall Square, ſurrounded with miſerable Houſes, filled with miſerable ugly old Women, they ſoon gathered about us, wondering what brought us thither; but when the Men who were with us broke away the paltry Machine with which they uſed to draw up ſmall Buckets of Water, I thought we ſhould have been ſtoned by them: Till, perceiving one more furious than the reſt, whom we found to be *Padrona* of the Well, by applying a ſmall Bit of Money to her, we made a ſhift to quiet the Tumult. Our having all the Tackle for deſcending to ſeek, gave Time for all the Town to gather round us, which was very troubleſome: For, when any one offered to go down, he was prevented either by a Wife, or a Mother; ſo that we were forced to ſeek a motherleſs Bachelor to go firſt. It being very difficult for the firſt to get in, the Well being very broad at that Part, ſo that they were obliged to ſwing him in, and the People above making ſuch a Noiſe, that the Man in the Well could not be heard, obliged our Company to draw their Swords, and threaten any who ſpoke with Death. This cauſed a Silence, after which our Guide was ſoon landed ſafe, who pulled us in by the Legs, as we came down. The Entrance is 82 Feet from the Top of the Well: It is large, and branches out into many Ways, which they have cut. We were forced to mark with Chalk, when we came to any Turning, to prevent loſing ourſelves. It gives one a perfect Idea of a City deſtroyed in that Manner: For one there ſees great Quantities of Timber, in the Form of Beams and Rafters, ſome lying one Way, ſome another; ſome, as they broke in the Fall, others entire: Theſe are ſticking in the Sides of the Ways, and are become a perfect Charcoal; but thoſe in moiſt Places, and where the Water ouſes, you may run your Hand into, and work like a Paſte, and they have more the Colour of rotten

Wood. The Walls are ſome tumbled ſlanting, others croſſing them, and many are upright. One ſees great Quantities of Marble, as Bits of Window-caſes and other Ornaments, ſticking out on all Parts. There ſeem to be, in one Place, the Ruins of ſome magnificent Building, which they have dug round; for there appear the Baſes in white Marble of ſquare and round Columns, which are all of a Size; and, what is ſurpriſing, they have not examined whether they have any Columns on them, which one Stroke of the Pick-ax would have done. I ſcraped away the Earth at the Side of the Baſe of a Pilaſter, and found the Wall covered with a very beautiful Marble, but could not reach to diſcover what was on the Top of it. There are but two Columns that appear, one of a red Marble, the other of Brick covered with Stucco, and fluted. In one Place there are about 14 Steps, which reſembled the Seats of a Theatre. Some of the Walls have the Plaſter remaining, and are painted, the Colours ſtill freſh. *We found many Ways filled up, which they had done to ſave the Trouble of carrying out the Earth.* I obſerved that they had not gone near the Bottom of the Ruins, for fear, I ſuppoſe, of the Springs; for in ſome Parts they ſeem to be as low as the Water in the Well. One ſees nothing but pure Earth mixed with theſe Ruins; whereas the Surface of all that Part of the Country, quite to the Sea, is covered with the Cynders of *Veſuvius*. One ſees the Buildings were of Brick covered with Marble; for I found no other Sort of Stone there, but thin Plates of Marble of all Sorts in great Quantity. Neither are there any Baſes or Capitals of large Columns; two Feet Diameter is the moſt. Captain *Emelie* brought away a ſmall Capital of a Pilaſter, which is very curious, it being much the ſame as was uſed by the *Goths* in *Italy*. This makes me think, that they revived the ancient barbarous Style, uſed before the Introduction of the *Greek*, for the Capital: This is certainly more ancient than the Time of the *Goths* in *Italy*. It was the only one of the Kind we ſaw there.

Rome, *April* 24, 1740.

Extract of a Letter from Mr Criſpe, *upon the ſame Subject.* Ibid. 493.

4. At *Portici* I ſaw ſome antique Paintings, which have lately been taken out of the Ruins of *Herculaneum*: Two of them, about 12 Feet ſquare, with their painted Frames or Borders round them, are as freſh and perfect as if done yeſterday; much more ſo, I aſſure you, than ſome of *Raphael*'s in the *Vatican*; and for Excellence, and fine Taſte, they are, I think, beyond any Thing I have ſeen. One of theſe is called the *Pomona*, becauſe, among other Figures, there is a Woman ſitting crowned with Fruits and Bloſſoms. The other is *Theſeus*, having juſt killed the *Minotaur*, who lies dead at his Feet; a Figure of a Youth is kiſſing his Right-hand; *Ariadne* and another Figure ſtand at his Left. The Figures in both theſe are as big as Life. There is a third, ſomewhat leſs, of *Chiron* teaching *Achilles* on the Harp, if poſſible, ſtill beyond the two former. There are above 50 other Pieces, ſome

ſome whole Figures, ſome Heads, ſome *Maſcheras*, ſome Landſkips, ſome Architecture.

I was to viſit the Ruins under-ground, where I ſaw ſeveral Pieces that were taking down, particularly one 15 Feet wide, and eight high: It conſiſts of the Front of a large Temple, with Buildings of the ſame Architecture projecting on each Side, in the Nature of the Wings of a Houſe. There are Houſes alſo adjoining to this Temple, with Windows divided into Squares, which Squares are painted of a greyiſh Colour: I will not pretend to ſay, this is to repreſent Glaſs, becauſe I believe we have no Authority for it in any Author of Antiquity: But I tell you the Fact as it is, and among the *Virtuoſi* of your Acquaintance you may find out the Meaning. I muſt obſerve to you, that in this Architecture the Perſpective is very exact; which one may judge of with a good deal of Certainty in thoſe Wings which project. The Architecture is very rich and noble: The *Clair-Obſcur* likewiſe in the other Pictures is well underſtood; particularly in the *Pomona*, where there are ſix Figures, which are very agreeably grouped, and the Eye is immediately pleaſed and repoſed. They have dug up a good many Statues, but not above one or two that are tolerably good. There is, however, a perfect Buſt of *Agrippina*, Mother of *Nero*, which was found ſtanding in it's Niche: It is as clean as if juſt finiſhed, has not the leaſt Damage, and is, in the Judgment of every body, as well as myſelf, equal to moſt Things of that Kind in the World: For my own Part, I ſhould not ſtick to ſay, it is altogether as fine a Portrait as the *Caracalla* of the *Farneſe*. There are two Equeſtrian Statues in Bronze, broken all to Pieces, but which, by the Parts, one may judge to be as big as the *Marcus Aurelius*: They are ſoon to be put together. They have found ſeveral antique Rings, with *Cameo's* and *Intaglia's* ſet in them; a Fork, a Silver Spoon, made in the Handle like a modern one; the Bowl is pointed like an Olive-leaf; a Caſe of Surgeon's Inſtruments, ſeveral Kitchen Utenſils, Mouſe-traps, Veſſels full of Rice, a triumphal Car of Bronze, *&c.*

XVII. It may not be improper to obſerve, that theſe *Barrows*, or conical Hillocks, are generally ſituated on Places of Eminence, on or near the Summit of Downs, and ſo capable of being ſeen at a great Diſtance; and likewiſe very often near the moſt publick or greateſt Roads, though ſometimes in incloſed or fenced Lands, but not often: They lie ſometimes 2, 3, even 7, in a ſtrait Line, now and then only one or two by themſelves: Sometimes alſo the ſingle ones ſeem to regard, in reſpect of their Poſition, a greater Number, as is obſervable in N° IV. where the Urn was found, and N° V. on the ſame Down.

An Attempt to examine the Barrows *in* Cornwall, *by* Stephen Williams, *M. D. F. R. S.* Ibid. p. 465.

Fig. 24.

The Height and Dimenſions of the *Barrows* in *Cornwall* are various, from 4 to 30 Feet high, and from 15 to 130 broad; but they always bear a regular Proportion in their Form. Some have a *Foſſa* or Ditch round their Circumferences, others none; ſome a ſmall Circle of Stones

at

at the Top, others none; ſome a Circle of Stones round the extreme Verge of their Baſis.

The *Barrows*, which are the Subject of our preſent Inquiry, lie on the Summit of *St Auſtle Downs*, about a Mile from the Town, and half a Mile from the Sea; where a fine Bay is formed by Nature, well defended from moſt Winds, with good Anchorage, and deep Water. Mr *Mitchel*, Lieutenant in the Navy, has lately taken a curious Survey of it, by Order of the Admiralty, and for the Benefit of the *Engliſh* Fleet.

Fig. 24. Barrow, No. 1. We opened *Barrow*, N° 1. a ſmall one, with no Ditch round it, but a ſmall Circle of Stones on the Top, of the Height of 4 Feet, of the Breadth, at the Baſis, of 15: When we had taken off the Surface, the Body of the *Barrow* ſeemed to be compoſed of foreign or adventitious Earth, which being cut through near the Centre, we found a circular Pit of a Foot deep, and of the ſame Diameter, dug out of the natural Soil of the Country, and two flat Stones in it. By adventitious or foreign Earth, is meant ſuch as does not riſe on the Place, but is fetched from ſome Diſtance; ſo the Earth of this and the other *Barrows*, of a yellow Colour, is known to be the natural Soil of a Hill a Mile diſtant from them.

Barrow, No. 11. The perpendicular Height is about 8 Feet Diameter, at the Baſe about 30 Feet, with a *Foſſa* or Ditch round it: The Surface being removed, the Body of the *Barrow* conſiſted of the adventitious Earth, of a yellow Colour, and now and then ſome ſmall Stones interſperſed, not regularly; at the middle we found a Pit of a cylindrical Shape, 2 Feet broad, and 1 ½ Foot deep, out of the natural Soil: Over the Pit we obſerved 3 Stones placed Edgeways, to cover the ſame, though nothing in it but ſome Earth of the *Barrow*, and 3 ſmall Stones.

Barrow, No. 111. The perpendicular Height of the *Barrow* was 10 ½ Feet, Diameter, at the Baſe 46, with a Ditch round it: Upon removing the Heath or Graſs, (which was the common Surface to all the *Barrows*) we obſerved the ſame yellow adventitious Earth, which being penetrated a Foot through, we found a ſmall Circle of Stones at *B*, which ſurrounded the *Barrow*; then being paſſed through the ſame yellow Earth, we came to *C*, within 10 Feet of the Centre of the *Barrow*, where we found a *Stratum* or Lay of flat Stones, carefully laid flatways, to cover the reſt underneath, as in the Roof of an Oven; which being taken off by the 6 Tinners, (whom an ingenious Gentleman of *St Auſtle*, and myſelf, employed on Purpoſe) a large Bed or Heap of Stones, irregularly and confuſedly mixed together, and of various Sorts, appeared, and under them a large Number of Stones artfully placed and contrived, ſo as to form the Shape of a Cone, their Points uppermoſt, and their largeſt Parts downward. Under this Heap we ſaw a Circle of 2 Feet Diameter, equal in Height with the natural Surface of the Country, and cauſewayed with ſmall Stones laid Edgeways, their ſharpeſt Point downward; which Stones being taken up, we obſerved a cylindrical Pit at *D*, two Feet broad,

Fig. 25.

broad, and 2 ½ Feet deep, cut out of the natural Soil, as the former; the Sides of the Pit were carefully lined round with these flat Stones, though none at the Bottom. We met with, first, some small Stones of various Shapes and Sizes, lying irregularly; under them appeared a black greasy Matter, but not above an Inch thick; some of the adventitious Earth had crept through the Crevices of the causewayed Stones into the Pit. It deserves our serious Observation, that the Stones (which composed the Heap lying over the cylindrical Pit) were brought from Places both high and low situated, and many Miles distant from one another, as the *Par*, *Polmeor-Clif*, *Hainsbarrow*, *Pentuan*, and *Carnclays*, a high Hill, the Distance between some of these being four or five Miles.

Though we had hitherto found no Urn, yet being persuaded by the unctuous black Earth, and the cylindrical Pits, in the Centre of every one of the *Barrows*, the artful Position of the Stones to cover and guard them, and the foreign Earth, that these *Barrows* were erected for Sepulchres; we resolved to proceed farther, and pitched upon N° IV. as one somewhat different from the rest, both as it's Situation seemed to regard a greater Number of *Barrows*, and as it's Circumference appeared to have a very large Circle of Stones round it, without any Ditch or *Fossa*. Barrow, No. IV.

We began our Passage at *A*, through a Circle of Stones of five Feet broad, and two high; then we passed through adventitious Earth *B*, when we came to a second Circle at *C*, of Stones of 3 Feet high, and 3 Feet broad; after them appeared nothing but foreign Earth, till we found, at the Centre *E* of the *Barrow*, an oblong square Pit, of the Depth of 1 ½ Foot, and Breadth 2 Feet, and Length 5 Feet; in the Bottom appeared a black greasy Matter or Substance, as in the last *Barrow*, about an Inch thick; the Pit was not covered or defended by any Stones. However, being not satisfied, we examined the uttermost Circle of Stones, and on the Inside of it we struck on a great flat Stone, about 5 Feet broad, and one Foot thick, under which, when lifted up, we found two other thin flat Stones, and under them a smaller flat Stone, which covered an Urn, which also stood upon another flat Stone in a small Pit, deeper than the Circle of Stones, and carefully wedged in, as well as supported, with many small Stones round it: This Urn is made of burnt or calcined Earth, very hard, and very black in the Inside; it has 4 little Ears or Handles; it's Sides are not half an Inch thick; in it were 7 Quarts of burnt Bones and Ashes; we could easily distinguish the Bones, but so altered by the Fire as not to be known what Part of the Skeleton they composed: The Urn will hold 2 Gallons, and more; it's Height is 13 ½ Inches, Diameter at the Mouth 8, at the Middle 11, and at the Bottom 6 ½. Fig. 26. Fig. 27.

Before we proceed any farther, a natural Observation will occur, in what Manner the Ancients (that used Cremation, and all Nations of that Way of Burial) expressed their Regard for the Deceased; and this plainly

plainly appears from the Structure of the *Barrows* or *Tumuli*, particularly N° 111. which is not only compoſed of foreign Earth, but of Stones brought from ſo many and ſo different Places; for, in erecting theſe *Tumuli*, the greater the Charge or Trouble, the greater muſt be the Reſpect due to their Princes or Generals. Thus each Soldier or Friend might bring ſome of the Earth or Stones from diſtant Places, where they lived, or were ſtationed, to compoſe the *Tumulus*, which generally was in Proportion to the Greatneſs, Rank, or Power of the Deceaſed. Many Paſſages might be repeated from Authors of different Nations; but a few will not be tedious: Thus *Horace*, [*Lib.* I. *Ode* 28. *Carm.*]

Quanquam feſtinas, non eſt mora longa; licebit
Injecto ter pulvere curras.

Thus, again, we find *Achilles*, in *Homer*, complaining, how ſmall a *Tumulus* he had made for his beloved *Patroclus*, [*Iliad.* Ψ. v. 245.]

Τύμβον δ' ὐ μάλα πολλὸν ἐγὼ ποιέεσθαι ἄνωγα,
Ἀλλ' ἐπιεικέα τοῖον, &c.

That theſe *Tumuli* were erected by pouring on Earth, or heaping up Stones, is plain from the Words ſo frequent in *Homer*, [*Homer*, *Iliad.* Ψ. v. 257.] χέειν, χεύαντες τόδε σῆμα; and χερσὶν ἐχώσσμεθα, in the *Anthol. Epigr.* Again, that they were compoſed of Stones, appears from the Words, Λαΐνοισι τ' ἐξοιχώμασι in *Euripides*, and ſometimes poliſhed, ξεστοὶ τάφοι, τύμβος ξεστὸς, from the ſame Author. Parallel to this, Mr *Rowland*'s Obſervation appears, who found a curious Urn in a *Carnedd*, or Heap of Stones, in *Angleſey* [*Mona Reſt. pag.* 49.] So the *Britains* had the ſame Cuſtom of throwing Stones on the Deceaſed: Hence comes the *Welſh* Proverb, *Karn ar dy Ben*, Ill betide Thee.

So, again, Pillars of Stones were erected as ſepulchral Monuments, near the Ways, or in Memory of ſome Battle or Victory, as well as for Places of Religion and Sacrifices. I need not quote the Eaſtern Authors ſo well known; only obſerve, that they are frequent in *Cornwall* and *Wales*, were called *Meini Gwyr*, a Stone for Play, perhaps in Memory of Funeral Games, and ſometimes *Llech*, i. e. *Tabula Saxea*: The following is a remarkable one.

A Stone Pillar. Fig. 24. No. VI. This large Stone is called by the Natives *Long Stone*, and ſtands upright on the Summit of the Downs, between the Highways after they are divided: The End fixed in the Earth has been examined above 8 Foot deep, but not diſcovered how much lower it lies; above the Surface of the Earth the Stone meaſures 13 Feet in Height, 3 Feet in Breadth, and 2 ½ Feet in Thickneſs.

An Encampment. Fig 24. No. XIII. An Encampment, about a Mile and half diſtant, ſhews itſelf: It lies near the Cliffs, and overlooks *Par*, or *St Auſtle-Bay*, by it's high Situation: The Form is a true Circle, about 100 Yards Diameter; the

Agger,

Agger, or Rampart, is very low; the Ditch is about 2 Yards deep, and 5 broad, imperfect towards the Sea, where the Ground has a great Declivity, and the Aſcent to the *Agger* more difficult: It is called *Caſtle Gotha*. However, to prevent the Influence which a falſe Interpretation might produce, we muſt obſerve, that *Gothys*, both in *Welſh* and *Corniſh*, ſignifies High, or Proud; ſo that from *Kaſtelh*, or *Caſtellyn Gothys*, eaſily flows *Caſtle Gotha*, in the modern Dialect, as it's Situation declares. Fig. 28.

I have annexed a Map of *Par-Bay*, (as copied from Mr *Mitchel*, by a good Hand of our Dock) and of the Country, with the *Barrows*, Stone Pillar, *&c.* that this Eſſay may be rendered more intelligible. I have alſo been more nice in examining the internal Structure of theſe *Barrows*, as will appear by the Section and Ichnography of them. Becauſe the beſt Authors have been contented with an external View of theſe *Tumuli*, but never penetrated the inmoſt Receſſes, nor have we left any certain Characteriſtick to diſtinguiſh one Nation from another, I wiſh my Endeavours may give any new Light into this Affair. Fig. 24.

It will be tedious and needleſs to enumerate what Nations burnt their Dead, and erected *Tumuli* over them; we muſt only remember, that it was the Cuſtom among moſt Eaſtern Nations, and continued with them, after their Deſcendants had peopled the moſt Weſtern and Northern Parts of *Europe*: Hence it is eaſily traced in *Greece*, *Latium*, *Iberia*, *Gallia*, and *Britannia*, as well as *Germany*, *Sweden*, *Norway*, *Denmark*, till *Chriſtianity* appeared, and aboliſhed it.

Let us next conſider what Nation or People inhabited, or were acquainted with, the moſt Weſtern Part of *Britain*.

That the *Celtæ* and *Britons* inhabited here, need not be proved; though, perhaps, I may hereafter trace their Relicks or Remains of *Druidiſm* in *Carneds*, *Cromleches*, *Meini Gwyrs*, Fortifications, and the like. Celtæ.

That the *Phœnicians* firſt, and after them the *Grecians*, knew theſe Iſlands, and traded here for Tin, long before the *Romans* Knowledge of them, is plain, and eaſily proved by *Grecian* and *Roman* Authors, as *Strabo*, *Polybius*, *Pliny*, &c. *Polybius* wrote a Book, Περὶ τῶν Βρεττανικῶν Νήσων, καὶ τῆς Κασσιτέρου Καλασκευῆς. Which Book, though now loſt, yet *Strabo* witneſſeth, that therein he refuted the Errors of *Dicæarchus*, *Pythias*, and *Eratoſthenes*, concerning the Magnitude of *Britain*, Authors much older than himſelf. And though Diſputes may ariſe, whether the *Bratanac* of the *Phœnicians* gave Name to theſe Iſlands, yet it is certain, that the *Greeks* knew them under the Title of *Caſſiterides*, the Tin-Iſlands. Phœnicians *and* Grecians.

But whether theſe Nations were ever ſettled here as Inhabitants, and became Bodies Politick, to erect Fortifications, Towns, Cities, Encampments, and the like, is without any Certainty. Indeed a learned, and no leſs laborious Author, [*Sammes*'s *Britan.*] has endeavoured to derive the Names of Places, Cuſtoms, Religion, Art of War, Lan-

guage, and Government, of the ancient *Britons* from the *Phœnicians* being ſettled here; and this only upon a ſuppoſed Affinity between ſome *Britiſh* and *Phœnician* Words, and their Trade for Tin: But by the ſame Way of Reaſoning, we might as well and eaſily prove, that the *Phœnicians* received theſe very Words from the Deſcendants of *Gomer*, the *Celtæ*, before they paſſed over the *Helleſpont*; and alſo that the *Britiſh* or *Celtic* Words, which occur in the *Grecian* and *Roman* Languages, are derived and owe their Origin to the ſame People as they journeyed Weſtwards, and ſent Colonies to different Parts to inhabit them, particularly the moſt South; the Northern Parts being peopled by the Deſcendants of *Aſkenez*, *Gomer*'s Son: Hence the *Teutonic* Language flows, though not without ſome Affinity to the *Celtic* in few Words.

Romans. That the *Romans* conquered great Part of *Britain*, is not diſputed; but whether they poſſeſſed the moſt Weſtern Part, now *Cornwall*, many Learned doubt. Let us enumerate the chief Arguments and Proofs for it: The Geography and Figure of *Britain* is delivered in various *Grecian* and *Roman* Authors, and the moſt Weſtern Part is not forgot. *Cæſar*, the firſt *Roman* Invader, mentions the triangular Form of the Iſland, [*Comment. Lib.* v.] *Inſula eſt triquetra*; *unum latus eſt contra Galliam, alterum vergit ad Hiſpaniam & ſolem occidentem, qua ex parte eſt Hibernia*; *tertium eſt contra ſeptentrionem*. But, out of a great many, let us hear *Ptolemy*, Geograph. Lib. 11.

Νήσου Βρεττανικῆς θέσις.—Δυσμικῆς πλευρᾶς περιγραφὴ, ἡ παράκειται, ὅτε Ἰβέρνιῳ ὠκεανὸς, καὶ ὁ Οὐεργίβιῳ.—Ἡρακλέους ἄκρον, Ἀντιβέσταιον ἄκρον, τὸ καὶ Βολέριον· Δαμνόνιον, τὸ καὶ Ὄκρινον ἄκρον· τῆς ἐφεξῆς μεσημβρινῆς πλευρᾶς περιγραφὴ, ἣ ὑπόκειται Βρεττανικὸς ὠκεανὸς, μετὰ τὸ Ὄκρινον ἄκρον· Κενίωνῳ πόλαμῶ ἐκβολαὶ, Ταμάρα πόλαμῶ ἐκβολαὶ, Ἰσάκα πόλαμῶ ἐκβολαί. And again: Μεθ' ὃς [Δυρότριγας,] δυσμικώτατοι Δαμνόνιοι, ἐν οἷς πόλεις Οὐολίβα, Οὔξελα, Ταμαρὴ, Ἴσκα. Λεγεὼν δευτέρα Σεβαστή.

Which may be thus tranſlated: "After the Poſition of the *Britiſh* "Iſland, let us ſurvey the Weſtern Side, which lies along the *Iriſh* and "*Vergivian* Seas, where lie the Promontory of *Hercules*, the Promon- "tory *Antiveſtæum*, ſometimes *Bolerium*, the Promontory *Damnonium*, "called alſo *Ocrinum*; and in the Side towards the South, and bounded "by the *Britiſh* Ocean, after the Promontory *Ocrinum*, the Rivers *Ce-* "*nion*, *Tamar*, and *Iſaca*, diſcover themſelves, by diſcharging them- "ſelves into the Sea." The Coaſt and Rivers being mentioned, next deſcribed are the Cities. "The moſt Weſtward after the *Durotriges*, "are the *Damnonii*, among whom are theſe Cities (πόλεις); *Voliba*, "*Uxela*, *Tamare*, and *Iſca*, with the *Legio Secunda Auguſta*." *Ptolemy* of *Alexandria*, under the Reigns of *Trajan*, *Hadrian*, and *Antoninus Pius*, wrote his Geography. In the *Iter Britan. Antonini*, *Itiner.* XII. & XV. ſuppoſed to be compoſed or begun in the Times of *Antoninus Pius* or *Caracalla*, Mention is made of *Dumovaria*, *Moriduno*, * *Sca-*

* Which is only a falſe reading for *Iſca Dum*nunniorum. *C. M.*

dum

dum Nunniorum, *Leucaro*, *Bomio*, and *Nido*, *Iter* XII. and in *Iter* XV. of *Dumovaria*, *Moriduno*, *Iſca Dumnoniorum*. That by theſe laſt-mentioned Names are meant *Dorcheſter*, *Seaton*, and *Exeter*, is generally allowed; though whether *Leucaro*, *Bomio*, and *Nido*, are to be traced in *Damnonium*, may admit of a future Inquiry. The *Notitia Romana*, ſuppoſed to be written at the End of *Theodoſius* the younger, is indeed ſilent in reſpect to the moſt Weſtern Part of *Britain*, then called *Flavia Cæſarienſis Britannia*, but ſeems principally to regard the Eaſtern and Northern Coaſt, the *Littus Saxonicum*; the *Roman* Soldiers being then withdrawn to theſe Parts, to defend the Iſland againſt the Invaſions of the *Saxons*, and Inroads of the *Picts*.

In the *Chorographia Britanniæ Ravennatis*, ſuppoſed to be compiled by *Gallio*, the laſt *Roman* here with any Command or Forces, we have this Preface: *In Britannia plurimas fuiſſe legimus Civitates & Caſtra, ex quibus aliquantas deſignare volumus, Tamaris, Uxelis, Scadum Namorum, juxta quam civitatem eſt Moriduno:* Allowed by all Commentators to be *Tamerton*, *Leſtwithiel*, *Exeter*, and *Seaton*. Again: *Currunt autem per ipſam Britanniam Flumina plurima, ex quibus aliquanta nominare volumus*, i. e. *Tamaris*, Tamer, *Iſca* Ex, *Tamion* Tavy, *Leuca* Low, *Dorvatium* Dart, *Antrum* Arm, *Vividin* Foy or *Foath* of the *Britons*. Moſt Interpreters allow the *Engliſh* Names agreeably tranſlated to the *Latin*.

In the *Tabula Theodoſiana* or *Peutingeri*, ſuppoſed to be made about the Time of *Theodoſius the Great*, occur two Stations, *Iſca Dumnoniorum*, *Riduno*, which exactly anſwers to *Iſca Dumnoniorum* and *Moriduno* of *Antoninus*.

More might be extracted, to prove that the Geography of *Dumnonium*, or *Damnonium*, was well known to the *Romans*. But let us now conſider, that ſince the *Iſca Dumnoniorum* is ſaid by *Ptolemy* to have the *Legio Secunda Auguſta* ſtationed at it, and ſo great and exact Account is given of the *Civitates* (πόλεις) *& Flumina*, in the ſame Author, as well as *Antoninus*, *Chorographia Ravennatis*, and *Tabulæ Peutingeri*, can we ſuppoſe, that the *Romans* could be ignorant of the Tin, the Product of *Damnonium*, ſo often mentioned in the *Grecian* Authors? And ſince that their own Name of *Dunmonium* * was by themſelves changed from the *Britiſh*, *Dun Mwyn*, a Hill, or Country of Metals; agreeable to which Etymology we have at this Day a Place abounding in Metals, called *Mwyn*, as *St Mwyn* Pariſh, within two Miles of the above-deſcribed *Barrows*. Beſides, it muſt be contrary to Reaſon, and the *Roman* Genius, [*Vita Agric.* Sect. 12.] (*Nobis nec deeſt Avaritia*, ſays *Tacitus*, their own Countryman) to imagine, that the *Romans*, called *Raptores Orbis*, (by the ſame Author) ſhould neglect to hunt after the Metals of Tin and Lead, which were valued as the Rewards of Victory. *Tacitus* has a beautiful Paſſage to this Purpoſe, [*ib.* Sect. 12.] *Fert Britannia Aurum & Argentum, & alia Metalla, pretium Victoriæ.* Again:

* Rather *Dunmunium*, q. s. Dun mwyn *ium*. *C. M.*

I hope it will not be tedious to make ſome Extracts out of *Galgacus*'s Speech to his Army, going to encounter the *Roman* Eagle, and when the *Roman* Fleet had ſurrounded and created Terror to *Caledonia*: *Nullæ ultra Terræ, aç ne mare quidem ſecurum imminente claſſe Romana.—Nunc terminus patet: Romani,—Raptores Orbis,—avari,—& ambitioſi, quos non Oriens, non Occidens ſatiaverit,—bona fortunaſque in tributa egerunt; in annonam frumenta, corpora noſtra ac manus ſylvis & paludibus emuniendis verbera inter & contumelias conterunt;—neque ſunt nobis Arva, aut Metalla, aut Portus, quibus exercendis reſervemur:—hic Dux, & exercitus ibi, tributa, & metalla, & cæteræ ſervientium pœnæ.*—Perhaps the Curious have not ſufficiently remarked this beautiful Speech of *Galgacus*, where he ſo pathetically lays before them the Loſs of their Support, the Metals, for which the *Romans* ſo eagerly fought, and hazarded their Lives, as the expected Reward. He likewiſe relates the Fear created by the Appearance of the *Roman* Fleet on their Coaſts. If we reflect again, that the *Roman* Fleet not only ſailed round *Caledonia*, but alſo the *Dunmonium*, when the *Roman* Ships went to attack the *Silures* in *Wales*; and that the Name *Dun Mwyn*, muſt declare the Product of the Country, as Authors did likewiſe; and that the ſecond Legion was ſtationed at *Exeter* the capital City; could the *Romans* in an unuſual Manner ſit idle, and forget their darling Metals, and not penetrate the moſt ſecret Places?

It will be a Digreſſion, but I hope not an impertinent one, to confute a vulgar Error, that the *Roman* Soldiers made the Highways in *Britain*; when it is plain, that the poor conquered *Britons* under them, as Maſters and Overſeers, & *inter verbera & contumelias*, cauſewayed the Bogs, and pared Woods; *Paludibus & Sylvis emuniendis*, are *Tacitus*'s Words: This was the unhappy State of our conquered Anceſtors the *Britons*.

Much more might be ſaid from the Metals: Let us take a Remark from the Language, and this is one of the learned Mr *Edward Llwyd*'s, who ſays, [*Archæol. Brit.* p. 32.] that the *Dunmonian* and other Southern *Britons*, being, on account of their Situation, earlier conquered by, and conſequently more converſant with the *Romans*, than we of *Wales*, it is not to be wondered, if ſeveral *Latin* Words occur in the *Corniſh* Dialect not owned by the *Welſh*, as *Corniſh* Splender, *Latin* Splendor, *Welſh* Eglyrder, *Corniſh* Glitis, *Latin* Glacies, *Welſh* Jâ, *Corniſh* Bovin, *Latin* Bovina, *Welſh* Kigeidon, *&c.*

If we trace the *Romans* by their Remains, as Caſtles, Camps, Coins, Amphitheatres, we may probably be very lucky. Thus we obſerve three circular Camps or Fortifications within a Mile and half of *Grampound*, the *Voluba*, which lies in the Centre of them. They have a ſingle *Agger*, and a Ditch: In the Rampart of one of them was found an Urn ſome Years ſince, but broken by the Workmen: Another Caſtle *Dennis*, where there is a triple Rampart and Ditches, which has a Cauſeway leading to it peculiar to the *Romans*; and I am informed of

an Amphitheatre at *Torran* in *Zabulo*: But I ſhall not dwell longer, at preſent, on this Subject, but mention a very weighty Argument from Coins found in the moſt Weſtern Part of *Dunmonium*. The firſt were found in *Manacon* Pariſh near *Helford* River, and not many Miles from the *Ocrinum Dunmoniorum*, *Lizard-Point*. I have had the Sight but of three, which are Copper, and of a ſmall Size, very fair and legible: I had them from a Friend at *Falmouth*.

1. *Conſtantinus jun. Nob.* Reverſe *Corona Civica.*
2. *Conſtantius* — — — *Provident. Caes.*
3. *Conſtantius Nob.* — — *Gloria Exercitus.*

On the other Side of *Helford* River, in the Pariſh of *Conſtantine*, laſt Year, a labouring Man at Plough turned up about 40 or more: I have ſeen about 30 of them, 6 of which are Silver, and the others Copper. The Silver ones are very fair and beautiful, and about the Bigneſs of a Farthing, or the *Roman Denarius*, and are theſe:

Silver.	Reverſe.
1. *Imp. Cæſar Veſp. Aug.* — —	*Pontif. Maxim.*
2. *Hadrianus Aug.* — — —	*Coſ.* III.
3. *Divus Antoninus* — — —	*Divo Pio.*
4. *Imp. Cæſ. Nerva Trajan. Aug.*	*P. M. TR. P. Coſ.* III. *P. P.*
5. *Diva Fauſtina.* — — —	. . *ugus* . . other Letters defaced.
6. *Imp. M. Jul. Philippus Aug.* —	*Annona Aug.*

Copper.

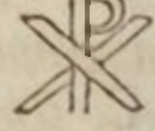
Six in Number, the Size larger than a Halfpenny, and near the Weight of the *Roman As* of half an Ounce, ſcarce legible.

1. *Imp. Cæſar Domit. Aug. Germ. Coſ.* XIII. } . . *Auguſti.*
2. *Antoninus Aug.* — — — — — — — — —
3. *Nerva Trajan. Aug.* — — — — — — —

The Reverſe not legible, except one Word *Auguſti.* Three more of the ſame Size, entirely defaced.

Copper Coins.

Five in Number, about the Bigneſs of a Farthing.

1. *Conſtantius Jun. Nob.* Reverſe *Fel. Temp.*
2. *Conſtantius.* — — — — — — — — —
3. Seems to be a Head of *Conſtantine.* }  the *Labarum*, I take, of *Conſtantine.*

The other two defaced.

Twelve in Number, leſs in Size than a Farthing, or *Triens* or *Quadrans* of the *Roman As*, of which

4 *Conſtantinus.* — — — — *Gloria Exercitus.*

2 *Conſtan-*

2 *Conſtantinus Aug.* — — — *Votis* x.
1 *Conſtantinus.* — — — — *Roma.*
1 *Conſtantinus Jun. Nob.* — — *Providentia Cæſ.*
1 — — — *Aug.* — — — *Oriens Aug.*

Three others not intelligble.

Theſe Coins are in the Cuſtody of Dr *Ruſſel* of *Truro*. If I had Leiſure, perhaps I might have been nice in diſcovering the Faces and Reverſes: This Gentleman informs me, that near the Place where the Coins were found, is a circular Camp near *Helford* Harbour.

Danes. I could have longer dwelt on this Subject, but have been tedious already: However, muſt not forget the *Danes*, who certainly landed here in *Cornwall*, but by Invitation from the *Britons*, to aſſiſt them to overcome the *Saxons*, and probably never had any Settlement here: They, as Friends, did not want Fortifications for their Defence in *Cornwall*, ſince they went as far as *Exeter* with the *Britons* againſt the *Saxons*, who could never penetrate *Cornwall* till the ninth Century, when, by one fatal Battle, the *Britons* were obliged to become Tributaries. This Battle was fought near *Lanelford*. Several Places, I am ſatisfied, ſuppoſed to be *Daniſh* by the Names, never did belong to them. Thus, to inſtance in one, *Carlle Dennis*, which is certainly a *Britiſh* and *Corniſh* Name; *Kaſtelh Ennys*, or *Caſtellyn Enny*, ſignifies a Caſtle on an Iſland, or in the Form of one either moated or trenched round, and here are three Trenches. Again; *Pendennis* might, for the ſame Reaſons, be reckoned *Daniſh*, when *Pedn*, or *Pen Ennys*, in *Corniſh*, ſignifies the Head of an Iſland, or a Peninſula.

References to Fig. 24. N° I, II, III, IV. *The* Barrows *on the Down, which were opened: In the laſt was found the Urn.* V. *A* Barrow, *whoſe Poſition reſpects a larger Number, as* N° IV. *does the others lying Eaſtward of it.* VI. Long Stone. VII. *St* Auſsle. VIII. *The Road to* Grampound, *after it's Diviſion near the* Barrows, IX. *and near* Grampound *it meets the other Branch* (VIII.) *again.* N. B. *There is not any other convenient Road between* Uxella, Leſtwithiol *and* Voluba, Grampound. X. *Road to* Uxella, *or* Leſtwithiol. XI. *Road to* Foy, *or* Vividin. XII. *A Brook of Water.* XIII. *Caſtle* Gotha. XIV. *Hills.*

Fig. 25. Fig. 25. *The Section and Ichnography of* Barrow, N° III. A. *The Circumference of the* Barrow. B. *A ſmall Circle of Stones.* C. *The Body of Stones, which lay over the cylindrical Pit.* D. *The cylindrical Pit.* E. *The Earth of the* Barrow. F. *The Paſſage cut by the Workmen. The Diameter of the* Barrow *was* 46 *Feet. The perpendicular Height* 10 ½ *Feet.*

Fig. 26. Fig. 26. *The Section and Ichnography of* Barrow, N° IV. A. *The firſt Circle of Stones.* B. *Earth.* C. *The ſecond Circle of Stones.* D. *Earth.* E. *The Centre.* F. *The oblong Pit.* G. *The Paſſage cut by the Workmen.* H. *The Place where the Urn was found.*

Fig. 27. Fig. 27. *The Urn. It's Height was* 13 ½ *Inches. Diameter at the Mouth* 8 *Inches, at the Middle* 11, *at the Bottom* 6 ½.

Fig. 28.

Fig. 24.


XIV
X
VII
VIII
XI
VI
IV
III
V
II
I
XII
IX
Polmear Isl.
Dubber Point
Crinis Isl.
New Horn
Short Horn
Polgaver Point
Spite Point
Port Pean
Pol-kerres
Par Bay
Flat Rock Point
Watering Place
XIII
Great Gribbin
Rope Haven
Gerren Point
Fowl Ground
Little Gribbin
Black Head
A Scale of one Mile.

Fig. 28. *The Plan of Caſtle* Gotha. A. *The Diameter of the Camp,* 100 *Yards.* B. *The Rampart* [Agger.] C. *The Ditch,* 5 *Yards deep, and* 2 *Yards broad, which reaches no farther than* D D, *where there is a falling away of the Ground towards the Sea.* Fig. 28.

Concerning the Remains of a Roman Hypocauſtum, *or* Sweating-Room, *diſcovered under-ground at* Lincoln, *Anno* 1739, *by Mr* T. Sympſon. No. 461. p. 855. Aug. *&c.* 1740.

XVIII. Mr *Chanter* having ſet ſome Labourers to dig a Cellar in an Outhouſe (belonging to his Manſion) fronting the Weſt End of the *Minſter*, and adjoining to the Checquer-Gate; they found 2 or 3 Stone Coffins, which had probably lain there ever ſince the Demolition of the ancient Pariſh-Church of *St Mary Magdalen*, to make Way for the Foundation of the Cathedral, and it's Appendages: But going lower, about 10 or 11 Feet deep, they found ſome Building; and at 13 Feet, to their no little Surprize, they ſtruck into the Corner of a Vault. Mr *Sympſon* took it to be a *Roman Hypocauſtum*: He had the Dimenſions of it taken, as in the Plan; ſee *Fig.* 29, and the Profile, *Fig.* 30. Fig. 29, 30.

A. The *Præfurnium*, [Stoking-place] Entrance or Place, where the *Fornacator* [the Stoker] ſtood to manage the Fire. It is 3 Feet 6 Inches ſquare, it's Height not certainly known, becauſe of the Rubbiſh which lay at the Bottom.

B. The *Fornax*, Furnace, or Fire-place, built of Brick, and arched over with the ſame. It's Length from *E* to *G* 5 Feet 6 Inches; it's Height 3 Feet at *E*, but 4 Feet at *F*, riſing gradually; 3 Feet 6 Inches long from *E* to *F*, and 2 Feet wide between *E* and *F*; 2 Feet long from *F* to *G*, and but 19 Inches wide between *F* and *G*.

C. The *Alveus* [or Body of the Kiln], 21 Feet 4 Inches long; 8 Feet 4 Inches broad; and 2 Feet 4 Inches high. The Floor is made of a ſtrong Cement compoſed of Lime, Sand, Brick-duſt, *&c.* which the Maſons of that Country call *Terrace-Mortar*. Upon this Floor ſtand 4 Rows of low Pillars, made of Brick, 11 in a Row; the outſide Rows round, the 2 inner Rows ſquare: The round ones are about 11 Inches Diameter, the others 8 Inches ſquare: Each ſtanding on a Brick 11 Inches ſquare, as at *Fig.* 32, and 2 Inches thick; the Shaft 2 Feet high, upon which lies another Brick likewiſe 2 Inches thick, ſome 17, 18, and others 19 Inches ſquare, as at *Fig.* 31, which repreſents the Profile of 2 ſquare Pillars with the ſquare Bricks at Top and Bottom, which make the whole Height of the *Alveus* 2 Feet 4 Inches. The Pillars, both round and ſquare, are jointed with Mortar, and that very clumſily: The round Pillars being compoſed of 10 Courſes of ſemi-circular Bricks, as at *Fig.* 32, *A*, laid by Pairs; the Joint of every Courſe croſſing that of the former at right Angles, as at *Fig.* 32, *C*; with ſo much Mortar betwixt, that the 2 Semicircles rather form an Oval, and ſo the Pillars look at firſt Sight as if they were wreathed: The ſquare Pillars are compoſed of 13 Courſes of Bricks, as at *Fig.* 32, *B*; 8 Inches ſquare, as at *Fig.* 32, *D*; theſe Bricks being thinner than thoſe which compoſe the round Pillars. Fig. 32. Fig. 31.

On the Top of theſe Pillars reſts the *Teſtudo* or Floor of the *Sudatorium* or Sweating-Room, *Fig.* 30, *H I*, which is compoſed thus: Firſt, there

there is a Floor of large Bricks, 23 Inches long, and 21 broad, which lie over the ſquare Bricks on the Tops of the Pillars, as at *Fig.* 31, the four Corners of each Brick reaching to the Centres of four adjoining Pillars, as at *Fig.* 33, where only one of theſe larger Bricks is repreſented, as it bears upon four of the ſmaller Bricks with their Pillars under them. On this Courſe of Bricks is a Covering of Cement 6 Inches thick, and upon that is ſet a teſſellated Pavement: The *Teſſellæ* of the Corner uncovered, *K*, in *Fig.* 29, 30, are of a whitiſh Colour.

L and *M*, in *Fig.* 29, 30, are 2 *Tubuli* or Flues, 12 Inches wide, and 14 deep, for carrying off the Smoke: The Bottoms of them are even with the Bottom of the *Alveus*, and they are carried upon the Level about 15 Feet, under another Room by the Side of the *Hypocauſtum*, and then it is preſumed they turn upwards. The Walls of this Room were plaſtered, and the Plaſter painted red, blue, and other Colours, and it's Floor teſſellated white; no Figures diſcernible in either Painting or Pavement. This Pavement, which is on a Level with the *Teſtudo* of the *Hypocauſtum*, is about 13 Feet below the preſent Surface of the Ground: So deep is old *Lindum* buried in it's Ruins! The Workmen, in digging up this Pavement, ſtruck into the Flue *M*, 3 Feet from the North-Eaſt Corner of the *Hypocauſtum*; and opened it to the very Corner *K*, which ſhewed one of the round Pillars, and ſo the whole was diſcovered. In ſinking the Hole *N K*, at 5 or 6 Feet Depth, they came to the Wall, which was dug up by Pieces with the Rubbiſh, before they came to the Pavement. This had been the Wall of a Room under which the *Tubuli* ran by the Side of, and not over the *Alveus*, but on the Eaſt Side of it.

Mr *Sympſon* got a Youth to creep in at the Opening made at *K*, and take the Dimenſions of the ſeveral Parts, who, the *Alveus* being quite black with Smoke, returned like a Chimney-ſweeper, but could not take the exact Meaſures of the *Fornax* and *Præfurnium*, on account of Rubbiſh he found in them: Wherefore, Mr *Sympſon*, being deſirous to inform himſelf thoroughly of all the Parts of this curious Piece of Antiquity, with the Leave, and at the Expence, of the Proprietor, cauſed another Hole to be ſunk 16 Feet deep, and by driving a Level *O P*, ſee *Fig.* 29, 30, he broke into the Middle of the *Fornax*; and, having cleared it of Rubbiſh, found it's Dimenſions as above, and that the Bottom of the narroweſt Part between *F* and *G*, was raiſed 18 Inches higher than the Bottom of the Part between *E* and *F*.

The *Præfurnium* was covered over at Top with a large flat Stone.

The *Fornax*, and the two ſquare Pillars in the *Alveus* fronting the Opening of the *Fornax*, were greatly impaired by the Fire, which muſt have been very violent: Some ſmall Fragments of Wood-coal were thrown out among the Rubbiſh in the Bottom of the *Fornax*; whence probably it was heated with Wood.

At the Concluſion of the Account Mr *Sympſon* ſent to Mr *Willis*, he gives us the following Remark upon a Paſſage in the ſecond Letter from

from Mr *Baxter* to Dr *Harwood*, concerning the *Hypocauſta* of the *Ancients*, printed in theſe *Tranſactions*, N° 306 *.

" Mr *Baxter* ſays, the *Hypocauſis* was called *Alveus* and *Fornax*: But, " with due Deference to that learned Gentleman, (ſays Mr *Sympſon*) I " humbly apprehend them to have been diſtinct Parts of the whole, " which was called *Hypocauſis*: The Ground of my Conjecture is this: " In the firſt Place, it would hardly be poſſible to make a Fire in that " Part of this *Hypocauſt*, which I call the *Alveus*; much leſs to come " at it, to manage it, being ſo low, and ſo crowded with Pillars, as to " admit only a ſlender Perſon to crawl amongſt them, and that not " without Difficulty. In the next Place, the Floor does not ſeem de- " ſigned for it, nor are there any Appearances of Aſhes on it: And, " further, that the *Fornax* was, where I have placed it in this, appears " not only from the Structure of that Part, but from the Bricks being " much burnt [and Pieces of Wood-coal being found in it]; whereas " in the *Alveus*, the Bricks are only black with the Steam and Smoak " being drawn through it by the *Tubuli*. But I ſubmit my Opinion to " your better Judgment." He might have added, that only thoſe Pillars in the *Alveus*, which faced the Mouth of the *Fornax*, had ſuffered much by the Fire, the others not.

That *Hypocauſt*, deſcribed in N° 306 above-mentioned, muſt have been a much hotter Room than this; for, inſtead of the Flues being carried under another Room, the Walls of the Sweating-room itſelf were hollow or double, and a great Number of Flues carried up between them all round the Room. A curious Model of this is ſtill to be ſeen in the *Muſeum* of the *Royal Society*.

This *Hypocauſt* may ſerve as a Model for Malt-kilns, or for drying Hops, *&c.*

Concerning the Remains of an ancient Temple in Ireland, *of the ſame Sort as the famous* Stonehenge, *and of a Stone Hatchet of the ancient* Iriſh, *by the R. R.* Rob. *Lord Biſhop of* Corke, *and F. R. S.* No. 471. p. 581. *Read* Nov. 10. 1743. Fig. 34, 35.

XIX. As I never met with any ſatisfactory Account of theſe *ancient Temples*, I imagined that a ſhort Account of this one, which I met with in the County of *Corke*, in the Pariſh of *Kilgarriffe*, when I was upon a parochial Viſitation, would not be unentertaining; it ſtands about 10 Miles from *Bandon* to the S W.

As to the Drawing (*Fig.* 34) the Ground-plan is exact, but the Upright (*Fig.* 35) was not taken upon the Place, but drawn from my Deſcription of it. It contains the Repreſentation of a very ancient Heathen Temple, and the Burial-place of ſome Perſon of great Renown, before the erecting of covered Temples was made uſe of, in this Part of the World, or perhaps in any other Part of the World, except *Judea*. Which Sort of Places of Devotion ſeem to be the moſt ancient of any that we have Accounts of in Hiſtory. For *Temples* were originally all open, and thence received their Name, according to *Varro*, (*Lib.* vi. *de Ling. Lat.*) *a templando*, which was an ancient Word that ſignified to *ſee* or *look out*. Theſe Places therefore were called Temples by the

* See Vol. V. Part ii. Chap. 2. §. xx. 3.

Heathens, becauſe they were holy Places, that were marked out by the Augurs for taking their Auguries in; and were therefore left open, that the Prieſt or Augur, who ſtood with his Face to the South, according to *Roſinus*, (*Roſ. Ant. Lib.* iii. *c.* 9.) or with his Face to the Eaſt, according to *Calepine*, (*Cal. Dict. Templum*) might be able to ſee all around him; his Art of Prediction depending on the Flight of Birds, or ſome Appearances in the Face of the Sky, which varied their Signification according as they ſhewed themſelves, either on the Right-hand or Left-hand of the Augur. Whether the Diſpoſition of theſe Stones, in the Plan, was deſigned or accidental, with regard to the Points of the Compaſs, I cannot ſay; but it is remarkable, that there are 2 Stones, which are fixed directly in the N. and W. Points of this Circle; and 2 Openings anſwering to the E. and S. So that it is poſſible both our Authors may be in the right, and that the Prieſt ſometimes ſtood with his Face to the E. and ſometimes to the S. The middle Stone, which was the Place where the Prieſt ſtood, is lower than the reſt, not being above 3 Feet high, and was always dedicated to ſome Deity or other; and was conſecrated to that Uſe by the pouring on of Olive-oil: Which Cuſtom was of very ancient Date, and ſeems to have been borrowed from the Practice of the ancient Patriarchs, who called theſe Stones *Bethels*: For when *Jacob* was going from *Beerſheba* towards *Padan-Aram*, or *Haran*, to ſeek for a Wife, by Command from his Father *Iſaac*, having laid down to ſleep, God appeared to him in a Dream; and, when he roſe up in the Morning, it is ſaid, that *he took the Stone which he had put for his Pillow, and ſet it up for a Pillar, and poured Oil upon the Top of it, and he called the Name of that Place* BETHEL (Gen. xxviii. 18, 22); which Word literally ſignifies in *Engliſh*, GOD's *Houſe*. Again, when *Jacob* and *Laban* made a Covenant together, *Jacob took a Stone, and ſet it up for a Pillar*, and probably poured Oil thereon, by Way of dedicating it to God, as he had done before; for that *Moſes* made uſe of Oil in the Dedication of the Tabernacle, and Altar, and Veſſels, *&c.* is plain from *Lev.* viii. 10, *&c.* And in this Place, when *Jacob* and *Laban* had finiſhed their Covenant, it is obſerved, that *Jacob offered up a Sacrifice*. (Gen. xxxi. 45, 54.) Again, when *Jacob* afterwards fled from the *Shechemites*, God appeared unto him; and in the Place where God talked with him, it is ſaid, that *he ſet up a Pillar, even a Pillar of Stone, and poured a Drink-offering thereon, and he poured Oil thereon. And Jacob called the Name of the Place where* GOD *ſpake with him,* BETHEL. (Gen. xxxv. 9, 15.) And hence theſe Stones, which were erected as Marks of theſe Places having been dedicated to God, came to be called *Bethels*; and, by a corrupt Pronunciation of the Word, they were in *Greek* called Βαιτύλια (*vide Sanchoniatho*). Which is the Reaſon why that Stone, which *Rhea* is ſuppoſed to have given *Saturn* to ſwallow inſtead of a Child, is called Βαιτύλος; and not becauſe it was covered with a woollen Garment, which is called Βαίτη in *Greek*, as *Heſychius* pretends. *Heſych. Etym.*

And

And that this Cuſtom of dedicating ſingle Stones to God was not confined to *Judea*, is plain from *Clemens Alexandrinus*, who obſerves, that before the Art of Carving was invented, the Ancients erected unwrought Pillars, and paid their Worſhip to them as to the Statues of the Gods. (*Clem. Alex. Strom. Lib.* i.) *Herodian* alſo mentions a Pillar, or large Stone, of a black Colour, and a conical Form, at *Antioch* in *Phœnicia*, which was erected in Honour of the Sun. (*Herod. Lib.* v.) *Pauſanias* alſo mentions ſeveral of theſe uncarved Pillars in *Bœotia* in *Greece*, and ſays they were the ancient Statues erected to their Gods. (*Pauſan. in Bœot. & in Acha.*) And that this Cuſtom continued till after the Time of the Prophet *Iſaiah*, is plain from his making uſe of the Expreſſion of erecting a Pillar to God, to denote the Worſhip of God: For, ſays he, *In that Day ſhall there be an Altar to the Lord in the midſt of the Land of Egypt, and a Pillar at the Border thereof to the Lord. And it ſhall be for a Sign, and for a Witneſs, unto the Lord of Hoſts in the Land of Egypt.* (Iſa. xix. 19, 20.) And *Arnobius*, who flouriſhed about 330 Years after *Chriſt*, ſays, that this Cuſtom continued to his Time; and that, when he was a Heathen, he never met a Stone, which had the Marks of Olive-oil being poured upon it, that he did not look upon as ſomething divine, and offered up his Prayers to it as ſuch. (*Arnob. cont. Gent. Lib.* i.)

As to the Cuſtom of erecting this *Bethel* with a certain Number of Stones around it, this alſo is to be found in the Old Teſtament. For it is ſaid of *Moſes*, after he had been in the Mount with God, and had returned to the People of *Iſrael*, that *he roſe up early in the Morning, and builded an Altar under the Hill, and twelve Pillars according to the twelve Tribes of Iſrael.* (Exod. xxiv. 4.) Which Altar was probably ſurrounded with theſe 12 Pillars, or 12 large Stones, pitched on an End, and ſtuck in the Ground; for ſo the Word מצבה, *Matſebah*, literally ſignifies; as a proper Deſignation of the Quantity of Ground, which ought to be looked upon as ſanctified by the Altar, and dedicated to God. Of the ſame Kind alſo we may ſuppoſe thoſe 12 Stones to be, which *Joſhua pitched* in *Gilgal*, after the Children of *Iſrael* had paſſed the River *Jordan*. (Joſh. iv. 20.) The Number of Stones which ſurrounded theſe *Bethels*, I ſuppoſe therefore were entirely voluntary, at the Diſcretion of the Perſons who dedicated the *Bethel*; and might be fewer or more, either according to the Number of Perſons principally concerned in the Dedication, or the Size of the Place, or the Number of Stones which could conveniently be found large enough for that Purpoſe. The Number of thoſe, of which I have ſent the Draught, are 9, which ſurround the *Bethel* at 15 Feet and half Diſtance from the Centre; the Height of each Stone is about 6 Feet above-ground, and their Breadth is from 3 ½ Feet to near 4 Feet, ſome a little more, and ſome a little leſs.

The Stone marked (*b*), which ſtands detached from the reſt, I take to be a *Matſebah*, or Pillar erected as a Memorial of the Burial-place of

ſome eminent Perſon; either the Prince or Prieſt of the Country, or probably both: For anciently the principal Perſon of each Family, Tribe, or Nation, officiated both as Prince and Prieſt: And in *Hebrew* the ſame Word *Coben* ſignifies both Prince and Prieſt. And what confirms this Opinion of it's being a ſepulchral Monument is, that ſome of the ancient Popiſh Families hereabouts make uſe of it as a Burial-place to this Day. The firſt Account we have of this Cuſtom of erecting Stone Pillars on or near the Burial-place of eminent Perſons, is that of *Rachel*'s, who dying in Child-birth of her Son *Benjamin*, in the Road between *Bethel* and *Ephrah*, it is ſaid, that *Jacob ſet a Pillar upon her Grave.* (Gen. xxxv. 20.) Of the ſame Kind alſo may we ſuppoſe that *Matſebah* or Pillar to be, which *Abſalom* erected for himſelf during his Life-time, though better wrought, and more ornamental, in the King's Dale; where it is more than probable he deſigned to have been buried; for it is obſerved that he ſaid, *I have no Son to keep my Name in Remembrance, and he called the Pillar after his own Name.* (2 Sam. xviii. 18.) Which Cuſtom, of erecting Pillars over the Burial-places of eminent Perſons, was not confined to the Land of *Judea*; but was univerſally practiſed, as appears from a Paſſage in *Homer*, where *Minerva* exciting *Telemachus* to go in Queſt of *Ulyſſes*, and ſuppoſing the worſt that could happen, that is, that he ſhould come to a certain Knowledge of the Death of his Father, ſhe directs him then to raiſe a Pillar, or Signal, to his Memory.

And hence, in my Opinion, came the Origin of *Obeliſks* in *Egypt*, which abounding with the fineſt Quarries in the World, gave them an Opportunity of pitching Stones of the largeſt Size over the Burial-places of their eminent Men. And you may obſerve, that this Stone, of which you have the Plan marked (*b*), is ſomewhat in the Form of an *Obeliſk*, being 10 Feet high, and 2 Feet ſquare at the Bottom, diminiſhing gradually to a Point at the Top.

It is remarkable, that ſome of theſe Stones manifeſtly appear to have been reduced to the Form they are in by Art, particularly that one laſt mentioned, as well as the one marked *N.* 7, which is reduced into an hexagonal Form, the inward and the outward Front being ſimilar, with an Angle in the middle, as repreſented in the Ground-plan. There is no Appearance of any Mark of a Tool, ſo that it is probable, that this was done with great Labour, by the Aſſiſtance only of ſharp Stones; which, before the Invention of Iron, or of that Metal's being common, ſeems to have been the uſual Inſtrument of Operation in other Circumſtances as well as this. For it is obſerved of *Zipporah*, the Wife of *Moſes*, when ſhe was ordered to circumciſe her Son, that *ſhe took a ſharp Stone, and cut off the Foreſkin of her Son.* (Exod. iv. 25.) And, when God orders *Joſhua* to circumciſe the *Iſraelites*, he ſays, *make thee ſharp Knives*, as we tranſlate it; but, in the Original it is, *Knives of ſharp Stones.* (Joſh. v. 2, 3.)

Herodotus and *Diodorus Siculus* both take Notice, that it was the Cuſtom among the ancient *Egyptians*, at the Time of embalming the Dead, to cut open the Body with an *Ethiopic* Stone: (*Herod. Euterp. Diod. Lib.* i. *c.* 5.) And *Ovid*, in deſcribing the Origin of the Cuſtoms of the *Corybantes*, &c. ſays, that a *Phrygian* Youth with whom the Goddeſs *Cybele* was in Love, and to whom he proved faithleſs, for a Puniſhment * to himſelf, cut himſelf all over with a ſharp Stone; *Ille etiam ſaxo corpus laniavit acuto*, &c. (*Ovid. Faſt.* 4.)

It is manifeſt, indeed, that the Uſe of Iron was found out in *Egypt* before the Time of *Joſhua* and *Moſes*, both of whom mention it as made uſe of not only for cutting of ſoft Things †, but alſo for chizelling of Stones. (*Deut.* xxvii. 5. *Joſh.* viii. 31.) But I apprehend it muſt have been very rare, and that the Art of reducing of Iron to the Hardneſs and Conſiſtency of Steel, was not yet diſcovered; becauſe, when God orders *Joſhua* to write the Words of the Law upon Stones, as ſoon as he had paſſed over *Jordan*, the Way he is ordered to do it is this; to plaſter the Stones over with Plaſter firſt, and then to grave in this Plaſter the Words of the Law. (*Deut.* xxvii. 2, 3.) And yet this is called both by *Moſes* and *Joſhua*, writing upon the Stones. (*Deut.* xxvii. 8.)

It is certain, that the Art of poliſhing of Jewels, and of cutting one hard Stone with another that was harder, was invented and practiſed in *Egypt* before the Time of *Moſes*; for he ſpeaks of graving the Names of the Children of *Iſrael* in two Onyx-ſtones, which, being harder than Iron, even than Steel, are not to be wrought upon therewith; but muſt be cut by ſome Stone which is harder than themſelves. Wherefore *Moſes* ſays, *with the Work of an Engraver in Stone, like the Engravings of a Signet, ſhalt thou grave the two Stones.* (Exod. xxviii. 9, 11.) And therefore the Prophet *Jeremiah* mentions a *Pen of Iron*, as made uſe of for engraving. (*Jer.* xvii. 1.)

But the Uſe of Iron does by no Means ſeem to have been found out in theſe Weſtern Parts of the World till much later; and therefore it is probable, that the Inhabitants of theſe Countries made uſe of Stones, which were the original Inſtruments uſed in cutting both for domeſtic and military Service, in all Countries of the known World, as appears of late Years from the Practice of the *Americans*. And it is alſo manifeſt, from the many Inſtruments of War, that are made of Stone, which have been dug up in theſe Weſtern Parts of *Europe*, that the Uſe of Iron was not very common in theſe Parts, till of late Years. *Montfaucon*, in the IVth and Vth Tome of his *Antiquities*, gives us an Account of ſeveral Tombs being opened near *Paris*, and in other Places; wherein the hard and deſtructive Part of the Weapons found therein conſiſted of Stone. He particularly gives us the Cut of a Stone Hatchet

* Of the Antiquity of this Practice, ſee *Lev.* xix. 28.

† *Joſeph*, when he was ſent for by *Pharaoh*, *ſhaved* himſelf, *Gen.* xli. 14.

in

in his own Poſſeſſion, which was made of Touchſtone, in the IVth Tome of his Supplement, *p.* 30. But as I have at preſent in my Poſſeſſion a much more compleat one, made of the ſame Kind of Stone, I have ſent you the Draught of it done with Exactneſs, by a Scale of ½ of an Inch to an Inch, and you will ſee, that it is plainly made for doing Execution both Ways, and therefore anſwers the Deſcription given by *Montfaucon* of the *Amazonian* Hatchet, or the *Sagaris* of *Xenophon*. (*vide Montf.* Tome IV. *p.* 69.) The Handle is made of Yew, and the Stone is not inſerted into the Handle at right Angles, but makes an acute Angle below towards the Hand; the Uſe of which appears at firſt Sight.

Fig. 36.

CHAP. II.

VOYAGES and TRAVELS.

Obſervations made in a Journey over the Tyrol Alps, *by* Balthaſar Ehrhard, *M. D.* No. 458. p. 547.

I. HAVING ſpent 5 Days in travelling over ſeveral Mountains, equal in Height to thoſe of *Swiſſerland*, I did not meet with any petrified marine Bodies, either *conchitæ* or *nautilitæ*, though I ſought diligently for them; which is a Contradiction to *Woodward*'s Hypotheſis, May there not be Tracts of Sea equally ſpacious, and void of Inhabitants, or marine Animals, on account of Veins of Metal, Bitumen, or Vitriol? On this Principle, 2 Years ago, I propoſed to the States of *Holland* a Remedy againſt the *Teredo*, or Worm that eats their Piles.

The different Qualities of the *Alps* afford no mean Argument of the divine Providence. In my whole Journey I ſaw only one Mountain that afforded Hay. It is called *Heuberg*, and lies near the Village *Pichelbach*, and affords ſo great a Plenty, that the neighbouring Towns are ſupplied from it with Hay, to feed their Cattle during Winter. This is owing partly to the thick Coat of Earth, with which it is covered, partly to the Veins of Clay and Marle, which lie under this Coat, and exude a plentiful Quantity of Water all over the Mountain. It is a known Thing, that ſubterraneous *Strata* of Clay and Marle are appointed by God to perform the ſame Effects, which Men produce by Pipes under-ground. I ſhall add another Reaſon, that in this Mountain there is a ſmaller Quantity of metallic Vapours, to injure the Roots of Vegetables. But, this being granted, I ſee no Reaſon why among 100 other Mountains, not one ſhould be comparable to this in Fertility. Where then is that abſolute phyſical Neceſſity? None, ſurely; but it is a Sample of free divine Will and Providence.

As I often conſidered the Direction of the ſtony *Strata*, in other Mountains, which, on account of the vaſt Number of Rocks, were as barren

Fig. 36.

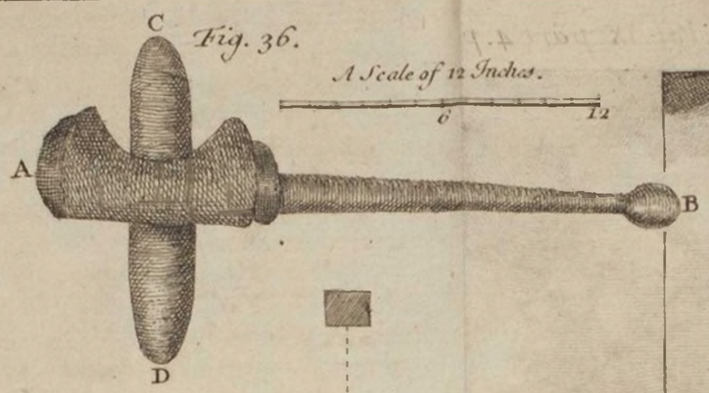


Fig. 34.

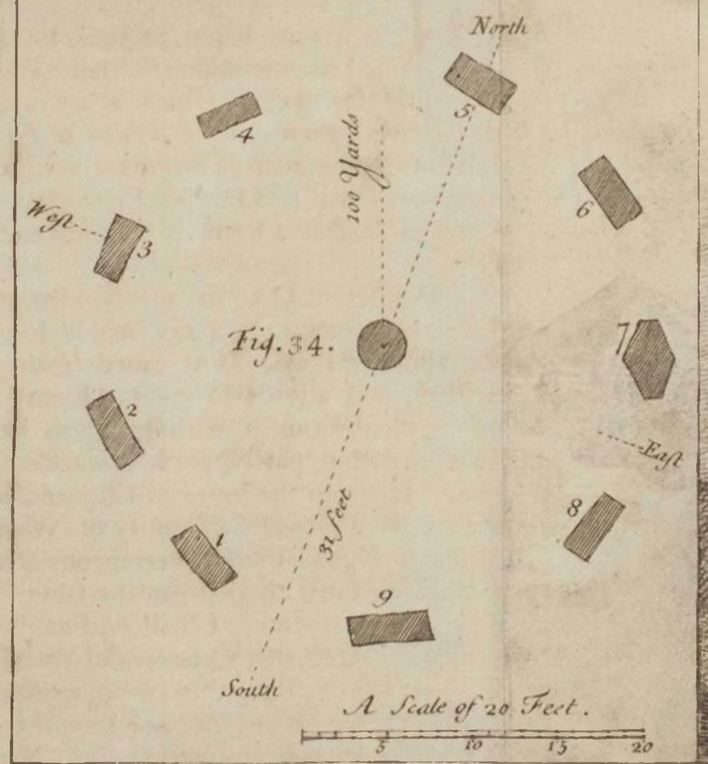


Fig. 35.

barren as the *Libyan* Deſerts, I obſerved the Variation of the *Strata* through all Angles, from parallel, oblique, and perpendicular. Wonderful, according to *Woodward*, that all the *Strata* after the Deluge were exactly circular to the Centre, or Parallel; and that now there ſhould hardly ever be ſuch a *Stratum* remaining, of which the pure Parallelism ſhould be found to continue for the Space of an Hour's Journey. I found it quite otherwiſe, when I travelled ten Years ago through *Germany*, chiefly with a View to this Study, from *Zurich* to *Hamburgh*, and from *Dreſden* to *Amſterdam*, having firſt laid a Foundation of phyſical Knowledge, and read a great Number of Books on that Subject. From the *Phænomena* obſerved in my late *Alpine* Journey, I plainly perceived the Variety of ſtony *Strata*, of which the *Alps* are compoſed, to be another irrefragable Proof of the divine Goodneſs and Providence; for if the *Strata* of Mountains were horizontal, they would be ſubject to daily Ruin, to the great Damage of the Inhabitants and Travellers. But, on the contrary, the ſurpriſingly various Poſition of the *Strata*, compoſed chiefly as it were of converging Lines, make the Mountains evidently appear to be conſtructed for Eternity.

I make no Doubt but that it may be demonſtrated, that the *Strata* had this Difference at the Creation of the World, as well as ſince the Deluge. Here at *Memingen* we have Mountains of more than half the Height of the very talleſt, which at their very Summits have vaſt *Strata* of round Stones of various Bigneſs, juſt like thoſe which are ſo formed by the rolling of Rivers; and are erroneouſly fancied by *Gaſſendi*, in his Life of *Peireſki*, to be formed from I know not what *Mucus* of the Rivers. Now it ſeems demonſtrable, that this vaſt Heap of ſuch Stones at the Tops of Mountains, could not be formed by a Torrent of Waters, as no River could flow there. Much leſs can we admit the ingenious Suppoſition of M. *de Reaumur* in the *Mem. de l' Acad. R. de Sc.* For I have obſerved another *Phænomenon*, that from *Memingen* toward the *Alps*, thoſe Stones are found to increaſe in Diameter, till they come to be 3 or 4 Feet; but toward the oppoſite Part from *Memingen* they decreaſe ſucceſſively, till they are not bigger than coarſe Sand. This remarkable Obſervation relating to the Theory of the Earth is confirmed by the following Obſervations and Corollaries.

I have obſerved among the *Tyrol Alps* whole Ridges of Mountains, which contain the very ſame Sort of Stones in a continued Rock, as thoſe laſt-mentioned between the *Alps* and the *Danube* have in ſeparate and diſtinct Stones.

There are as many Varieties of thoſe Stones, as there are of theſe *Alpine* Rocks.

The Cauſe which broke the *Alpine* Rocks, and rolled the Fragments about till they were round, and overſpread all that Part of *Germany* which I inhabit, muſt have been a very great Deluge; but I queſtion whether it could be that of *Noah*.

The

The Waters of such a Flood, in the same Tract of 20 Leagues in Length, and as much in Breadth, were at that Time directed constantly from South to North.

The Fragments of the broken Mountains, which were twice as high before the Deluge, being rolled about by the Waters, have decreased in Bulk in Proportion as they have been farther rolled. Hence the greatest Pieces are found in the Places nearest the Mountains; and to those at a greater Distance are smaller, and some not bigger than coarse Sand.

The most exact Likeness of the least of these Stones, to the greatest of the *Alpine* Rocks, is evident to the Sight.

But amongst the most remarkable Pieces, with which the whole Province of *Swabia* is covered, I have not yet seen any that are composed of Metal, whereas in the *Alps* there are whole Mountains that abound in Metal. Therefore before the Deluge, either the Veins of Metal were covered by huge Heaps of Rocks, or else the Ore has wasted in the Fragments that have been torn off; whence many Stones are found in *Alemania*, that seem hollow like Honey-Combs.

I shall now speak a Word or two of the Salt-Pits at *Hall* in *Tyrol*. As every Mountain of the *Alps* represents the whole World, and has it's torrid, frigid, and temperate Climate; that Part of the Ridge of Mountains which contains the Salt-Pits, is strongly exposed to the S. and is, in my Opinion, more scorched in many Places by the Summer-Sun, than the Countries under the Equinoctial Line.

The Connexion of Fossils is a *Phænomenon* hitherto but little known or observed. At *Hall* in *Saxony* the Salt-Pits are accompanied by a softer Sort of grey Stones like Clay. Above them are *Strata* of a reddish Marble, covered by Pieces of a Sort of *Selenites*. Not far from the Salt-Pits is Plenty of a bituminous Fossil, or Coal: So at *Hall* in *Tyrol* I have with great Pleasure observed a like Concomitance of Fossils, the Difference between them being only this, that the Water is saturated with Fossil-Salt naturally in *Saxony*, but artificially in *Tyrol*. For here the Vein of Salt being muddy, must be washed in subterraneous Chambers for that Purpose, and when a Lee is thus prepared, the Salt is obtained from it by boiling. The Roof of this Chamber is of Stone, and the Floor of Clay. But this Structure is found in many Parts of the *Alps*; so that here is a new Instance of the Difference between the divine Power and human Architecture. But *Becher*'s Account is false, that the subterraneous Chambers, being deprived of their Fossil-Salt, by letting in the Water, are filled again by the Salt growing anew: But this I first discovered myself, that from the black Mud first deprived of the Fossil-Salt by washing, there shoots a bitter Salt, exactly like the *Epsom*-Salt; so that the People of *Tyrol* might, if they would, provide a very great Quantity of it, to furnish the rest of *Germany* with it, instead of the *English* Salt. But whether Fossil-Salt is generated under the Earth after the Manner of Vapours, I have not been able to discover:

cover: But the Miners know nothing of thoſe ſuffocating Steams, which are ſo frequent in the *Saxon* Works, and known there by the Name of *Schwaden*.

I ſhall only add an Obſervation concerning the Dialect of *Alemania*, or *Upper Swabia*, that it has ſo many Dipthongs, ſuch Ways of pronouncing, and ſuch Words, as to be very like the *Engliſh*, but eſpecially the *Welſh*; and affords a ſufficient Proof, that the *Suevi* and *Angli* were in the moſt ancient Times the ſame Nation. This is difficult to be proved from Hiſtory, but is evident from this Argument.

II. * I have obſerved many groſs Miſtakes in Peoples Notions of *Virginia*, when diſcourſing of the Natives, which have riſen from the Want of making a Diſtinction in their Expreſſions, when they ſpeak of the *Engliſh* or *Whites* born there, and ſo called *Natives*; and the *Aborigines* of the Country. Pleaſe therefore to take Notice, that when I ſpeak of the Natives in general, I mean only the *Indians*.

As therefore to your firſt Query: Their *Wiochiſt*, that is, their Prieſt, is generally their Phyſician; and is a Perſon of the greateſt Honour and Eſteem among them, next to the King, or to their great War-Captain.

2. Nature is their great Apothecary, each Phyſician furniſhing himſelf, according to his Skill, with Herbs, or the Leaves, Fruit, Roots, or Barks of Trees; of which he ſometimes makes uſe of the Juice, and ſometimes reduces them into Powder, or perhaps makes a Decoction thereof.

3. Though every one, according to his Skill, is a Sort of Doctor, (as many Women are in *England*) yet their Prieſt is peculiarly ſtiled their Phyſician, to be conſulted upon greater Emergencies. The Rules of the Deſcent hereof, as to Families, I do not know; for they are a ſullen, cloſe People, and will anſwer very few Queſtions.

4. They reward their Phyſician with no certain Fees, but according as they bargain for *Wampampeake* Skins, or the like. If it be to an *Engliſhman* they are ſent for, they will agree for a Watch-coat, a Gallon or two of Rum, or ſoforth, according to the Nature of the Cure. Sometimes the Prieſt will ſell his Remedy; for ſome of them have told me, that they have bought the Root which cures the Bite of the Rattle-ſnake from their *Wiochiſt*.

5. Their King allows no Salary, that ever I heard of; but every one that in any Nature can ſerve his Prince, is ready to do it, and to do it *gratis*.

6. They have no Conſultations, their Practice being merely empirical. They know little of the Nature or Reaſon of Things. Aſk them any Queſtion about the Operation of a Remedy, and, if in good Humour, perhaps they will reply, *It cures*; otherwiſe, they will ſhrug their Shoulders, and you may aſk forty Queſtions, and not know whe-

* *A Letter from the Rev. Mr* John Clayton, *(afterwards Dean of* Kildare *in* Ireland) *to Dr* Grew, *in Anſwer to ſeveral Queries relating to* Virginia, *ſent to him in* 1687, *communicated by the R. Rev.* Robert *Lord Biſhop of* Corke, *to* John *Earl of* Egmont, *F. R. S.* No. 454. *p.* 143. July, *&c.* 1739.

* This may ſerve as a Sequel to the Accounts of *Virginia* formerly given by Mr *Clayton*. See Vol. III. Part ii. Chap. 3. §. xix.

ther they underſtand either the Thing, or what it is that you ſay to them.

7. They pay a certain Deference of Honour to their Prieſt or *Wiochiſt*, whoſe Perſon they hold ſacred; but Laws they have none (as far as I could ever learn) that binds them thereto: In general, the Will of their Prince ſtands for Reaſon and Law.

8. The Means whereby they convey their Art to Poſterity, I take to be this: They lodge in their *Wiochiſan* Houſes, *i. e.* their Temples, certain Kinds of Reliques, ſuch as Mens Skulls, ſome certain Grains or Pulſe, and ſeveral Herbs, which are dedicated to their Gods, *viz.* the Skulls in Memory of their Fights and Conqueſts; the Pulſe by Way of Thank-offering for their Proviſions; and the Herbs upon the ſame Account, for ſome ſpecial Cure performed thereby. For when any one is cured by any Herb, he brings Part thereof, and offers it to his God; whereby the Remembrance of this Herb and it's Virtue is not only preſerved, but the Prieſt alſo becomes beſt inſtructed thereby, and knowing in the Art of Medicine: For otherwiſe they are mighty reſerved of their Knowledge, even among themſelves. Whether the Prieſt takes certain Perſons to inſtruct, or teaches only his own Children, I know not. Often when they are abroad hunting in the Woods, and fall ſick, or come by any Hurt, they then are forced to make uſe of any Herbs which are neareſt at Hand, which they are not timorous in venturing upon, though they know not the Virtue or Qualities thereof. And thus, by making many Trials and Experiments, they find out the Virtues of Herbs; and by uſing ſimple Remedies, they certainly know what it is that effects the Cure.

9. They are generally moſt famed for curing of Wounds, and have indeed various very good Wound-herbs, as an Herb commonly called *Indian-weed*, which perhaps may be referred to the *Valerians*, and be ſaid to be *Platani foliis.* They uſe alſo the *Gnaphalium Americanum*, commonly called there *White Plantain.* As to our *Plantain*, or the *Heptapleuron*, they call it the *Engliſhman's Foot*, and have a Tradition, that it will only grow where they have trodden, and was never known before the *Engliſh* came into this Country. The moſt famous old Phyſician among the *Apomatick Indians*, as I was informed by a Perſon of a very good Underſtanding, uſed moſtly an Herb which he ſhewed me, whoſe Leaf is much like *Self-heal* in Winter. I obſerved it was red underneath, and would at length appear tinged on the upper Side alſo: It makes a good Salve, only it fills a Wound too faſt with Fleſh. I took a Draught of this Herb, along with ſome others, which I have left in the North of *England.* The great Succeſs they have in curing Wounds and Sores, I apprehend moſtly to proceed from their Manner of dreſſing them: For they firſt cleanſe them, by ſucking, which, though a very naſty, is, no Doubt, the moſt effectual and beſt Way imaginable; then they take the *biting Perſicary*, and chew it in their Mouths, and thence ſquirt the Juice thereof into the Wound, which they will do as if it

were

were out of a Syringe. Then they apply their Salve-Herbs, either bruiſed or beaten into a Salve with Greaſe, binding it on with Bark and Silk-Graſs. Colonel *Spencer*, the preſent Secretary of State of *Virginia*, told me of a very ſtrange and extraordinary Cure performed by an *Indian* on one of his *Negroes*. The *Negro* was a very good Servant, wherefore his Maſter had valued him much; but by Degrees he grew dim-ſighted, and was troubled with terrible Pains in his Eyes, ſo that with one he could ſee but a little, and none at all with the other; and as the Pain ſtill increaſed, the Colonel was greatly apprehenſive, leaſt his *Negro* would be quite blind. Several Surgeons were ſent for, who had tried to cure him, but in vain; when an *Indian*, coming to the Houſe, ſaid he would cure him; they told Mr Secretary thereof, who ſent for the *Indian*, and agreed with him for two Quarts of Rum. The *Indian* told him, that he could ſave one Eye, but that the *Negro* would be blind of the other. The next Morning the *Indian* went a hunting into the Woods for his Herbs, and returned with them about Noon, which he bruiſed, putting thereto a little Water; and having preſſed forth ſome of the Juice, he dropped ſome thereof into the Eye which he ſaid would be blind, and laid the Herbs thereon, which he would have bound faſt with Bark; but the Colonel called for ſome Linen Rags, and had it bound up therewith. He then intimated to the Colonel, that ſhortly after Sun-ſet the *Negro* would be mad, if his Medicine took Effect, but would come to himſelf again before Morning; wherefore ſtrict Orders were given, that he ſhould be well attended, and that nothing ſhould be altered, let what would happen. All Things therefore being accordingly done as the *Indian* had directed, every Thing ſucceeded likewiſe as the *Indian* had foretold. Then, about 11 o'Clock the next Day, the Binding being removed, and the Herbs taken off from the Eye, the *Indian* bid the *Negro* hold down his Head, which when he had done, out dropped the cryſtaline and aqueous Humours. The *Indian* afterwards bound it up again, and by Degrees the *Negro* was freed from his Pain, and had perfect Sight with the other Eye. What the Herbs were, the Colonel could never learn from him, though he proffered him whatever he would demand.

10. The Diſtempers amongſt the *Engliſh* Natives (for I cannot give ſo particular an Account of the Diſtempers moſt predominant among the *Indians*) are, *Scorbutical Dropſies*, *Cachexies*, *Lethargies*, *Seaſonings*, which are an intermitting Fever, or rather a continued Fever with quotidian Paroxyſms. Theſe are now rarely ſharp, but ſhew themſelves in a lingering Sickneſs. The *Griping of the Guts*, moſtly dry, and when the *Tormina Ventris* ceaſe, they generally ſhoot into the Limbs, and fix there, in a terrible Sort of Gout, taking away the Uſe of the Limbs. Thus they will pine away to Skin and Bone, ſo that their Joints will ſeem diſlocated, and their Hands utterly crippled. *Sore Throats*, which the laſt Year were very frequent, and deemed infectious, running generally through whole Families, and, unleſs early prevented, became a

cancerous Humour, and had Effects like the *French-Pox*. Likewise *Pains in the Limbs*, which I apprehended to have proceeded partly from the same Humour floating up and down the Body. These Pains are very exquisite, mostly nocturnal; for while they walk, if they have the Use of their Limbs, they feel the least Pain. The Oil of a Fish called a *Drum* was found very effectual to cure these Pains, and restore the Limbs. I was Eye-Witness when a very worthy Gentlewoman, who had lost the Use of her Limbs, was entirely recovered by the Use of this Medicine: For her Feet being anointed with this Oil, the Pains flew into her Head; her Head thereupon being anointed, the Pain descended again; then anointing both Head and Feet, she was recovered. There are three Sorts of Oils in that Country, whose Virtues, if fully proved, might not perhaps be found despicable: The Oil of *Drums*, the Oil of *Rattle-Snakes*, and the Oil of *Turkey Bustards*. The Oil of *Sassafras-Leaves* may be deservedly considered too, for they will almost entirely dissolve into an Oil. But to return: There is another Sort of Distemper, which I judge to be the *Lepra Græcorum*. And it may perhaps be no bad Conjecture, that this chiefly proceeds from their feeding so much as they do, on a delicate luscious Sort of Pork. Among the *Indians* they have a Distemper which they call the *Yaws*, which is nearly related to the *French-Pox*; which they are said to cure with an Herb that fluxes them: But this I have only by Hear-say.

11. The *Indians* mind neither the Pulse nor Urine, only judge by the common most remarkable Symptoms; and some pretend to form a Judgment from the Countenance, and are fond of being thought Physiognomists.

12. I never could find, that they practised the *letting of Blood*. They purge much with several Sorts of Roots of their own Country Growth, and vomit frequently with various Herbs. They sweat boldly and excessively, and after a very strange Manner: For they have their Sweating-Stoves always upon the Bank of some River; whence they rush forth in the Height of their Sweat, and run into the River, where they wash and bathe themselves very plentifully. They use no *Blistering-Plasters*, but are exquisite at Cupping. As the *East-Indians* use *Moxa*, so these burn with *Punk*, which is the inward Part of the Excrescence or Exuberance of an *Oak*. When they design to give a *Purge*, they make use of the following Herbs: *Poake-Root*, i. e. *Solanum bacciferum*, a strong Purge, and by most deemed Poison. The Roots of *Tythimal*, of which I have observed two Sorts; the one *Flore minimo herbaceo*, the other *Flore albo*. The Flower of this last is small, but large in Comparison with the other: They are *repentes*, and grow in old manured Grounds. They chiefly make use of the latter of these, and it is a most excellent Purge, though it sometimes vomits: It is a quick but moderate Worker enough; and has this Peculiarity, that it opens the Body in the *Gripes*, when other much violenter Purgatives will not move it. There is another Herb, which they call the *Indian Purge*: This Plant has

has ſeveral woody Stalks growing near three Feet tall, and, as I remember, *perfoliat*: It bears yellow Berries round about the Joints: They only make uſe of the Root of this Plant. They uſe alſo the *ſmall Fleur-de-Lis*, whoſe Virtues, I believe, are not yet half known, for it has ſome extraordinary Qualities: It does not grow above a Hand high, flowers in *March*, and is very fragrant. They uſe alſo ſome Sort of the *Apocynum's*; particularly that which I think *Gerard* calls *Vincetoxicum Americanum*; for there are ſeveral Sorts of *Apocynum's*, I think 13 or 14, but they are not all purgative: For having got ſome of the Root from an *Indian*, which he aſſured me was the *Rattle-Snake-Root*, I thought the Root of an *Apocynum* (which may well be diſtinguiſhed by that of *Roſæ Mariæ foliis*) was very like it, both in Shape and Taſte, conſidering the one dried, and the other freſh: Wherefore I got ſome Quantity thereof, and carrying it in my Pocket, I ventured to eat thereof, little by little, till I believe I have taken a Drachm at a Time, to obſerve if it had any peculiar Operation on the Body; but could never find that it had.

They have likewiſe ſeveral Sorts of Herbs, wherewith they *vomit*; one of which is a little Sort of *Squills*. They likewiſe take the Leaves of a certain curious odoriferous Shrub, that grows in the Swamps, which I take to be the *leſſer Saſſafras*; they bruiſe them in Water, and then expreſs the Juice, which they drink warm. The *Indian* Interpreter, who taught me this, prized it much, as excellent Phyſick, and ſaid they found it a very ſovereign Remedy. It is as odoriferous as any Shrub I ever ſmelt at in my Life: Whoever has once taken Notice of the Smell, cannot forget it, or be deceived therein afterwards, having ſomething peculiar in it. The Name which the *Indian* gave me hereof, was *Wiſochis*, which ſince I underſtand is the general Word for Phyſick.

13. The reſt of their *Materia Medica* conſiſts of Herbs, of which they have great Plenty, and ſeldom preſcribe any Thing elſe. I have collected above 300 ſeveral Sorts, that were no *European* Plants; but I ſhall only mention thoſe at preſent, whoſe Virtues I take to be moſt remarkable. And firſt, the *Saſſafras-Tree*, whoſe Root is well enough known. It ſhoots forth it's Bloſſoms in *March*, which are yellow, and grow in little Bunches like Grape-Flowers, and which, when gathered and picked from the huſky Bud, make a curious Preſerve. Moſt *Saſſafras-Trees* bloſſom, few bear Berries, but thoſe that do are generally very thick: They are ſhaped much like thoſe of *Dulcamara*, but are black of Colour, and very *aromatic*; I take them to have conſiderable Virtues. The *Gum-Tree*, which I refer to the Species of Plane-Trees, and diſtinguiſh it by it's Fig-like Leaf, only more ſharply dented. It's Leaf ſmells much like a Lemon. Their Practice is to beat the Tree, and then pill off the Bark, and ſo ſcrape the Gum, which has Virtues like Turpentine, or rather more aſtringent and drying. This they uſually mix with their common Turpentine, which is whiter and more

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Butter-like, than the *Venice* or *Chios* Turpentine. *Query*, Whether better or no? The further Method of preparing this Medicine, as I am told, is this: They expose it to the Sun on Paper, where at first it rather seems to melt, but it will afterwards grow hard; they then beat it to a Powder, and administer it. They use much the young Buds of the *Populus, sive Tulipa arbor*, a vast large Tree, extraordinary spacious, bearing-Flowers about *April*, much like Tulips; it's Leaves are large, smooth, and well-shaped, which, together with the Flowers, render the Tree exceeding beautiful to behold. It bears it's Seed coniferous, and is an excellent Opener of Obstructions. The *Sorrel-Tree* bears a Leaf something like a Laurel, in Taste much resembling *Lujula*. They use it in Fevers, and, as I am informed, with good Success. This Tree grows plentifully on the South-Side of *James River* in *Virginia*; I cannot say I ever found it to the Northward. The *Swamp-Plum-Tree*, whose Wood they calcine, and make into Charcoal, which they beat to a Powder, then mix it with Grease, and make an Ointment thereof, with which they anoint the Body, and foment it very much, whereby they cure the *Dropsy*; for it opens the Pores to that Degree, that the Water runs down their Legs. Among their Herbs, I have had 40 several Sorts, or near that Number, shewed me as great Secrets, for the *Rattle-Snake-Root*, or that Kind of *Snake-Root* which is good for curing the Bite of the *Rattle-Snake*: But I have no Reason to believe, that any of them are able to effect the Cure. One Gentleman shewed me a certain Root, which was a *Smilax*, and assured me, that that was certainly the *Rattle-Snake-Root*. And afterwards, when I shewed Mr Secretary *Spencer* the same Root, he said that certain *Indians* had given him of the same Root for the *Rattle-Snake-Root*, and that he had some Quantity to send for *England*; but this Root is by no Means the same with that which I have mentioned before, in Answer to *Query* 12, which I said was like the Root of an *Apocynum*, which I myself obtained from an *Indian*, who seemed to prize it highly, having sewed it carefully up in Leather on the Inside of his Belt. Others have shewed me *Chrysanthemum ferulaceis foliis* for it; others *Chrysanthemum tragopyri foliis*. Again; general Report goes in Favour of the *Asarum Cyclaminis foliis*, which many therefore particularly call *Rattle-Snake-Root*. There are strange Stories told in Favour of an Herb called *Dittany*, which however is not of the *Dittany* Kind, but is only a Mountain *Calaminth*. This they say will not only cure the Bite of a *Rattle-Snake*, but that the Smell thereof will kill the *Snake*. But however, * I have some Reason to believe, that this Herb will not cure the Bite, nor that the Smell thereof will kill the *Snake*; for Colonel *Spencer* assured me, that he had an Opportunity of making an Experiment thereof upon a Dog which was bitten by a *Rattle-Snake*, to which he gave plentifully of the Juice of his *Dittany*, as they called it; but the Dog died nevertheless

* See *Miscel. Curiosæ*, Vol. III. *p.* 352.

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a Day or two after. And Mr *Wormley*, one of the Council of State in *Virginia*, told me, that being in Company with another Gentleman, he had an Opportunity of making the following Experiment; for seeing a *Rattle-Snake* in her Coil, they went and got a Bunch of this *Dittany*, and tied it to a Pole; then putting the *Dittany* that was thereon to the Nose of the *Snake*, it seemed to offend her, whereupon she turned away her Head, which they still followed with the *Dittany*; then the *Snake* fled, and they still pursuing her, she at last stretched herself out at Length, and lay seemingly dead. Then they laid the *Dittany* upon her Head, and went into a neighbouring House to refresh themselves; for they were tired with skipping about after the *Snake*. When they had staid near half an Hour, they returned to see their supposed dead *Snake*; but, behold! the *Snake* was fled; so that they then judged, that the *Snake* had only stretched herself out, because she had been tired with their Pursuit. I look upon it probable therefore, that some Accident of the like Kind may have first given Origin to this Story; the Person had tired the *Snake* not having regularly waited for the Event, but perhaps, to secure the Conquest, may have given the *Snake* a Stroke with a Switch upon the Back, which would have killed the *Snake* without the *Dittany*. But yet nevertheless, this Plant is of more than ordinary Virtues, and might not unprofitably be used by our Physicians. It may be referred to the Class of the *Calamintha montana, pulegii odore*, which has been transferred from thence into *England*, and I think is now pretty common, but is hotter and more sudorifick.

I will now mention to you an Herb, though unknown, yet worthy to be fetched from *Virginia*, yielded the Country nothing else: It is the Herb called there *Angelica*, but which I take to be *Libanotis vera latifolia Dodonæi*. It grows generally on a rich sandy Ground, on a declining Brow, that faces the rising Sun; the Root shoots deep into the Earth, sometimes near three Feet, very tender, and easily broken, of a white or rather Cream-like Colour; and being lactescent, yields a little Milk, thick and yellow as Cream; a very early Plant. It seldom flowers or seeds under five Years Growth; for I have fully and distinctly observed that Number of Years in the several Sorts of this Plant, by the Growth of those not come to Maturity to bear Seed; and it is observable, that those which do not seed, have rarely more than one Branch, which divides when it spreads, and subdivides itself still into three. The Leaf is much like our wild *Angelica*, only thinner, and more the Colour of a Willow-green. Those that seed, have a fistulous Stalk about the Thickness of *Dill*, a white umbelliferous Plant; the Seeds are much like *Angelica-Seed*, but from the Fragrancy of the Root, and it's being peculiarly bearded, I undoubtedly style it a *Libanotis*. It stops the *Flux*, and cures it to a Wonder. Again; it often loosens and purges the Bodies of those that are bound, and have the Gripes, especially if it proceeds from Cold; and prevents many unhappy Distempers. I have Reason to speak well of it; for it is to it, under

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God, that I attribute the saving of my own Life. I have known it give 14 or 15 Stools, whereas it will not move a Child in Health. I take it to be the most sovereign Remedy the World ever knew in the Griping of the Guts, and admirable against Vapours. It is sudorifick, and very aromatick, and will not be concealed; for wherever it is mixed, it will have the predominant Scent. It is mostly called, by those who know it in *Virginia*, by the Name of *Angelica*: But shewing a Piece of the Root to a great Woodsman, to see whether he knew it, and could tell me where it grew, he seemed surprized to see me have thereof; and told me, that he kept an *Indian* once for some Weeks with him, because he was an excellent Woodsman, and going a hunting, (*i. e.*) shooting, they came where some of this Root grew: The *Indian*, rejoicing, gathered some of it, but was very careful to cut off the Top of the Root, and replant it: He then asked him, Why he was so careful? Whereunto the *Indian* replied, It was a very choice Plant, and very scarce; for they sometimes travelled 100 or 200 Miles without finding any of it. He then asked him, What Use it was of? To which the *Indian* answered, You shall see by and by. After some Time, they spied four Deer at a Distance; then the *Indian*, contrary to his usual Custom, went to Windward of them, and sitting down upon an old Trunk of a Tree, began to rub the Root betwixt his Hands; at which the Deer tossed up their Heads, and snuffing with their Noses, they fed towards the Place where the *Indian* sat, till they came within easy Shot of them; whereupon he fired at them, and killed a large Buck. The Truth of this Story I no further assert, than that I was told it by a Person of seeming Seriousness, who had no Inducement to tell a Lye, or impose upon me: But I have often taken Notice, that the *Indians* smell generally strong of this Herb. And I have since learned from others, that the *Indians* call it the *Hunting-Root*, which makes me more inclinable to give Credence to this Story. Another Gentleman, a white Native of that Country, when I once pulled a Piece of the Root out of my Pocket to bite thereof, (for I frequently carried some of it about me) asked me, If I loved Fishing? I required, Wherefore he asked me that Question? Because, said he, you have gotten some of the *Fishing-Root*. The *Fishing-Root!* replied I; pray why do you give it that Name? Because, said he, when we were Boys, we used to get some of it to lay with our Baits to invite the Fish to bite. This I can say of my own Knowledge, that having one Day got some Quantity of the Root, and likewise of the Branches, to distil, the strong Scent, as I went home, palpably put me into a breathing Sweat. In the Night I was waked by a Rat, which ran over my Face, whereas I never at any other Time had the like happen to me; but will not be positive to conclude, that this Root was the Cause thereof, only the precedent Relations made me reflect thereon. There is another Root of the Species of *Hyacinths*, the Leaves whereof are Grass-like, but smooth and stiff, of a Willow-green Colour, and spread like

like a Star upon the Ground; from the Middle ſhoots a tall long ruſh-like Stem, without Leaves, near two Feet high; on one Side grow little white Bell-Flowers one above another: The Root is black outwardly, but brown within. It is bitter, and I take it to have much the ſame Virtues as *Little Centaury*. Some call it *Ague-Graſs*, others *Ague-Root*, others *Star-Graſs*. I have likewiſe been told by ſeveral, of a Root which the *Indians* cure Bruiſes wonderfully with; but I apprehend it is the ſame Root with which the *Indian* cured the *Negro*'s Eye afore-mentioned; for it operates much after the ſame Manner, according to their Relation, making the Patients mad for ſome Hours, if they be recoverable. It is not to be applied where the Skin is broken. They uſe it thus: They chew ſome of the Root in their Mouths, and then ſquirt it forth on the bruiſed Part, fomenting it well with their Hands; then they give a little to the Perſon bruiſed to chew, who muſt ſwallow the Juice, but ſpit forth the Root again, which they bind on the Part aggrieved. If the Relations I have had of Cures performed thereby, be abſolutely true, the World has not yet diſcovered a more wonderful Remedy. I had it deſcribed to me by Colonel *Smith*, of the *Iſle of Wight County*, to be like *Langue de Bœuf*, with a yellow Flower, and rough hoary Leaf, the Root yellowiſh, and taſted ſomething ſweetiſh like Liquorice. There are ſeveral others I might name, whoſe Virtues are by no Means deſpicable; ſuch as the *Chryſanthamum platani foliis*, whoſe Root is very uſeful in *old Pains*, the *Sciatica* and *Gout*. It is a large Herb, grows betwixt five and ſix Feet tall. There are likewiſe many others, which bear ſome Analogy to the *European* Plants, ſuch as *Solomon's Seal*, *Wood-Sage*, much better, I think, than the *Engliſh*; which the *Indians* uſe much for Infuſions, and which they take as we do Diet-drink. *Little Centaury*, red, white, and yellow, *&c.* However, I never could find above 12 or 14 Plants, which were Natives of that Country, that agreed perfectly with any of our *European* Plants, but what had ſome notable Differences, if they were not rather to be reckoned a diſtinct Genus.

13. There go Traditions of their having an Art to poiſon their Darts; but I could never find any ſolid Grounds for that Report. I have obſerved, that in thoſe Countries, upon an ill Habit of Body, the leaſt Scratch is dangerous; and that, for all the Care that can be taken to prevent it, it often turns into a very deſperate ulcerous Sore. Some Herbs there are of analogous Nature with *Hemlock*, whereof, I think, they know nothing further, than that they are to avoid them; but any Herbs, wherewith they poiſon their Darts, I never could hear ſpecified. And as Perſons engaged in long Marches are liable to many Accidents, which may contribute to an ill State of Health, when a ſlight Wound in Battle has then proved mortal; this I apprehend to have been the Cauſe, why the Phyſician has rather choſen to attribute the Death of his Patient to the Poiſon of the Dart, than the Want of Skill in himſelf.

14. As to their Morals, they are ſimple and credulous, rather honeſt than otherwiſe, and unpractiſed in the *European* Art of Lying and Diſſimulation; but as to the brutal Paſſions, they are ſottiſh and ſenſual as the Beaſts of the Field.

15. They are almoſt always either eating or ſleeping, unleſs when they go a hunting: At all Hours of the Night, whenever they awake, they go to the *Homing-Pot*, that is, Maze dreſſed in a Manner like our pilled Wheat; or elſe a Piece of Veniſon *barbecued*, that is, wrapped up in Leaves, and roaſted in the Embers.

16. They drink, I think, little beſides *Succahannah*, that is, fair Water, unleſs when they can get Spirits, ſuch as Rum, from the *Engliſh*, which they will always drink to Exceſs, if they can poſſibly get them; but do not much care for them, unleſs they can have enough to make them drunk; and I have heard it ſaid, that they wonder much at the *Engliſh* for purchaſing Wine at ſo dear a Rate, when Rum is much cheaper, and will make them ſooner drunk.

17. They uſe *Tobacco* much, which they ſmoak in ſhort Pipes of their own making, having excellent Clay, which I tried a little before I came for *England*, making Crucibles thereof, which I could not diſcern were inferior to the *German*. They make alſo neat Pots of the ſame Clay, which will endure the Fire for any common Uſes.

18. They have no *Opium*, though in ſome old Fields upon *York River*, I found Poppies perhaps of no deſpicable Virtue. I have been told, that in Fevers, and when their Sick cannot ſleep, they apply the Flowers of *Stramonium* to the Temples, which has an Effect like *Laudanum*. I have had aſſerted by many, that when the Soldiers were ſent over to quell the Inſurrection of *Bacon*, *&c.* they being at *James-Town*, ſeveral of them went to gather a Sallad in the Fields, and lighting in great Quantities on an Herb called *James-Town-Weed*, they gathered it; and by eating thereof in Plenty, were rendered apiſh and fooliſh, as if they had been drunk, or were become Idiots. Dr *Lee* likewiſe aſſured me, that the ſame Accident happened once in his own Family; but that after a Night or two's Sleep, they recovered.

19. Their *Sports* are Dancing, their *Games* are playing with Straws, which as I am not perfectly acquainted with, I find it hard to deſcribe; I can therefore only tell you how it appears to a Looker-on: They take a certain Number of Straws, and ſpread them in their Hands, holding them as if they were Cards; then they cloſe them, and ſpread them again, and turn them very ſuddenly, and ſeem very dextrous thereat. Their *Exerciſe* is Hunting, that is, ſhooting with a Gun, or with Bow and Arrow, wherein they excel. Their Women work, plant the Corn, and weave Baſkets or Mats.

20. Several have been very old; I cannot ſay, that herein there is any remarkable Difference between them and the *Engliſh* Natives. If the *Engliſh* live paſt 33, they generally live to a good Age; but many die between 30 and 33.

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21. I have been told, that one of their famous *Wiochists* propheſied, that bearded Men (for the *American Indians* have no Beards) ſhould come and take away their Country, and that there ſhould none of the original *Indians* be left within a certain Number of Years, I think it was an hundred and fifty. This is very certain, that the *Indian* Inhabitants of *Virginia* are now very inconſiderable as to their Number; and ſeem inſenſibly to decay, though they live under the *Engliſh* Protection, and have no Violence offered them. They are undoubtedly no great Breeders.

22. Though they are ſluggiſh by Nature, and ſlow of Speech, yet their Method of Expreſſion ſeems vehement and emphatical, and always attended with ſtrong Geſticulations. They are generally well proportioned, and for the moſt Part are rather taller than the *Engliſh*. They have all either a very dark-brown Hair, that may well be called black, or a Jet-black, all lank.

CHAP. III.

MISCELLANEOUS PAPERS.

South-Carolina, Charles-Town, Jan. 22, 1740-1.

Extracts of two Letters from Dr John Lining, *Phyſician at* Charles-Town *in* South-Carolina, *to* James Jurin, *M. D. F. R. S. giving an Account of Statical Experiments made ſeveral Times in a Day upon himſelf, for one whole Year, accompanied with Meteorological Obſervations; to which are ſubjoined ſix general Tables, de-*

I. I Began theſe Experiments the firſt of laſt *March*, and have continued them ever ſince, with the Loſs only of a few Days; and propoſe to continue them till the Year is finiſhed, afterwards ſhall make them a few Days in every Month, and as conſtantly as poſſible in epidemic Seaſons.

What firſt induced me to enter upon this Courſe, was, that I might experimentally diſcover the Influences of our different Seaſons upon the human Body, by which I might arrive at ſome more certain Knowledge of the Cauſes of our epidemic Diſeaſes, which as regularly return at their ſtated Seaſons, as a good Clock ſtrikes 12 when the Sun is in the Meridian; and therefore muſt proceed from ſome general Cauſe operating uniformly in the returning different Seaſons.

Keil, indeed, has obliged the World with his *Statical Experiments*, but theſe his extenſive Practice made leſs perfect than he could have wiſhed, having many deficient Days, and he ſeldom gives the diurnal Perſpiration. Had theſe been carried on with all the Conſtancy poſſible, they could not have ſo clearly demonſtrated the Changes made in the animal Œconomy, in the ſeveral Seaſons, as would a Courſe of ſuch Experiments made in our Clime, where thoſe Influences are in a much

duced from the whole Year's Course. No. 470. *p.* 491. *Read* May 19, 1743.

more eminent Degree; and where the Excurſions from Heat to Cold are very conſiderable, and often ſudden, I having ſeen 30 Degrees Difference in 24 Hours by *Fahrenheit*'s Thermometer.

Sanctorius, it is true, lived in a warm Climate, and has deduced many uſeful Aphoriſms from his Experiments; but then he has not left us the Experiments themſelves: Hence we are not only deprived of the Authorities from whence he deduced his Aphoriſms, but likewiſe of a long-continued Series of Experiments; from whence the Changes induced upon the human Frame, in the different Seaſons, might have experimentally appeared.

From the Hiſtories of the Air and epidemic Diſeaſes, we learn what Conſtitutions of the Air are productive of certain Diſeaſes: Were we, however, once furniſhed with a Courſe of Statical Experiments of one whole Year, together with the Hiſtory of the Weather, we, probably, might have more diſtincts Views of the Nature of the Diſeaſes themſelves, by knowing experimentally the Changes produced in our Conſtitutions, diſpoſing us to ſuch and ſuch Diſeaſes, in certain Periods of the Year.

To theſe Tables I likewiſe would have added an Analyſis of a little of my own Blood and Urine, in every Month, with the Blood's Coheſion, could I have got the Inſtruments: But that I propoſe afterwards to do, if I can get the ſame Kind which Dr *Langriſh* analyſed the Blood, *&c.* with, and an Inſtrument exactly the ſame with his, for meaſuring the Blood's Coheſion.

The Method I have obſerved in the Tables is this:

I weigh myſelf twice every Day, once in the Morning immediately after I riſe, and again before I go to Bed at Night. As in *July* 1, my Weight at 6 ½ *a. m.* was ℔ 165. 13. 0. at 10 in the Night was 167. 5. 4. *&c.* ℥ 12 was the Quantity of Urine excreted from 6 ½ in the Morning, to 10 ½ that Night: And ℥ 9 ½ was the Urine from 10 *p. m.* of the firſt Day, to 7 ½ in the Morning of the ſecond Day. The Figures placed in the next Column, directly oppoſite to theſe Quantities of Urine, expreſs the Quantity perſpired in the ſame Space of Time; *e. g.* ℥ 68 and ℥ 3 was perſpired betwixt 6 ½ *a. m.* and 10 ½ *p. m.* in the firſt Day, and ℥ 23 ½ the Quantity perſpired from 10 ½ *p. m.* of the firſt Day, to 10 ½ *a. m.* in the ſecond Day.

The Number of Pulſes I take in the Morning, and immediately before I go to Bed at Night.

In the Column titled Stools, the Quantity is in Ounces and Drachms. When the Figures are placed in the upper Part of the Column, that Excretion was in the Morning; when in the middle or lower Part of the Column, then it was in the middle of the Day, or in the Night before Bed-time. Where 1, 2, or 3, occur in a Column, they expreſs the Number of Stools that Day, as in *July* 6, there were 3 Stools.

The

The Figures placed in all the reſt of the Columns, are in Ounces and Decimals: The Calculations I made with a two Foot ſliding *Gunter*'s Scale.

In the Column Urine 24^h, you have the Urine of 24 Hours calculated each Day; becauſe, as I do not always weigh at one Hour in the Morning, the Space of Time betwixt two Morning Weighings muſt be unequal; whence the Difference betwixt the Quantities of each Day does not appear; as from *July* 1, 6 ½ *a. m.* to *July* 2d 7 ½ *a. m.* is 25 Hours, and the Quantity of Urine in that Time amounts to 21 ½ Ounces, which, calculated to 24 Hours, is 20.62 Ounces. In the ſame Manner have I calculated the Perſpiration of 24 Hours.

In the Column Urine diurnal 6^h, is the mean Quantity of 6 diurnal Hours Urine calculated; as *July* 1, from 6 ½ *a. m.* to 10 ½ *p. m.* being 16 Hours, the Quantity of Urine in that Time is ℥ 12; which, calculated to 6 Hours, (upon Suppoſition that the Urine was equally ſecreted in all theſe Hours, which we know never can be) amounts to 4.50 Ounces.

In the ſame Manner have I calculated the nocturnal Urine of 6 Hours, and the diurnal and nocturnal Perſpiration of 6 Hours; which ſerves very well in the following Columns, to ſhew their Differences, where they are compared together. For the Space of Time in which the diurnal Urine and Perſpiration are excreted, is much greater than that in which the nocturnal Urine and Perſpiration are excreted; whence, without comparing them together, by taking their Means in equal Spaces of Time, their Difference would not appear, as it now does in theſe Tables at firſt Inſpection.

In the Column Evacuation of 24^h, is the whole Quantity excreted in 24 Hours, which is found out by adding together the Stools, and the Urine and Perſpiration of 24 Hours by Calculation; whence the exact Quantity retained, or *è contra*, in every 24 Hours, appear in the ſucceeding 2 Columns.

By theſe tedious Calculations I have endeavoured, as much as poſſible, to prepare the Tables for Uſe, that juſt Deductions may more eaſily be drawn from them.

In the Columns Quant. of Meats, and Quant. of Drinks, the Quantities are in Ounces and Drachms. The Weights I have uſed are Gr. 60 = ℥ 1, 38 = ʒ 1, ʒ 16 = ℔ j.

The Cloaths in which I dreſs before I weigh myſelf are taken Care of, ſo that their Weight ſhall vary as little as poſſible in the different Changes of the Air's Humidity.

In the Summer, as Opportunity ſerved, I weighed myſelf every Hour, ſecond or third Hour, through the Day, to inveſtigate the Difference of the Urine and Perſpiration, in different Hours of the Day, under different Circumſtances; one Table of which I now ſend you, in which the Urine and Perſpiration are likewiſe in Ounces and Drachms, and is

to

to be read together with the Account of the Quantity of Meat, Drink, and Exercise used; *e. g.*

July 3d, betwixt 11 ¼ and 12 ½, I drank ℥20 of Punch, used no Exercise, was not exposed to the Wind, and was cloathed in a Holland Jacket unbuttoned: Made in that 1 ¼ Hour, ℥1 of flammeous Urine, and sweated so excessively, the Heat of the Air I sat in being 87, that both my Shirt and Jacket being wet with Sweat, was obliged to shift: Whence, though the Perspiration was, no doubt, greatly diminished by the Coldness of the wet Cloaths, towards the End of the 1 ¼ Hour, yet I perspired betwixt ℥11 ¼ and 12 ½, 14 ⅜.——Having shifted, and being cloathed in a Holland Jacket and Chince Gown, was exposed, betwixt 12 ¼ and 2 ¼, to the third Degree of the Wind's Force; eat ℥10 ⅝ of roasted Lamb, Bread, and Shallots, drank ℥40 of Punch, and used no Exercise; in these 2 Hours made ℥3 ⅛ of Urine, and, being exposed to the Wind, perspired only ℥12, though I sweated a little all the Time, and though the natural Heat of the Air was the same as in the former Experiment.——The same Day again, betwixt 2 ¼ and 5 ⅛, *p. m.* my Cloathing being the same, and using no Exercise, I drank betwixt ℥23 and 25 more of Punch; and the Air being cooled by the Clouds overspreading the Heavens, the Quantity of Urine was greatly increased, amounting in these 2 ½ Hours to ℥28 ⅝; but the Perspiration was so much diminished, that the Quantity of humid Particles attracted by my Skin exceeded the Quantity perspired in these 2 ½ Hours by ℥8 ⅛. Two more Instances of this Attraction you have in the same Table; and, no doubt, it often occurs in the Summer, and might be discovered by any who can conveniently weigh themselves every second or third Hour of the Day. Here there was no Waste of the Fluids, the predisponent Cause, according to *Keil*, of such Attraction, but Reason to suspect the contrary, by drinking so plentifully of Punch.

The Punch, or *Diapente*, as I have improperly called it, is made thus: Take Water ℔ 2, Sugar ℥1 ½, recent Juice of Limes ℥2 ½, Rum ℥3 ½ *M.* This is the Punch we commonly drink in the Summer; but that which we drink in the Fall and Winter is richer, having more Sugar and Rum, and less of the Acid. It is a pleasant, subacid, coolling, and exhilarating Drink; and proves an excellent Diaphoretic in warm Weather, and a good Diuretic in cold Weather.

The Barometer is a common portable one; the Diameter of it's Bore is about ; of an Inch.

The Thermometer is *Fahrenheit*'s; the other Thermometer is made by *Thomas Heath* in *London*, and is divided into 90 equal Parts; 65 is the freezing Point, and 49 temperate: I suspect it to be the same with *Hauksbee*'s, and have called it so in the Tables.

The Hygroscope is a Whipcord, prepared after the same Manner as that of the Society's in *Edinburgh*; the Difference betwixt it's greatest and least Length, by their Manner of Preparation, I found to be 5 Inches;

Inches; for which I made an Index 5 Inches long, and divided it into 100 equal Parts, the first of which is the Hygroscope's greatest Length.

These Instruments are conveniently placed on the Outside of a N E Window, in a large square Box, about 3 Feet broad, 6 high, and 1 ½ deep; which is so constructed, that neither the Sun nor Rain can have Access to the Instruments, and is at the same Time sufficiently perflated to shew the Temperature of the Air, having a great Number of large Holes, regularly placed, and passing obliquely upwards, in both Sides, and in the Front, with Weather-Boards placed over each Range of Holes, so as to hang over them obliquely downwards; and has likewise a large Window in the Front, which is open from Morning to Bed-time: The Shutters of the Window are in many Places perforated obliquely upwards, that the Air may have a free Circulation through the Box when the Window is shut at Night.

In the Column *Face of the Sky*, I have only taken Notice of the Sky's Appearance from the *Zenith* to within about 30 Degrees of the Horizon.

C. Clouds.	/ Small Rain.	☇ Thunder.
T. Thick.	// Greater Rain.	
S. Spread.	/// Very great Rain.	
L. Light.		

The Characters for Rain express the Time in which it rained, according as they are placed in the Column. When in the upper Part, it rained in the Forenoon: In the middle, Rain about the middle of the Day: In the under Part, Rain in the Evening, or Night before Bed-time; and when placed upon the Lines which divides the Days, then it rained in the Night.

I have observed the same Rule with the Character of Thunder, in placing the upper Part of it *a* (☇*a*) in the same Manner as of the Character of Rain; and likewise have placed it in that Direction, by which the Point of the Compass where the Thunder began, may be known, the Part *(a)* pointing to the Place where the Thunder began, supposing the Points of the Compass to lie in the same Manner in the Tables as in Maps. The numerical Figures placed upon it's Left-hand, express the Degree, Violence, or Continuance of the Thunder, 4 being the greatest.

Of the Wind's Force, I am obliged to judge by my Senses: 4 Degrees of it being insufficient in such Experiments, I have made 8. For a small Increase of the Wind's Force has a considerable Influence in sweeping away the Heat of our Cloaths; and, thereby cooling the Skin, diminishes Perspiration.

The Depth of the Rain is in Inches and Decimals.

I make

I make 3 Observations, by these Instruments, of the Weather every Day, *viz.* in the Morning, and at Bed-time, at the same Hours in which I weigh myself, and the other at 3 *p. m.*

Heat of the Room is that where I sleep or sit, by *Fahrenheit*'s Thermometer; have mentioned in the *Observationes Miscell.* when I was exposed in it to the Wind.

Thus have I now spent near one Year, with no small Labour, Confinement, and Expence, in the Loss of Practice, in making these Experiments and Calculations; and if they will be of any Service to Mankind, of which you are the most proper Judge, shall then obtain all I had in View, in entering upon the Course.

South-Carolina, Charles-Town, April 11, 1741.

Extract from the 2d Letter. Read May 19, 1743.

I will not take up your Time in giving you the Reasons which first induced me to undertake a Course of such troublesome Experiments for one whole Year, which I have now finished: However, I presume, that a Course of such Experiments, made in a Clime where the Excursions from Heat and Cold, in the different Seasons, are very great, and the Transitions often surprisingly sudden, these Experiments, I say, made almost every Day through the Year, wherein the Day's Urine and Perspiration are distinguished from the Night's, may be of some Use in illustrating the Nature and predisponent Causes of epidemic Diseases, which so regularly return at stated Seasons; and especially as nothing, I know of, is extant of that Nature, so compleat as I have endeavoured: But of this, Sir, you are the best Judge.

Least the Tables I sent you before, should be lost, I have again presumed to trouble you with this; and have sent one Table more of the Experiments, being the remaining Part of *July*, and likewise six general Tables deduced from the whole Year's Course; these general Tables containing so many Corollaries deduced from the whole, and exhibiting, at one View, the Changes made in the sensible and insensible Excretions through the whole Year, you may communicate to the *Royal Society*. All the *Means* in these Tables are calculated after your Method.

N. B. The Table for *July* would have taken up too much Room here: I therefore thought it better to insert only the general Tables, in order to give a general Idea of the whole Year's Observations, which would make a small Volume by themselves. *C. M.*

TAB. I exhibits the Quantity of Meats and Drinks in Inches and Decimals, and the Sum of all the Evacuations made at the Time of the Experiments; whence it appears evidently what Increase and Diminution is made in the human Body for a whole Year.

Days of Experiment.		Meat.	Drink.	Urine.	Persp.	Stools.	Meat and Drink More than Evacuations.	Less
March	13	297. 87	1282. 37	971. 50	548. 50	43. 00	17. 25	
	12	332. 12	1026. 37	793. 37	532. 37	46. 00		13. 25
April	13	310. 12	1096. 12	798. 62	591. 62	50. 25		34. 24
	10	244. 75	854. 12	562. 37	506 00	27. 87	2. 63	
May	16	424. 25	1293. 37	880. 12	816. 37	61. 00		39 87
	14	367. 37	1431. 37	804. 37	927. 00	42. 00	25. 00	
June	14	313. 12	1447. 50	739. 87	1000. 87	52. 75		27. 87
	15	338. 37	1535. 87	780. 87	1069. 50	57. 12		33. 25
July	16	378. 37	1787. 75	787. 00	1301. 37	66. 50	11. 25	
	15	378. 12	1614. 50	569. 87	1387. 37	55. 75		20. 37
Aug.	15	398. 75	1591. 00	823. 87	1129. 37	50. 37		13. 61
	15	357. 37	1565. 62	838. 37	998. 12	76 87	9 62	
Sept.	15	350. 00	1599. 25	669. 62	1199. 00	81. 75		1. 12
	15	352. 75	1244. 50	532. 12	1113 75	52. 25		100. 87
Oct.	16	368. 62	1134. 50	749. 00	642. 75	80 37	31. 00	
	15	373. 75	1123. 87	729. 00	621. 50	110. 12	37. 00	
Nov.	15	413. 62	1284. 00	981. 62	609. 37	64. 00	42. 63	
	11	284. 75	882. 00	660. 62	442. 75	33. 25	30. 13	
Dec.	13	343. 25	1186. 25	875. 12	555. 12	47. 25	52. 01	
	14	383. 25	1285. 75	1036. 75	593. 75	53. 75		15. 25
Jan.	15	357. 62	1320. 75	958. 50	629. 75	50. 87	39. 25	
	13	304. 75	1328. 37	1069. 50	489. 37	62. 50	11. 75	
Febr.	15	382. 00	1381. 87	1138. 75	563. 87	48. 62	12. 63	
	13	306. 62	1244. 75	1041. 37	484. 75	41. 50		16. 25

TAB. II.

	Urine 24h.			Perſpiration 24h.		
	Greateſt.	Leaſt.	Mean.	Greateſt.	Leaſt.	Mean.
March	102. 20	33. 40	70. 59	74. 75	28. 00	43. 23
April	87. 50	36. 00	59. 17	69. 40	34. 00	47. 72
May	88. 12	25. 25	56. 15	94. 00	30. 62	58. 11
June	85. 00	28. 70	52. 09	106. 90	36. 75	71. 39
July	92. 90	20. 62	43. 77	105. 00	51. 90	86. 41
Auguſt	76. 50	31. 00	55. 41	107. 00	38. 90	70. 91
September	78. 75	11. 15	40. 06	130. 00	42. 37	77. 09
October	73. 40	22. 45	47. 67	63. 10	30. 20	40. 78
November	99. 00	39. 50	63. 16	49. 30	29. 00	40. 47
December	143. 50	41. 00	70. 81	56. 60	27. 65	42. 55
January	121. 00	39. 75	72. 43	49. 25	33. 10	39. 97
February	115. 00	45. 60	77. 86	46. 10	24. 40	37. 45

TAB. III exhibits the mean Quantities of both diurnal and nocturnal Urine and Perſpiration, which were ſecreted in every Month of the Year, in equal Times, and their Proportions to each other.

	6h Mean Diurn. Urine	6h Mean Noct. Urine	6h Mean Diurn. Perſp.	6h Mean Noct. Perſp.	Diurn. Urine 6h as 1 to Noct. Urine 6h is to	Diurn. Perſp. 6h as 1 to Noct. Perſp. 6h is to	Diurnal Urine 6h as 1 to Noct. Perſp. 6h as 1 to	Nocturnal Urine 6h is to Diurnal Urine 6h is to
March	18. 35	15. 10	10. 94	9. 90	1. 21	1. 11	0. 59	0. 65
April	16. 39	12. 33	13. 03	10. 24	1. 33	1. 27	0. 79	0. 91
May	13. 13	15. 58	16. 44	10. 64	0. 84	1. 54	1. 25	0. 69
June	12. 13	15. 37	20. 69	12. 68	0. 79	1. 63	1. 70	0. 82
July	09. 02	14. 14	26. 73	12. 43	0. 63	2. 15	2. 96	0. 88
Auguſt	12. 41	17. 02	21. 32	10. 08	0. 73	2. 11	1. 71	0. 59
September	10. 54	12. 22	22. 58	11. 07	0. 86	2. 04	2. 14	0. 90
October	10. 33	14. 30	10. 37	9. 88	0. 72	1. 05	1. 00	0. 69
November	16. 87	13. 88	10. 64	9. 92	1. 21	1. 07	0. 63	0. 71
December	19. 02	14. 51	12. 03	8. 19	1. 31	1. 47	0. 60	0. 56
January	21. 16	12. 46	11. 26	8. 22	1. 70	1. 37	0. 53	0. 66
February	23. 19	13. 31	10. 43	7. 56	1. 74	1. 38	0. 45	0. 57

TAB.

Tab. IV. being deduced from Tab. I. contains the Quantity of Food and Evacuations in Inches and Decimals, there being 30 Days ſuppoſed in every Month; and in the ſame Proportion on the vacant Days, as when the Experiments were made: Alſo the Proportion of each Evacuation to the Food, and of the Urine to the Perſpiration: And then, that the Cauſe of the different Proportions, which they have to each other through the whole Year, may more plainly appear, the greateſt and leaſt Stations of the Barometer, and greateſt, leaſt, and mean Stations of the Thermometer and Hygroſcope, with the Quantity of Rain in Inches and Decimals, are added.

	Meat.	Drink.	Food.	Urine.	Perſpir.	Stools.	Food Greater than the Evacuations.	Food Leſs than the Evacuations.	Food as 1 to Urine is to the	Food as 1 to Perſpir. is to	Food as 1 to Stools are to	Perſp. as 1 to Urine is to	Height of the Barometer. Greateſt	Height of the Barometer. Leaſt	Height of Fahrenheit's Thermometer. Great	Thermometer. Leaſt	Thermometer. Mean	Height of the Hygroſcope. Great	Hygroſcope. Leaſt	Hygroſcope. Mean	Quantity of Rain.
Mar.	758.82	2762.61	3521.43	2112.66	1298.33	107.15	03.29		1. 66	2. 71	32.86	0. 61	30. 40	29. 60	80	34	57	25	4	12	1. 141
Apr.	724.92	2545.91	3270.83	1765.00	1442.12	99.74		36.03	1. 85	2. 27	32.89	0. 82	30. 48	29. 58	83	51	67	14	2	7	1. 092
May	791.35	2746.15	3537.50	1686.94	1759.56	102.19		11.19	2. 15	2. 01	34.61	1. 04	30. 30	29. 90	87	56	74	30	2	9	5. 612
June	679.21	3086.76	3765.97	1573.58	2141.86	113.63		63.10	2. 39	1. 75	33.14	1. 36	30. 28	29. 90	90	66	79	28	5	10	4. 648
July	732.85	3290.52	4023.37	1307.69	2607.41	118.10		09.83	3. 07	1. 54	34.06	1. 99	30. 22	29. 98	91	70	81	30	4	11	3. 013
Aug.	756.12	3856.62	3912.74	1662.24	2127.49	127.24		04.23	2. 35	1. 83	30.75	1. 28	30. 25	29. 95	90	67	77	34	4	12	7. 301
Sept.	702.75	2843.75	3546.50	1201.74	2312.75	134.00		101.99	2. 95	1. 53	26.46	1. 92	30. 36	29. 86	84	56	75	19	6	12	3. 200
Oct.	719.34	2187.47	2906.81	1431.19	1224.08	185.47	66.07		2. 03	2. 37	15.67	0. 85	30. 50	29. 95	73	35	56	33	4	12	1. 257
Nov.	801.93	2486.72	3288.65	1882.48	1213.12	109.33	83.72		1. 21	2. 71	30.08	0. 64	30. 55	29. 73	67	32	52	31	3	14	1. 848
Dec.	806.68	2746.34	3553.02	2120.60	1276.68	112.10	43.64		1. 67	2. 77	31.71	0. 60	30. 58	29. 65	69	21	42	29	3	10	2. 736
Jan.	709.25	2853.48	3562.73	2192.54	1194.40	122.99	52.80		1. 62	2. 98	28.96	0. 55	30. 65	29. 54	63	31	45	40	6	18	4. 492
Feb.	735.80	2818.12	3553.92	2340.3	1123.20	96.50		06.12	1. 51	3. 16	36.82	0. 48	30. 63	29. 88	68	30	46	43	7	16	3. 135
Total	8919.02	33624.45	42443.47	21277.00	19721.00	1428.44															39. 475

TAB. V.

Becauſe the Quantity of Food in each Column of the other Table is very different, ſo that the Increaſe and Decreaſe of any Evacuation, as they are affected by the Conſtitution of the Air, is not very manifeſt; therefore this Table is drawn up, ſuppoſing the Quantity of Food taken in every Month, or 30 Days, to be ℥ 3543. 40, which exceeds the Mean of 30 Days ℥ 8. 40; whence the Increaſe and Diminution of the ſenſible and inſenſible Evacuation through a whole Year are plainly ſhewn to be affected by the Temperature of the Air, as it is exhibited in TAB. IV.

	Urine.	Perſpir.	Stools.	Weight.		Urine.		Perſpiration.		Stools.	
				Increaſed	diminiſhed	Increaſed	diminiſhed	Increaſed	diminiſhed	Increaſ.	diminiſh.
March	2127. 04	1307. 13	107. 87	03. 36							
April	1913. 16	1563. 17	108. 11		39. 04		213. 88	256. 04		00. 24	
May	1691. 27	1763. 49	102. 39		11. 75		321. 89	200. 32			05. 72
June	1481. 41	2016. 41	106. 94		59. 36		209. 86	252. 92		04. 55	
July	1152. 34	2297. 65	104. 07		08. 66		329. 07	281. 24			02. 87
Auguſt	1506. 18	1927. 75	115. 29		03. 82	353. 84			369. 90	11. 22	
September	1201. 36	2312. 03	133. 95		101. 94		304. 82	384. 28		18. 06	
October	1745. 60	1492. 99	226. 22	80. 56		544. 24			819. 04	92. 27	
November	2029. 42	1307. 82	117. 87	90. 29		283. 82			185. 17		08. 35
December	2116. 05	1273. 94	111. 85	43. 56		086. 63			33. 88		06. 02
January	2181. 87	1188. 59	122. 39	52. 55		065. 82			85. 35	10. 54	
February	2334. 72	1120. 20	96. 26		06. 09	152. 85			68. 08		26. 13

TAB.

TAB. VI. being drawn from TAB. IV. shews the Sum of the Food and Evacuations, through the various Seasons of the Year, and exhibits the Proportions of them to each other.

	Food.	Urine.	Perspir.	Stools.	Weight. Increas.	Weight. Dimin	Food as 1 to Urine is to	to Food as 1 to Perspiration is	Food as 1 to Stools are to	Perspir. as 1 to Urine is to
Spring	10346. 1	6218. 00	3863. 65	303. 39		38. 86	1. 66	2. 67	34. 10	0. 62
Summer	11326. 84	1568. 21	6508. 83	333 92		84. 14	2. 48	1. 74	33. 92	1 42
Autumn	10366. 05	1205. 17	5661. 32	146. 71		40. 15	2. 41	1. 83	23. 20	1. 32
Winter	10404. 40	6195. 62	3684. 20	344 42	180. 16		1 68	2 82	30 20	0. 59

℥ 24.78 Meat
93.12 Drink } Mean daily Quantity.
117.90 Food

59.10 Urine
54.78 Perspiration } Mean daily Quantity of 24^h through the whole Year.
3.97 Stools

9042.92 Meat
33990.05 Drink } 365 Days.

4032.97 = ℔ 2689 ℥ 9 of Food taken in the Space of a Year.

The mean Morning Weight is to the whole Quantity of Food of one Year as 1 to 15 97, and to the whole Food of one Month as 1 to 1.34.

	℔	℥	ʒ	
Jan. 19 - - - - -	177	00	4	Greatest } Morning Weight.
Oct. 1 - - - - -	159	13	6	Least } Morning Weight.
	17	02	6	A great Difference between the Autumnal and Winter Weight.
	168	07	1	Mean Morning Weight.

Urine
Perspiration } of the whole Year are to the Food as 1 to { 2.02. / 2.18. / 30.13.
Stools

The Perspiration of the whole Year is to the Urine as 1 to 8.

The Stools of the whole Year are to the Urine and Perspiration taken together as 1 to 28.7, and to the whole of the Meat of the whole Year as 1 to 6.24.

The least Winter Perspiration in 30 Days is to the greatest Summer Perspiration, in the same Time, as 1 to 2.06.

The least Summer Urine for 30 Days is to the greatest Winter Urine, in the same Time, as 1 to 2.03.

II. In

An Account of the Standard Measures preserved in the Capitol at Rome. *By* Martin Folkes, *Esq; V. P. R. S.* No. 442. *p.* 262. July, *&c.* 1736.

II. In the Wall of the Capitol is a fair Stone of white Marble, of the Length of 8 Foot 5 Inches *English*, and of the Breadth of 1 Foot 9 Inches and a half; upon which are inscribed the Standards of several Measures with these respective Inscriptions:

Piede Ro: Pal. IIII. Onc. XII. Deti XVI.
Piede Greco.

Canna di Architet. Palmi X.
Staiolo Pal. V. Quar. III.
Canna di Marca. Palmi otto d' altra misura.
Braccio di Merc. Pal. III. d' altra misura
Braccio di Tessito di Tela.

Curante Lu. Pœto.

The Lines that represent these Measures, are cut in the Marble, pretty deep; but as they have, consequently, a considerable Thickness, it is somewhat difficult to be very exact in taking off their Dimensions. I, however, attempted to do it as nearly as I could, by setting the Point of my Compasses in the Middle of the cross Lines, that are drawn to determine the Beginnings and Ends of the Measures. The Palm of the Architects is easier to give than the others, by reason the whole Canna is inscribed on the Stone: This I therefore took off, as I presume others have generally done, and then divided it into 10 equal Parts. Afterwards my chief Attention was given to the *Roman* Foot, as of greater Consequence than the other Measures. They all, however, follow as they occurred to me, in such Parts as the *London* Foot contains 1000 of.

The *Roman* Foot 966+. This is divided upon the Stone, first into 4 Palms, and then on the upper Part into 12 Unciæ, and on the lower into 16 Deti, according to the Inscription.
The *Greek* Foot 1006+. This is also divided like the *Roman*.
The *Canna* of the Architects 7325. It is divided into 10 Palms, each of which is therefore $732\frac{1}{2}$ of the *English* Foot.
The *Staiolo* being 5 Palms and $\frac{1}{4}$ is 4212—.
The *Canna de Mercanti*, divided into 8 Palms of another Measure, 6 Foot 6 Inches $\frac{21}{38}$.
The *Braccio de Mercanti*, divided into 4 Palms of another Measure, 2 Foot 9 Inches $\frac{11}{24}$.
The *Braccio di Tessitor di Tela*, divided into 3 Parts, 2 Foot 1 Inch $\frac{1}{24}$.

The Palm of the Architects is assigned by Mr *Greaves* 732 of the *English* Foot; and the same is given by M. *Picart* to the *Paris* Foot, as

as 494 ¼ to 720; which reduced, becomes 732 -+- of the *Engliſh* Foot, as before, and as it came out from my own Trial.

The *Roman* Foot is given by *Picart* from this very Stone 653 $\frac{1}{10}$ of ſuch Parts as the *Paris* Foot contains 720; that is, by Reduction, 967 -+- of the *Engliſh*; and the ſame by *Fabretti*, who alſo meaſured it upon this Stone, is aſſigned to the Palm of the Architects, as 2040 to 1545; which reduced upon the former Meaſure of a Palm, is 966 ½ of the *Engliſh* Foot. Theſe Meaſures come out as near as the Nature of the Standard can poſſibly allow; and as it was ſomewhat freſher in M. *Picart*'s Time than it is now, I would make no Difference in the Proportion he has aſſigned; but ſuppoſe the *Roman* Foot on this Marble was intended to be ſuch a one as ſhould contain 967 Parts of the *Engliſh* very nearly.

Mr *Greaves* had long before aſſigned the Meaſure of the *Roman* Foot from *Coſſutius*'s Monument, to be 967 of the *Engliſh*, and had preferred that Meaſure to the others he had taken from the Tomb of *Statilius*, and the *Congius* of *Veſpaſian*. And I think one can make no Doubt, from what has been ſaid, but *Coſſutius*'s Foot was the Foot intended to be inſcribed upon this Marble; though that Monument is itſelf now loſt: At leaſt when I was at *Rome* I could get no Intelligence of it, though I made a diligent Enquiry amongſt all the People likely to be acquainted with it.

Fabretti, in his Work concerning Aqueducts, where he gives the above-mentioned Proportion of the Palm to the Foot, finds Fault with *Lucas Pætus*, as having made a wrong Calculation of this Proportion in his Book, *De Menſuris & Ponderibus*. True it is, that the Proportion there given by *Pætus*, does not agree with the Foot upon the Marble, but yet it is no falſe Calculation, as *Fabretti* thought; and had he examined *Pætus*'s Book with Care, he would have been ſenſible this is not the Foot he there contends for, but the *Coſſutian* Foot which *Lucas Pætus* in his Book diſputes againſt. The Truth therefore is, that he either altered his Mind after the writing of that Book, before the Marble was ſet up; or, more probably, that though he had the Care of having theſe Meaſures inſcribed on the Marble, he was directed by a ſuperior Authority what Meaſures he was to have engraved; and that accordingly he had, as near as he was able, the *Coſſutian* Foot deſcribed for the ancient *Roman* Foot on the Stone: And that this was the Caſe, and no Miſtake about the Number, as *Fabretti* ſuppoſes, appears not only from the Tenure of his Book, where he condemns *Coſſutius*'s Foot, which there appears, but alſo from his Scheme at the latter End, where he has given what he calls *Scæma pedis legitimi*, agreeing with his own Numbers, *viz.* 12 Inches, whereof 9 $\frac{3}{5}$ make the Palm of the Architects, and alſo the *Menſuræ Colotiani & Statiliani pedis*, agreeing with that now inſcribed on the Marble. The *Colotian* is the ſame Monument as the *Coſſutian*, ſo called from the Perſon in whoſe Poſſeſſion it had formerly been; and he had before ſaid, *p.* 5, that according to the Teſtimony

Teſtimony of *Philander*, the *Statilian* agreed with it; though Mr *Greaves*, who meaſured both theſe Feet with great Care, found ſome Difference between them, ſtating the *Coſſutian*, as above, 967, and the *Statilian* 972. But by *Pæan*'s quoting *Philander*, it is plain he had not himſelf meaſured the latter; and therefore the Foot, called by him the *Colotian* and *Statilian*, is indeed purely the *Colotian* or *Coſſutian* Foot; and the ſame has occurred to me alſo very nearly from my Meaſure of the Height of the *Trajan* Pillar, which I find, from the Ground to the Top of the Cimatium of the Capitol, to be 115 Feet 10 Inches ⅛; and this Height divided by 120, gives very nearly 966 for the Quotient.

For the *Greek* Foot there ſeems to be no further Myſtery, than that it was intended to be made to the *Roman* in the Proportion collected from *Pliny*, which is, that 625 *Roman* Feet made 600 *Greek*; by which Account the *Greek* Foot ſhould contain 1007 of ſuch Parts as the *Roman* contains 967; and the actual Quantity I took off was 1006.

An Account of the Analogy betwixt Engliſh *Weights and Meaſures of Capacity by the Rev. Mr* William Barlow *of* Plymouth. No. 458. *p.* 457. Sept. *&c.* 1740.

III. The Analogy betwixt ancient *Engliſh* Weights and Meaſures ſeems for many Ages to have been entirely forgotten and unknown.

Our Forefathers ſuppoſed a cubic Foot of Water (aſſumed as a general Standard for Liquids) to weigh 62 Pound ¼; the Exactneſs of which Suppoſition is confirmed by modern Obſervation: For in *Philoſ. Tranſ.* N° 169, we find the Weight of a Foot of Pump-Water to be 62 Pound 8 Ounces. From a cubic Foot of Water multiplied by 32, is raiſed a Ton Weight, or 2000 Pound, luckily falling into large round Numbers, and for that Reaſon made Choice of.

Agreeably hereto were liquid Meaſures accommodated, *viz.* 8 cubic Foot of Water made a Hogſhead, and 4 Hogſheads a Ton in Capacity and Denomination as well as Weight.

Dry Meaſures were raiſed on the ſame Model. A Buſhel of Wheat (aſſumed as a general Standard for all Sorts of Grain) was ſuppoſed to weigh 62 Pound ¼, equal to a Foot of Water; 8 of theſe Buſhels a Quarter, and 4 Quarters a Ton Weight.

Coals were ſold by the Chaldron, which was ſuppoſed to weigh a Ton, or 2000 Pound. See *Chambers*'s Dictionary.

Therefore, though the Meaſures containing a liquid Ton, 4 Quarters of Wheat, a Chaldron of Coals, *&c.* be all of different Capacities; yet the reſpective Contents are every one of the ſame Weight: A Ton in Weight is the common Standard of all.

In after Times, through Ignorance of this Analogy, a Variety of Weights and Meaſures were introduced, incommenſurate, and not reducible to any common Standard, or analogous Relation: Whereas, had the original Analogy been kept up, it would have prevented that Diſorder and Confuſion ſo juſtly complained of at preſent concerning the Subject of Weights and Meaſures.

From the foregoing Scheme it is reaſonable to ſuppoſe, that Corn, and ſeveral other Commodities, both dry and liquid, were firſt ſold by

by Weight; and that Meaſures, for Convenience, were afterwards introduced, bearing ſome Analogy to the Weights before made uſe of.

From the modern Experiment before-mentioned, (a cubic Foot of Water weighing 62 Pound 8 Ounces) it appears, that the Meaſure of a Foot, and the Weight of a Pound, are the ſame now as were in Uſe many Ages before the Conqueſt.

The foregoing Scheme aſſigns a Reaſon, why the Word *Ton* is applied both to Weight and liquid Meaſure, *viz.* becauſe the ſame Quantity of Liquor is a Ton both in Weight and Meaſure. Probably 4 Quarters of Grain had formerly the ſame Appellation, till the Significancy of it was loſt in the Uſe of the *Avoirdupois* Ton.

The Word *Quarter*, as applied to Grain, is alſo hereby explained. Moſt Writers have ſuppoſed it the 4th Part of ſome Meaſure, but what that Meaſure was, could never ſatisfactorily be made out. The learned Biſhop *Fleetwood* gueſſed neareſt the Truth, ſuppoſing it the 4th Part—not of any Meaſure, but—of ſome Load or Weight [*Chron. Pretioſ.* p. 72]. I wonder he ſtopped here, and did not obſerve what that Load of Weight was, *viz.* a Ton or 2000 Pound: But the *Avoirdupois* Ton, in Uſe at preſent for all groſs Weights, threw ſuch a Miſt upon the Subject, as could not eaſily be ſeen through.

From the original and natural Signification of the Word *Hundred*, it plainly appears, that *Twenty hundred*, or a *Ton*, muſt be exactly two thouſand Weight.

An Account of the Proportions of the Engliſh *and* French *Meaſures and Weights, from the Standards of the ſame, kept at the* Royal Society. No. 465. *p.* 185. *Read* Nov. 11, 1742.

IV. Some curious Gentlemen both of the *Royal Society* of *London*, and of the *Royal Academy* of *Sciences* at *Paris*, thinking it might be of good Uſe, for the better comparing together the Succeſs of Experiments made in *England* and in *France*, propoſed ſome Time ſince, that accurate Standards of the Meaſures and Weights of both Nations, carefully examined, and made to agree with each other, might be laid up and preſerved in the Archives both of the *Royal Society* here, and of the *Royal Academy* of *Sciences* at *Paris*: Which Propoſal having been received with the general Approbation of both thoſe Bodies, they were thereupon pleaſed to give the neceſſary Directions for the bringing the ſame into Effect. In Conſequence of which, Mr *George Graham*, Fellow of the *Royal Society*, did, at their Deſire, procure from Mr *Jonathan Siſſon*, Inſtrument-maker in *Beaufort-Buildings*, two ſubſtantial Braſs Rods, well planed and ſquared, and of the Length of about 42 Inches each, together with two excellent Braſs Scales of ſix Inches each, on both of which one Inch is curiouſly divided by diagonal Lines, and fine Points, into 500 equal Parts: And upon each of the Rods Mr *Graham* did, with the greateſt Care, lay off the Length of 3 *Engliſh* Feet, from the Standard of a Yard kept in the *Tower* of *London*. He alſo at the ſame Time directed Mr *Samuel Read*, Scale and Weight-maker near *Alderſgate*, to prepare, in the beſt Manner he could, two ſingle *Troy* Pound Weights, with 2 Piles of the ſame Weights, decreaſing from 8 Ounces to $\frac{1}{4}$ of an Ounce reſpectively, two

Parcels of the leſſer correſponding Weights, that is to ſay, from 5 Dwt. to ½ Dwt. and Grain Weights from 6 Grains to ¼ of a Grain; together with 2 ſingle *Avoirdupois* Pound Weights: All which, when made, were carefully examined, and found to agree ſufficiently with each other. Things being thus provided, the 2 Braſs Rods, one of the Six-inch Scales, and one Set of all the Weights, were ſent over to *Paris*, one of the Rods to be returned, and all the other Particulars, to be preſented for their Uſe, to the *Royal Academy* of *Sciences* there: Who, upon Receipt thereof, deſired the late M. *Du Fay*, and Abbé *Nollet*, both Members of the *Academy*, and alſo Fellows of the *Royal Society*, to ſee the Meaſure of the *Paris* half Toiſe, containing 3 *Paris* Feet, accurately ſet off upon both the Braſs Rods, in the like Manner as the Length of the *Engliſh* Yard, containing three *Engliſh* Feet, had already been ſet off on the ſame: After which, thoſe Gentlemen returned over one of the Rods to the *Royal Society*, together with a Standard Weight of 2 Marcs, or 16 *Paris* Ounces, accompanied with a *Proceſs Verbal*, or authentick Certificate from the proper Office, of the due Examination thereof.

The Rod being returned, Mr *Graham* cauſed Mr *Siſſon* to divide both the Meaſure of the *Engliſh* Yard, and the *Paris* half Toiſe, each into 3 equal Parts, for the more ready taking off both the *Engliſh* and *Paris* Foot from the ſame: After which, both this Rod and the 2 *Marc* Weight ſent over from *France*, were, together with the other Particulars before-mentioned, carefully laid up in the Archives of the *Royal Society*, where they now remain, as their Duplicates do in thoſe of the *Royal Academy* of *Sciences* at *Paris*: But as, before they were ſo laid up, an accurate Examination and Compariſon of them was made by Direction of the Council of the *Royal Society*, the Reſult of the ſame is here ſubjoined as follows: That is to ſay,

1. The *Paris* half Toiſe, as ſet off on the Standard in the *Royal Society*, contains *Engliſh* Inches by the ſame Standard 38.355. Whence it appears, that the *Engliſh* Yard and Foot is to the *Paris* half Toiſe and Foot, nearly as 107 to 114. For as 107 to 114, ſo is 36 to 38.35514.

2. The *Paris* two *Marc*, or 16 Ounce Weight, weighs *Engliſh Troy* Grains 7560. Whence it appears, that the *Engliſh Troy* Pound of twelve Ounces, or 5760 Grains, is to the *Paris* two *Marc*, or 16 Ounce Weight, as 16 to 21: That the *Paris* Ounce weighs *Engliſh Troy* Grains 472.5, and that conſequently the *Engliſh Troy* Ounce is to the *Paris* Ounce, as 64 is to 63.

3. The *Engliſh Avoirdupois* Pound weighs *Troy* Grains 7004, whence the *Avoirdupois* Ounce, whereof 16 make a Pound, is found equal to 437.75 *Troy* Grains: And it follows of Conſequence, that the *Troy* Pound is to the *Avoirdupois* Pound, as 88 to 107 nearly; for as 88 to 107, ſo is 5760 to 7003.636; that the *Troy* Ounce is to the *Avoirdupois* Ounce, as 80 to 73 nearly; for as 80 to 73, ſo is 480 to 438; and laſtly,

lastly, that the *Avoirdupois* Pound and Ounce is to the *Paris* two *Marc* Weight and Ounce, as 63 to 68 nearly; for as 63 to 68, so is 7004 to 7559 873.

4. The *Paris* Foot, expressed in Decimals, is equal to 1.0654 of the *English* Foot, or contains 12.785 *English* Inches.

An Account of a Comparison lately made by some Gentlemen of the Royal Society, *of the Standard of a Yard, and the several Weights lately made for their Use; with the original Standards of Measures and Weights in the* Exchequer, *and some others kept for publick Use, at* Guild-Hall, Founders-Hall, *the* Tower, *&c.* No. 470 *p.* 541. *Read* June 16, 1743.

V. When there were some Time since prepared by Order of the *Royal Society*, to be kept in their Archives here, and also in those of the *Royal Academy* of *Sciences* at *Paris*, Standards of the *Yard Measure*, as also of the *Troy* and *Avoirdupois Weights*; an Account of which was some Months since published by Order of the Council of the Society *: It was not at all the Intention of the Society, to determine what was the absolute legal Length of the *Yard*, or the real and legal Weight of the said several *Pounds*; but only to lodge and preserve, in those respective Places, 2 Measures, and 2 Sets of those Weights, sufficiently near to what were in common Use, and well agreeing with each other, for the Purpose of comparing together, by some certain Standard, to which Recourse might be had in either Kingdom, the Success of such Experiments made either in *England* or in *France*, in which Measure or Weight might particularly be concerned.

And for the same Reason, the Gentlemen of the *R. Acad.* of *Sciences*, were pleased to take Care to have the Length of their *half Toise* set off on both the Brass Rods, upon which the *English Yard* had been already laid off, and to provide 2 Brass Weights of *two French Marcs* each; one of which was sent over hither, when one of the Brass Rods, just mentioned, was again returned over to the Society. And it was the Proportion only between *these* several Standards, that was proposed to be laid down in the said Paper, without intending thereby to ascertain the just and legal Proportions between the Weights and Measures of both Nations. Though it is not to be doubted, but that this Measure of the *French half Toise*, and the *French two Marc* Weight, are, like the *English*, sufficiently agreeable to what are there constantly used.

But as some Gentlemen have since been desirous to know, how far those Standards really agreed with the original ones, as they are looked upon to be, in the *Chamberlain's Office* of his Majesty's *Exchequer*, as well as with those kept for publick Use, at *Guild-Hall*, at *Founders-Hall*, with the *Watch-makers* Company, and in the *Tower* of *London*. Mr *George Graham*, F. R. S. was thereupon requested, with such other Assistance as he should find necessary, to take upon him the Comparison of the said several Standards; which he has accordingly done, and carefully viewed and examined the same, at the *Exchequer*, on *Friday* the 22d of *April* last, in the Presence of the *President*, the R. Hon. the Earl of *Macclesfield*, the R. Hon. the Lord *Charles Cavendish*, *John Hadley*, Esq; *William Jones*, Esq; *Peter Daval*, Esq; and *Cromwell Mortimer*, M. D. one of the Secretaries; and at *Guild-Hall*, *Founders-*

* See the preceding Article.

Hall, and the *Tower*, on the *Wednesday* following, the 27th of the same Month, in the Presence of all the same Persons, Mr *Daval* only excepted, who happened to be otherwise engaged that Day. All which Gentlemen were received with the greatest Civility and Regard, by the several Officers who have the Care and Keeping of the respective Standards in Question; who most readily favoured them with the free Use and Inspection of the same; and several of which were themselves also pleased to attend the Examination.

And, as the Council of the Society have now thought fit to direct an Account to be here published of these Trials and Experiments, we shall first, for Order-sake, begin with the *Measure* of the *Yard*; and then proceed to what concerns the several Weights of the *Troy* and *Avoir-dupois Pounds*.

The Standards of Length now used in the *Exchequer*, are two squared Rods of Brass, of the Breadth and Thickness of about ½ an Inch; the one called the *Yard*, and the other the *Ell*. The Ends of neither are exactly flat and parallel; or, if they were so once, they have since suffered some Bruise or Damage, and that possibly by the impressing near each End the Seal of a crowned *E.*; by which it appears, they were placed here during the Reign of Queen *Elizabeth*, and, probably, at the same Time when the several Standard-Weights, hereafter mentioned, were lodged here also.

To these Rods there belongs a substantial Brass Bar, of about the Length of 49 Inches, the Breadth of 1 ½ Inch, and the Thickness of an Inch: On one Edge of this Bar is a hollow Bed or Matrix, fitted to receive the square Rod of a *Yard*; and on another, a like Bed fitted to receive that of an *Ell*: And into these Beds they usually fit the *Yard* and *Ell* Measures brought to be examined and sealed at this *Office*. The square *Yard* and *Ell* Rods fit sufficiently well into these respective Beds, so as neither to rub or shake very sensibly; yet, as neither the Ends of the Rods, or of the hollow Beds, are accurately flat and parallel, the greatest Lengths of those Beds must, of Necessity, be somewhat greater than the greatest Lengths of the Rods intended to be placed in them: By which greatest Lengths of those Rods, and which were looked upon by all the Gentlemen present, as the real and proper Lengths of those Rods, are meant the Distances of 2 parallel Planes or Cheeks, so placed as to touch the Rods respectively at both Ends.

Besides all which, there also remains in this Office an old eight-sided Rod of Brass, of the Thickness of about ½ an *Inch*, very coarsely made, and as rudely divided, into 3 *Feet*, and one of those *Feet*, into 12 *Inches*. This is marked near each End with an old *English* Ⅱ crowned; and is supposed to have been the old Standard of a *Yard*, lodged there in the Time of King *Henry* the Seventh, and used as such, till the other above-mentioned, and now accounted the Standard, was made to supply it's Place.

Now,

Now, as the *Yard* is from very old Time mentioned in our Acts of Parliament, as containing *three Feet*, or 36 *Inches*; and the *Ell* is not therein particularly described, though universally reputed equal to *one Yard and a Quarter*, or to 45 *Inches*; we shall in the following Comparison suppose, that the Length of the square Brass *Yard Rod*, here kept, and marked with a crowned *E.* by that Length meaning, as above, it's greatest Length between 2 parallel Planes, to be the true and genuine Length of the *English Yard*, or of 3 *English Feet*: And with that Length we shall compare the others here mentioned, expressing how much they respectively exceed, or fall short of, this supposed Standard Measure.

To examine all which, Mr *Graham* was provided with very exact and curious Beam-Compasses of different Sorts, and adapted to the several Purposes they were to be used for. One of these was by parallel Cheeks intended for the taking the Lengths of the Standard Rods above-mentioned to be kept in the *Exchequer*: Another was by rounded Ends, one of which was moveable, designed to take the Lengths of such Standards as consist of hollow Beds or Matrices, like those already spoken of at the *Exchequer*, and the others, to be presently mentioned, at *Guild-Hall*: And a third Beam-Compass was fitted in the common Way, with fine Points, for the taking off, or laying down, such Measures as are marked out by the Distance of Points or Lines, on any plane flat Superficies. All which Compasses were severally so contrived, as to be lengthened by the turning of a fine Screw, one of whose Revolutions answered accurately to the 40th Part of an *Inch*, and to which there was applied an Index, shewing, on a small circular Plate with 20 Divisions, the broken Part of a Revolution; and whereon the Place of the Index might, by the Eye, be estimated to about the 10th Part of a Division; whereby the Motion of the moveable Cheek, End, or Point, might consequently be judged of, to about the 8000th Part of an *Inch*.

But Mr *Graham*, when he determined by these Instruments the following Particulars, desired it might be observed, that although the Alterations of the Compasses were sensible to so small a Quantity, it was not to be supposed the Measures here taken with them, could be estimated to the same Exactness. The Hand cannot judge with so much Nicety, of the Shake of a Rod, when applied between the Cheeks, or when let into one of the hollow Beds or Matrices above-mentioned: Neither can the Eye, though assisted with a magnifying Glass, pretend to see, with that Accuracy, the Place of the Compass-Points, when applied to the taking off a Measure, set out by Points or Lines, on the plane Surface of a Rod or Rule. All he therefore thinks possible, and that he has found he could several Times together, under the same or like Circumstances, be consistent in, is to take such Measures to about the 1600th Part of an Inch.

We shall, however, in what follows, give those Measures as they actually did come out, in Revolutions, Divisions, and Tenths: All which

which are also, for the Convenience of the Reader, in a second Column, reduced to the common *Decimals* of an *Inch*; and, in a third, to the *Vulgar Fractions* of the same.

It may further be noted, that the absolute Quantity of all Measures, any Ways inscribed on Standards of Metal, must, from the Nature of Things, vary with the Alterations in the Heat or Coldness of the Weather; and, for that Reason, the exact Proportion between any two Standards, taken at different Times, cannot be expected to be found the same to the most perfect Degree of Exactness, unless the Temperature of the Air shall at those different Times have been the same, or that a proper Allowance has been made for the Alteration of it. Yet, in the present Case, as all the several Measures referred to, are inscribed on the same Metal, Brass, as none of the Differences we are concerned about are very great, and as the Change of the Weather was not very considerable between the Days of Trial, it has been thought this last Consideration might be safely neglected, in setting down the following Particulars: Which are, that

	Rev.	Div.	
The greatest Length of the Matrix of the *Yard Measure*, at the *Exchequer*, exceeded the square *Standard Yard* by	0 :	8,2 = .0102 =	$\frac{1}{97.56}$
The *Yard* inscribed on the *Royal Society*'s Rod, exceeded the same by -	0 :	6,0 = .0075 =	$\frac{1}{133.3}$
The old Brass Standard at the *Exchequer*, marked with the crowned D, fell short of the same by - - -	0 :	5,7 = .0071 =	$\frac{1}{140.3}$
The Standard *Ell Rod*, at the *Exchequer*, exceeded 45 *Inches*, of such as the Standard *Yard* contains 36, by	1 :	19,5 = .0494 =	$\frac{1}{20.25}$

At *Guild-Hall*, the Standards of long Measure there used, are only two Beds, or Matrices, the one of a *Yard*, and the other of an *Ell*, cut out of 2 of the Edges of a substantial Brass Bar, much like that at the *Exchequer*, but not altogether so thick; which Bar is sealed with the *Exchequer* Seal, and marked at both Ends with *C. R.* crowned; and also, as it seems, with *W. M.* crowned in like Manner. But there are here no Rods fitted to these Beds; so that all that seemed requisite and proper to be done, was to take both the greatest Lengths of these Beds, and also the least Lengths of the same; the last being nearly the Lengths of such square Rods as might be so fitted into the Beds, as to go in every Way close, and without sensibly shaking: And, upon taking the said Measures, it appeared, that

	Rev.	Div.	
The greatest Length of the *Yard Bed*, at *Guild-Hall*, exceeded the Standard *Yard*, at the *Exchequer*, by - -	1 :	14,7 = .0434 =	$\frac{1}{23.04}$

The

	Rev.	Div.		
The least Length of the same *Bed*, exceeded the said Standard of a *Yard* by - - - - - - - - - -	1	: 11,7	= .0396	= $\frac{1}{25.2}$
The greatest Length of the *Ell Bed*, at *Guild-Hall*, exceeded 45 *Exchequer* Standard *Inches* by - - - -	1	: 15,5	= .0444	= $\frac{1}{22.5}$
The least Length of the same *Bed* exceeded the same Number of like *Inches* by - - - - - - - -	1	: 0,7	= .0258	= $\frac{1}{38.6}$

The Standard of a *Yard*, in the *Tower* of *London*, belongs to his Majesty's *Office of Ordnance*, and is kept in the *Drawing-Room* there: It is a solid Brass Rod, about $\frac{7}{10}$ of an *Inch* square, and about 41 *Inches* long; on one Side of which is laid off the Measure of a *Yard*, divided into 3 *Feet*, and each *Foot* into 12 *Inches*: The first *Foot* has the *Inches* divided into Tenths, the second into Twelfths, and the third into Eighths of an *Inch*, and the first *Inch* of all is divided into 100 Parts, by diagonal Lines. This Rod is said to have been provided by the late Mr *Rowley*; it is sealed with the *Exchequer* Seals, and two other Seals of *G. R.* crowned, near one of the Ends, together with his Majesty's Mark, commonly called the *Broad Arrow*. And the Length of the *Yard*, or of the 3 *Feet* inscribed upon it, exceed the forementioned *Exchequer* Standard of a *Yard* by - -

Rev.	Div.		
0	: 8,9	= .0111	= $\frac{1}{90}$

The Standard *Yard*, belonging to the *Clock-makers Company*, was delivered to them from the *Exchequer*, by Indenture, the 4th of *September*, 23 *Car.* II. *A. D.* 1671. It is a Brass Rod of 8 Sides, near $\frac{1}{2}$ an *Inch* in Thickness, sealed with the *Exchequer* Seal, and *C. R.* crowned, near each End; and whereon the Length of the *Yard* is expressed, by the Distance between 2 upright Pins, or small Cheeks, filed away to their due Quantity: This was procured by Mr *Graham*, to be brought to the *President*'s House of the *Royal Society*, on *Saturday* the 7th of *May* last, where all the above-named Company then met, to collate their respective Notes of these several Trials, all which were found to agree with each other: At which last Meeting, Mr *John Machin*, of *Gresham College*, the other Secretary of the Society, was present also: And the Length of this last *Yard Measure* was then tried, and found to fall short of the *Exchequer* Standard *Yard Measure*, now very carefully added on the middle Line of the *Royal Society*'s Brass Rod, - - - - -

Rev.	Div.		
0	: 16,8	= .021	= $\frac{1}{47.62}$

Now, as to the Weights, those in the *Chamberlain's Office* in his Majesty's *Exchequer*, and which are esteemed the Standards, are a File, or Box, of hollow Brass *Troy* Weights, from CCLVI *Ounces* downwards, to the 16th Part of one *Ounce*, all severally marked with a crowned

crowned *E.*: But they have no *Penny-weights*, or *Grain-Weights*, that are any Ways esteemed or looked upon as Standards.

The Weight mentioned in all our old Acts of Parliament, from the Time of King *Edward* the First, is universally allowed to be the *Troy* Weight, whose *Pound* consisted of 12 *Ounces*, each of which contained 20 *Penny-weights*: And as the Pound is the Weight of the largest single Denomination commonly mentioned in those Acts, 12 *Ounces* taken from the Pile of *Troy* Weights above-mentioned, as there is no single *Troy Pound* Weight, must now be reputed the true Standard of the *Troy Pound*, used at this Day in *England*.

Besides which *Troy* Standards, there are also kept in the *Exchequer* the following Standards for *Avoirdupois* Weights: That is to say, a 14 *Pound* Bell Weight of Brass, marked with a crowned *E.* and inscribed

XIIII. POVNDE AVERDEPOIZ.
ELIZABETH. REGINA.
1582.

as also a 7 *Pound*, a 4 *Pound*, a *two Pound*, and a single *Pound*, like *Avoirdupois* Bell-Weights, and severally marked as follows, excepting the Variations for the Number of *Pounds* in each respective Weight.

VII. A.
AN°  D°
E I.
1588.
A° REG. XXX.

With which are also kept a Pile of flat *Avoirdupois* Weights, from 14 *Pounds* down to the 64th Part of a *Pound*.

When the *Avoirdupois* Weight came first to be looked upon as a lawful Weight, does not appear; but by these Standards it is plain, it has been used as such, ever since the Reign of Queen *Elizabeth*. And as the Weight of 15 *Pounds Avoirdupois*, has before been made use of, in determining the Proportion between the Weight of this *Pound* and that of the *Pound Troy*, we shall begin by giving the Counterpoise of the said 15 *Pound Avoirdupois*, as it was found in *Troy* Weight: From whence we shall deduce the Proportions of those *Pounds*, and afterwards compare the same with the like Proportions, deduced from the 7 *Pounds*, and single *Pound* Bell-Weights, and the single *Pound* flat Weight abovementioned: All which Weights were taken in the Presence of the abovenamed Noblemen and Gentlemen, by Mr *Samuel Read*, Scale and Weight-maker near *Alderſgate*, who brought to the *Exchequer* a large Balance of his own for that Purpose, and which, when loaded with 15 *Pounds* at each End, was very readily turned with six *Grains*; as a lesser one he brought also for examining the single *Pound* Weights, was with ½ a *Grain*. He also brought with him what he called his own Standard *Penny* and *Grain* Weights, to supply what was necessary to make

make the Counterpoise of the *Exchequer* Weights: With all which the Result was, that

The Standard 14 *Pound*, and single *Pound Avoirdupois* Weights, taken together, were, upon a Medium of four Trials, after counterchanging the Weights in each Bason, changing the Basons, and then again counterchanging the Weights, found to be counterpoised by 218 *Troy Ounces*, 13 *Penny-weight*, 23 *Grains*, and one Fourth. From whence the *Avoirdupois Pound* is deduced equal to 6998.35 of such *Grains* as the *Troy Ounce* is reputed to contain 480 of; and the *Avoirdupois Ounce*, of which 16 are supposed to make a *Pound*, is found equal to 437.4 like *Grains*.

Again: The *seven Pound* Bell *Avoirdupois* Weight, with the same Scales, and upon a Medium of 4 like Experiments, counterchanging, as before, both Weights and Basons, was found to be counterpoised by 102 *Troy Ounces* one *Penny-weight*, and 21 *Grains*. According to which, the *Avoirdupois Pound* comes out equal to 7000.7, and the *Ounce* to 437.54 *Troy Grains*.

Again: The single Bell *Avoirdupois Pound*, with the lesser Scales, on the Medium of two Experiments, counterchanging the Weights, the Basons not being moveable, was found to weigh 14 *Troy Ounces*, 11 *Penny-weight*, and 18 *Grains*; or was equal in Weight to 7002, and the *Ounce* to 437.62 *Troy Grains*.

The single *Avoirdupois* Bell *Pound*, against the flat *Avoirdupois Pound* Weight, was found, on a Medium of 2 like Experiments, to be heavier by 2 ½ *Troy Grains*: Whence the flat *Avoirdupois* single *Pound* Weight weighs only 6999.5, and the Ounce 437.46 *Troy Grains*.

The *Royal Society*'s *Avoirdupois Pound* was, in like Manner, found to be lighter than the *Exchequer* single Bell *Pound* Weight, by one *Grain*.

And their *Troy Pound* Weight to be lighter than the 8 and 4 *Ounce Troy* Weights at the *Exchequer*, taken together, by half a *Grain*.

The *Founders Company* of *London* are, by their Charter from King *James* the First, *authorized and directed to have the sizing and marking of all Manner of Brass Weights, to be made or wrought, or to be uttered, or kept for Sale, within the City of* London, *or* 3 *Miles from the same.* And the Weights delivered to them from his Majesty's *Exchequer*, and now kept in their Hall, as their Standards for the Uses above-mentioned, are a Pile of flat Brass *Troy* Weights, from CCLVI *Ounces*, down to the 16th Part of an *Ounce*, all sealed with the *Exchequer* Seal, and marked with *C. R.* crowned, 1684, and a Stamp of the initial Letters of the Maker's Name: As also a Set of Bell Brass *Avoirdupois* Weights, sealed and marked in like Manner. And here the following Trials were made, before the above-named Gentlemen, by Mr *Read*, but with a large Balance, commonly used for Trials at the Hall, in their Office for that Purpose; and found to turn with about the same Weight as the former; and also with a lesser one, turning in like Manner under these Circumstances, with about ½ a *Grain*, which Balance belonged likewise

to the Hall, as did also the *Penny* and *Grain* Weights made use of, but which were not kept by them as Standard Weights.

And here it was found, that, on a Medium of four Trials, made in like Manner as before, at the *Exchequer*, that 15 *Pounds Avoirdupois*, being their 14 *Pounds*, and single *Pound* Standard Weights, were counterpoised by 218 *Troy Ounces*, 15 *Penny-weight*, and 23 *Grains*: Whence the *Avoirdupois Pound* is deduced equal to 7001 53, and the Ounce to 437 59 *Troy Grains*.

Again: The single *Avoirdupois* Standard *Pound* weighed, on a Medium of 2 Experiments, counterchanging the Weights, as before, 14 *Troy Ounces*, 11 *Penny-weight*, 16 ½ *Grains*: Or was equal to 7000.5, and the *Ounce* to 437.53 *Troy Grains*.

Again: This Standard *Avoirdupois Pound*, at a Medium as before, outweighed the *Royal Society*'s *Avoirdupois Pound*, by 2 ⅛ *Grains*: And the *Troy* Standards of 8 and 4 *Ounces*, taken together, outweighed the *Royal Society*'s single *Troy Pound* Weight, by 2 ⅛ *Grains* and ⅛, at a like Medium.

At his Majesty's *Mint* in the *Tower* of *London*, their Standard Weights are only a Pile of *Troy* hollow Weights, from CCLVI *Ounces*, down to the 16th Part of one *Ounce*, without any *Penny* or *Grain* Weights. The larger of these Weights, as low as the VIII *Ounce-weight*, are marked with *A. R.* crowned, and inscribed PRIMO MAII, A° DNI. 1707. A° REGNI VI°. The IIII and the II *Ounce* Weights are only marked with *A. R.* crowned, without the Date; and the lesser have only the *Exchequer* Seal, and the *Rose* and *Crown*, being the Mark of his Majesty's *Mint*, as all the larger ones have also. And here it was found by Mr *Joseph Harris*, one of the *Assay-Masters* of the *Mint*, with a very curious Balance of his own, fixed in a Glass Lantern, and which he was well assured might in such Circumstances be depended upon to less than 2 a *Grain*; and with the Addition of so many *Penny* and *Grain* Weights belonging to his Office as were necessary: That

The *Royal Society*'s whole *Troy Pound* Weight weighed, at a Medium, less than the 8 *Ounces* and 4 *Ounces* of these Standards, taken together, by 2 ⅛ *Grains*.

That the *Royal Society*'s *Avoirdupois Pound* weighed in *Troy* Weight by these Standards, 14 *Ounces*, 11 *Penny-weight*, 16 ⅜ *Grains*, or 7000.87 *Grains*.

That the *Royal Society*'s Pile of 16 *Ounces Troy*, was lighter than 16 *Ounces* of these Standard Weights, by 4 ¼ *Grains*.

And, lastly, that the *Royal Society*'s 8 *Ounces* and 4 *Ounces* together, taken from their Pile, weighed lighter than their single *Troy Pound* Weight, by ⅛ of a *Grain*.

A Method of making a Gold-coloured Glazing for Earthen Ware, by M. Godo-

VI. Take of Litharge Parts iij. of Sand, or calcined Flint p. i. pound and mix these very well together, then run them into a yellow Glass with a strong Fire. Pound this Glass, and grind it into a subtile Powder, which moisten with a well saturated Solution of Silver, make

it

it into a Paſte, which put into a Crucible, and cover it with a Cover. Give at firſt a gentle Degree of Fire, then increaſe it, and continue it till you have a Glaſs, which will be green. Pound this Glaſs again, and grind it to a fine Powder; moiſten this Powder with ſome Beer, ſo that by Means of an Hair Pencil, you may apply it upon the Veſſels [or any Piece of Earthen-Ware]. The Veſſels that are painted or covered over with this Glazing, muſt be firſt well heated, then put under a Muffle, and as ſoon as the Glaſs runs, you muſt * ſmoak them, and take out the Veſſels.

fridus Heinſius, *Aſtron. Prof. at* St Peterſburgh. No. 465. *p.* 188. *Read* Nov 11, 1742.

VII. As a beautiful and regular Form of Body renders a Perſon agreeable; ſo, on the contrary, Deformity of Body not only produces Weakneſs, but ſometimes is the Cauſe of Ridicule amongſt ſuch unthinking People as will not remember, *That it is He that made us, and not we ourſelves.*

The Deſcription and Uſes of the Steel-yard Balance Swing, invented and made by Mr Timothy Sheldrake. No. 462. *p.* 20. *Read* Jan. 21, 1741 2.

For the foregoing Reaſons, and to prevent ſuch bad Conſequences as the above-mentioned, it would be much to the Advantage of crooked Perſons, if any Method could be found for giving them any Help, by endeavouring to regain the original Symmetry of Parts, which, by it's Commonneſs, is not ſufficiently eſteemed, though juſtly valued by ſuch as Crookedneſs has unhappily deprived thereof.

Where Crookedneſs is cauſed by bad Accidents, as Falls, breaking of Bones, or any ſuch Cauſes, attended with Neglect; there it is to be feared no Help can be given. But where a Deformity of Body is owing to ſome Defect of Health, ill Habit of Body, or ſome internal Cauſe, I hope it is in the Power of Art and Care to prevent growing worſe; or with good Care and Endeavours, to recover entirely: For doing which, I hope, this *Steel-yard Swing*, now laid before this Honourable Society, will be thought an uſeful Invention for doing ſuch Service to crooked Perſons, whoſe Bones are tender, and capable of having their Form a little altered.

The Body, as it is compoſed of Bones with Joints, covered with Muſcles, *&c.* for moving the Body, as Neceſſity requires; ſo if any of theſe Muſcles that are of Uſe for bending the Body forward, backward, downward, or raiſing it upward, or for turning Part of the Body to the right or left Side, have by Illneſs, want of proper Nouriſhment flowing ſo freely to one Side as the other, a careleſs Way of ſitting or lying, been contracted on one Side of the Body, by which the Bones are braced cloſer together than Nature intended; in this Caſe, the Hip generally riſes, the Shoulder on the ſame Side falls lower; the great Support of the Body, the *Vertebræ* of the Back, are altered from their natural Uprightneſs to a Curve, and the other Side extended to too great a Length: Thus the *Viſcera* are preſſed too cloſe on the contracted Side, and probably hindered from performing their due Office; whilſt on the contrary Side, which is extended beyond it's true Bounds, there is too much Room for them, that may give too

* *Afflare debes fumum.*

large a Growth to them, or render them too lax and weak. From this united ill State of the *Viſcera*, it is poſſible that crooked Perſons are generally unhealthy.

For removing this diſtorted Form, and recovering a better, this *Steel-yard Swing* is propoſed, as a mechanical Method, for ſtretching the contracted Side, and giving Liberty to the too much extended Side to contract; that the Sides may thereby be brought to their original and regular Form, by ſuſpending the crooked Perſon with Cords properly covered for Eaſe, and put under each Arm, and then placed at equal Diſtances from the Centre of the Beam. The Gravity of the Body will, in great Probability, immediately affect the contracted Side of the Body, ſo as to put the Muſcles a little upon the Stretch; and if the Cord under the Arm on the longeſt Side of the Body be removed further from the Centre, the longeſt Side will become a Weight continually increaſing, as the Point of Suſpenſion is removed further from the Point of Motion; by which Means the ſhorteſt Side muſt be lengthened. Thus the *Vertebræ* of the Back will be gradually brought from their irregular Form, to a perpendicular; and the Head, that probably leaned too much to one Side, will riſe upright.

The Child, or crooked Perſon, may hang ſuſpended much longer upon this Swing, than by the Head in one of the ſemicircular Swings, which cannot extend the contracted Side in ſuch Manner as this can, as will appear by the juſt Obſervation of this Inſtrument. It may be neceſſary to keep the Arms down, by a ſmall Bandage round the Body and Arms a little above the Elbow.

By this Method of ſwinging a Child, it's own Weight muſt conſequently ſtretch the contracted Muſcles, *&c.* that draw the Shoulder and Hip too cloſe together, and give Liberty to the Ribs to extend themſelves to a greater Diſtance from each other; and at that very Moment of Time, the too much extended Side, by the Weight of the Body, will be preſſed cloſer together; and by daily increaſing the Time that the Perſon is upon the Swing, the deſired Effect may be produced, an agreeable Form of Body recovered, and a healthy Conſtitution reſtored, to the Satisfaction of the Parents, and great Benefit of the once crooked Perſon.

Fig. 37. *A B C*, Is the *Steel-yard Balance Swing*.

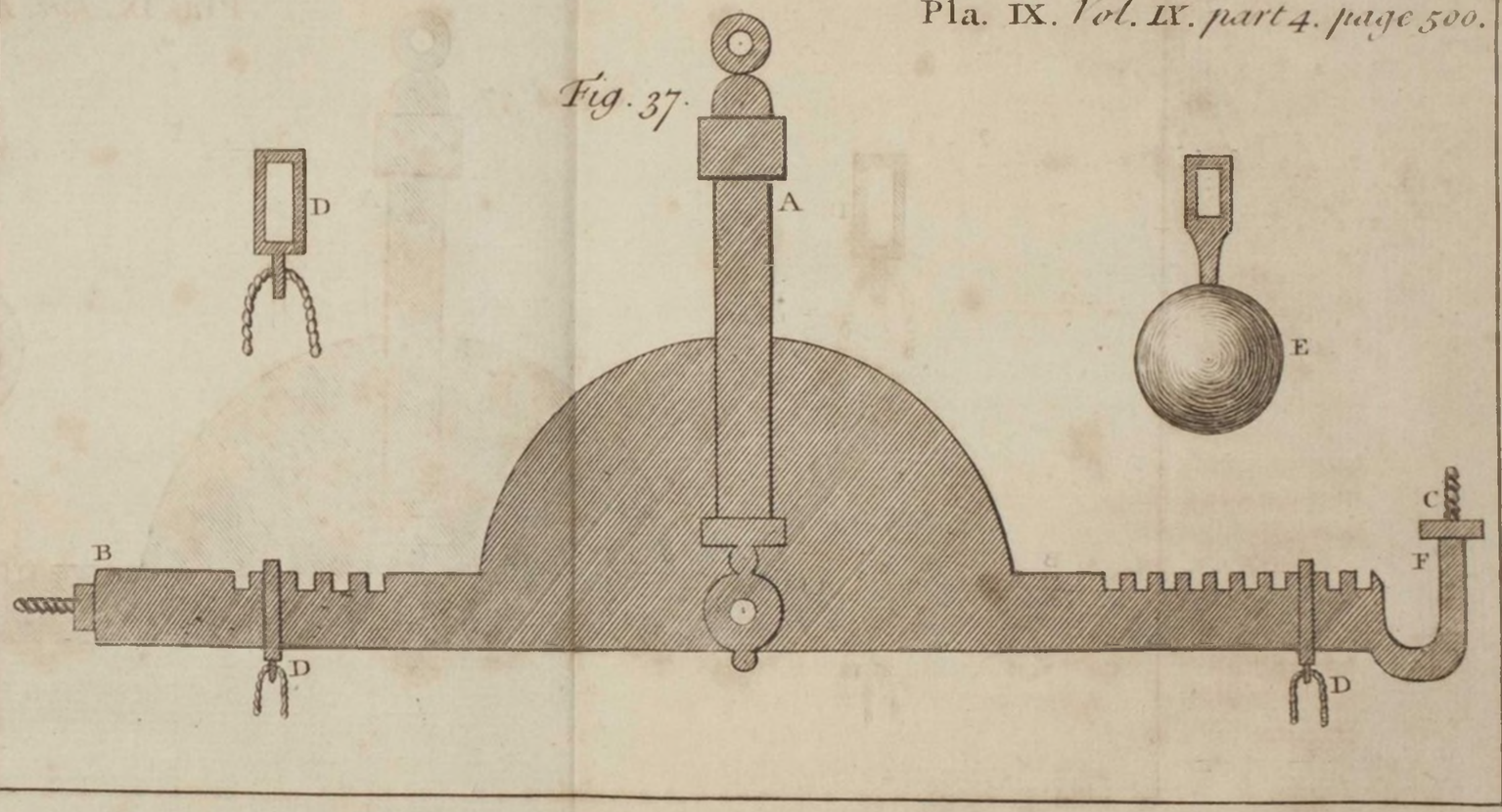
D, One of the ſquare Iron Loops to which the Cords are to be fixed, and which Loops, one on each Arm of the *Balance*, are moveable from one Notch to another.

E, A Weight, to be hung upon the Arm *C* at *F*, to add to the Weight of the too much extended Side, as Occaſion requires.

An Account, by Dr Richard Middleton Maſſey, *of a*

VIII. This magnificent Work is to conſiſt of four large Folio Volumes. The ingenious, curious, and moſt diligent Collector, takes in all Parts of Natural Hiſtory, and gives us Deſcriptions and Figures of Things

Fig. 37.



Things ſcarce ever ſeen or heard of before in *Europe*, which he has collected from all Parts of the World, with vaſt Charge as well as Induſtry.

The firſt Volume contains 111 Plates, beſides the Author's Effigies, and the Decorations curiouſly engraven by the beſt Hands. He begins with the Anatomy and Skeletons of ſeveral Fruits, Leaves, and Roots: The Method of performing which, he communicated to the *Royal Society* ſome Time ago. He then goes on with a Deſcription of ſeveral curious exotick Plants, with a particular Account of the *Zagoe Amboynenſium*, *Morus Papyrifera*, &c. After theſe follow a great Variety of different Sorts of Animals from all Parts of the World. *Armadillo's*, *Ai*, or *Sloths*, *Spiders*, *Millepedes*, *Scorpions*, *Flying Squirrels*, *Opoſſums*, *Mice*, *Rats*, *Cats*, *Dogs*, large *Frogs* and *Toads*. A Deſcription of the *Pipal*, a Sort of *Toad*, whoſe *Young* are produced on the Back of the Female. An Account of the Transformation of *Frogs* from *Fiſhes*, and back again from *Fiſhes* to *Frogs*. Several Kinds of ſcarce *Lizards*, *Iguana's*, *Chamæleons*, *Salamanders*, *Tortoiſes*, *Crocodiles*; of which two laſt, ſome are repreſented in the Eggs, and ſome juſt excluded. A *Dragon* or *Baſiliſk* from *America*, with above fifty ſeveral Sorts of *Serpents*.

Book, entituled, Locupletiſſimi Rerum Naturalium Theſauri, *accurata Deſcriptio*, &c. Vol. I. Amſtel. 1734, *in Fol. An exact Deſcription of the principal Curioſities of Nature, in the large Muſeum of* Albertus Seba, *F. R. S.* Vol. I. Amſterdam, 1734. No. 434. *p.* 415. Sept. *&c.* 1734.

CHAP. IV.

PAPERS omitted.

[Part i. Chap. III. *add the following Article.*]

JAN. 27, 1734, $6^h\ 23'$ *p. m.* I obſerved $\odot\ \mathfrak{D}\ \mathfrak{P}$. I found $\mathfrak{P}\ L\ 35'$ of $1^\circ\ \mathfrak{P}\ o\ \angle\ \mathfrak{h}$: *Venus* looked toward the S. and the Moon toward the N. $6^h\ 57'\ \mathfrak{P}\ L = 26'$, and in this Obſervation a Line was drawn through *Venus*, and each Cuſp of the *Falx* of the Moon, afterwards the Moon gradually departed farther from *Venus*

A Conjunction of Venus *with the Moon, by* Jo. Frid. Weidler, *F. R. S. obſerved at* Wittemberg. No. 442. *p.* 267. July, *&c.* 1736.

[Part ii. Chap. I. *add the following Articles.*]

In a Letter dated at *Plymouth*, *Nov.* 30, 1739, Dr *Huxham* ſays, "We have had a very tempeſtuous Seaſon for ſeveral Days paſt, though "now fair; the *Mercury* lower [28.1 Inches] than I have known it "for ſome Years, and the Tides exceſſively high."

Weather at Plymouth, *by* John Huxham, *M. D.* No. 460. *p.* 672. Apr. *&c.* 1741.

Laſt

An Account of an Earthquake at Scarborough, *on* Dec. 29, 1737, *by* Maurice Johnson, *Esq; jun. Secr. of the Gentlemens Society at* Spalding. No. 461. *p* 804. Aug. &c. 1741. *Dated* Spalding, Jan. 7, 1737-8.

Last *Thursday*, the following Account of an Earthquake, which has very lately happened at *Scarborough*, was sent in a Letter from an Eye-witness, to a Gentleman here, was dated thence *Dec.* 30, 1737, in these Words:

——" The Ends of several Inclosures or Fields behind the Clift, on " the Back of the Spaw, sunk down very low into the Ground, making " a large Valley of a vast Length, and considerable Breadth, with five " Cows then grazing on it (which they got out this Morning) the " Weight of which shook and opened the Hill behind the House, " after a frightful Manner, and forced up the Sands an hundred Yards " in Length on each Side the Space, and twenty-seven broad, to the " Height of six Yards, and in some Places ten Yards high.

" The Pier, entire as it was, moved Sideways out of it's Place, and " rose up about 5 Yards in the Air; the House fell down, and at the " same Time took Fire.

" The Flag-house, and wooden Rails, which were about the Mouth " of the Well, were forced up in the Air above 10 Yards high, so " that it is thought the Spaw-Water is entirely lost for ever *.

" The Tide was out when this happened, and I was walking on the " Spaw till after 12 o'Clock, when I saw the Sands beginning to rise " about half a Foot: There were but few People there then, but in " less than two Hours the Sands were covered with Men, Women, " and Children, to see the Sands and Pier rise gradually; which they " began to do about 12 o'Clock Yesterday Noon, and were at the " Height I mention before it was dark, and continues so now.

" No-body came by any Hurt, the People of the House getting a- " way in Time; but all *Dickey*'s † Houshold-Goods are lost, with a " Cellar well stocked with Wine and Ale."——

[Part iii. Chap. IV. *add the following Article.*]

An Account of some remarkable Stones, taken out of the Kidnies of Mrs Felles, *upon opening her Body after her Decease, by* Noah Sherwood, *Surgeon.* No. 459. *p.* 610. Jan. &c. 1741.

Upon opening the Body of Mrs *Felles*, I found nothing amiss in any of the *Viscera*, till I came to the Kidnies, both of which were considerably enlarged, and of an oblong Figure, and had several Protuberances bunching out, which made the Surface appear almost like a Beeve's Kidney. Upon feeling them externally, I could plainly perceive they were caused by Stones: I took them out of the Body, and laid them open longitudinally, and found in the right Kidney several Stones of an irregular Figure, branched like Coral: They had extended themselves beyond the Capacity of the *Pelvis* on every Side, (although that was greatly inlarged, so as each of them to contain half a Pint of *Pus*, or more) forming for themselves Cells in the *Parenchyma* of the Kidnies, which Cells were all ulcerated within, and full of Matter, com-

* *N. B.* The Spaw was soon after recovered as good as before.
† *Richard Dickinson.*

municating

municating with the *Pelvis*; the whole Subſtance of the Kidnies was ſcirrhous. The Patient had long been troubled with grievous Pains of the Back, and had voided great Quantities of *Pus* with all the Urine ſhe made, ſo that there was no Doubt of there being Ulcers in her Kidnies; and ſhe herſelf often declared there were Stones in the Kidnies, which, upon any Motion, ſhe could feel grate againſt each other. The Bladder and Ureters ſeemed to be leſs hurt by ſo long a Diſcharge of Matter than might reaſonably be expected, being only a little excoriated; and indeed leſs than I have found in other ſeemingly parallel Caſes, where the Matter has been of a more corroſive Nature; but in this Caſe it was thick and ſmooth.

The left Kidney was likewiſe full of Matter, and contained only one Stone, larger than any of thoſe in the right, nearly of a triangular Figure, with the Angles growing pointed at their Extremities.

The End of the Ninth VOLUME.

A GENERAL

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PAGE 31. Line 4. for V. read 2. p. 78. l. 19. for *as* read *at*. p. 79. l. 18. in the Margin add *Fig.* 34. p. 97. l. 16. for *Spheriod* r. *Spheroid*. p. 101. l. 19. for *Dimunition* r. *Diminution*. p. 107. l. 13. for *Suppoſiton* r. *Suppoſition*. p. 134. in the Margin, l. 14. for *Fig.* 61. r. *Fig.* 61 *. p. 272. l. 24. for *centrifical* r. *centrifugal*. p. 306. l. 24. for *diſappers* r. *diſappears*. p. 375. l. 30. for *at ſame* r. *at the ſame*. p. 420. l. 31. for *Tub* r. *Tube*. p. 525. l. 26. in the Margin, infert *Fig.* 34, 35, 36, 37. p. 527. l. antepenult. for *to* r. *the*. p. 641. in the Margin, for *Fig.* 43. r. *Fig.* 44. p. 764. l. 14. for *Stop* r. *Top*. p. 787. l. 10. for *tube-roſe* r. *tuberous*.

ERRATA in VOL. IX.

PAGE 24. Line 15. for *ſeems* read *ſeem*. p. 32. l. 31. for *Polpus* r. *Polypus*. p. 38. dele the Account of a ſtrange aquatic Animal, the Author having retracted it in the following Note, printed in a late Number of the *Philoſophical Tranſactions*.
" *N. B.* A Letter from Dr *Miles* to Mr *Baker* having been publiſhed in the *Phil. Tranſ.*
" N° 469, as that Gentleman has nothing in View but the Diſcovery of Truth, he
" thinks proper to rectify a Miſtake he then made, in ſuppoſing certain Bodies to have
" been animal Subſtances, from their ſeeming to have a ſpontaneous Motion in Water;
" it having ſince appeared to him that they were only the Seeds of the *Bidens foliis tri-*
" *partitò-diviſis*. *Caſalp.* 488. TOURNEFORT. p. 462. *Tab.* 262. that had fallen into
" the Water, and were poſſibly poſſeſſed by ſome Inſects which might give them that
" Motion." p. 73. in the Margin, for *Salu* read *Salv*. p. 142. for CHAP. IV. read CHAP. V. p. 175. l. 2. for *prickled* r. *pickled*. p. 179. l. 41. for *Badder* r. *Bladder*. p. 193. l. 1. for CHAP. V. r. CHAP. VI. p. 203. l. 36. for *verſicular* r. *veſicular*. p. 359. l. 12. for *properly* r. *Property*. p. 372. in the Margin, for *Fig.* 149. r. *Fig.* 150.

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