

'Tis in the Middle of this *Pericardium* that the Heart is suspended ; to wit, at it's *Basis* by the Arteries, and at it's inferior Part by a little Tendon, or a very thin Ligament, which, from the Point or Cone of the Heart, ascendeth to insert itself to that Part of the *Pericardium* which adheres to the Back.

This little Ligament is very remarkable in this, that by it's means the Point of the Heart is suspended on the Level of it's *Basis* ; without which 'tis visible that the Point of the Heart would fall lower, and bend the Vessel of the *Basis*, which might have interrupted the free Circulation of the Blood, and by consequence would have endanger'd the Life of the Animal.

The *Pericardium* being opened, the Heart appeareth as if it was standing by itself, being only fixed to the Arteries which go out of it (supposing the Animal turned upon it's Back) it's *Auricles* being separated and hid under it's *Basis* and Arteries, towards the Back of the Animal ; which is very different from the Sea-Tortoises, where the *Auricles* are situated on the Right and Left Angle of it's *Basis*, by which Way they push the Blood into the Heart.

The Figure of the Heart of this Animal is almost lenticular ; making nevertheless three obtuse Angles, two on the *Basis*, one to the Right, and the other to the Left ; the third is at the inferior Part, where the little Tendon, which suspendeth the Heart on the Level of it's *Basis*, is inserted.

If this Animal be opened alive, you have the Satisfaction to see the Circulation of the Blood, by reason of the Transparency of the Membranes of the Veins, and the Alternative Motions, or Dilatations of the Heart and *Auricles*, and the Arteries and Veins, which are very slow in this Animal.

From the *Basis* of the Heart pass out four great Arteries, that appear distinctly separated one from the other ; whereas in that of the Sea-Tortoise, these Arteries are involved, for the Length of an Inch, in a *Capsula* common to them all, which maketh them to appear as if they were but one Trunk. If these four Arteries be entirely cut, the Heart is no more suspended, but by the Conjunction of the two *musculous Conduits* of the *Auricles*, which pierce the Heart in it's *posterior* Part, towards the Middle of the Heart, on the Left Side ; by which the Blood runneth from the *Auricles* into the *Ventricle* of the Heart.

These Arteries being thus divided, and the Heart turned over, the *Auricles* appear lying transversely against the Back, in the Capacity of the *Pericardium* : They make but one continued fleshy Body, a little extended, about two Thirds inclining to the left Side. 'Tis in this Body that the Cavities of the *Auricles* are separated the one from the other, by a *muscular Septum*, situated internally to that Place, which appears contracted externally. These *Auricles* make a *muscular Production* about six Lines long, which uniteth them to the Heart, to-

wards the Middle and Left of it's Backside. This Production is composed of two Conduits, separated only from one another by the Extension of the *Septum*, which divideth the two *Auricles*: It is by these two Conduits that the Blood floweth from the *Auricles* into the Heart. The Body of these *Auricles* hath no Adherence to the *Pericardium*, nor any Support but that of the Veins, which end in it; for if you divide these Veins, the Heart and *Auricles* come out of the Body; and then if you suspend the Heart by the *Auricles*, they resemble two Funnels joined together, the little End of which opens into the *Ventricle* of the Heart, to pour the Blood into it: And 'tis in this manner we are to conceive them, in the natural Situation of the Animal.

After having thus consider'd the external Parts of the Heart and it's *Auricles*, we are to proceed to the Examination of the Inside of both of them. In order to that, it must be open'd at it's inferior Surface, (supposing the Animal turned upon it's Back) because all the Orifices of either the Arteries and Veins, and their *Valves*, are in the opposite Side: Therefore a Probe may be introduced thro' one of the Arteries into the Heart, and it open'd upon it; after that, you cut all this Side round about the inferior Circumference, from one Angle to the other, and then turn over all that Part which is cut on the *Basis* of the Heart: For then it is easy to remark and view all the internal Parts of an Heart, and observe that there is but one sole *Ventricle*, which comprehends the whole Extent of the Heart, and is as uniform and plain as either of the *Ventricles* of the human Heart, or of any other Animal whatsoever; and that it is impossible to remark any kind of *Septum*, either musculous or membranous, that might make any Division or *Cellule* in this *Ventricle*: And 'tis very surprizing, that the Anatomists of the Royal Academy of *Paris* have shewn, the one three, and the other four *Ventricles*, in the Heart of a Land-Tortoise of *America*.

After having consider'd the Extent of the Cavity of the Heart, there remain two Things to be examin'd. The first is, that in it's Back-part, there are five Holes or Orifices, two whereof are on the left Side: These are the Orifices of the two Funnels of the *Auricles*: They are cover'd by a large *Valve* lying flat upon them, supported in it's Middle by the Prolongation of the *Septum*, which divides the *Auricles* in such a manner, that half of it covers the Orifice of the right *Auricle*, and the other half that of the Left; so that this *Valve* resembles two Folding-Doors of a Porch, which have the same Support, and whereof one opens or shuts to the Right, and the other to the Left. It is visible, that this *Valve* permits the Entrance of the Blood into the *Ventricle* of the Heart, but opposes it's Return into the *Auricles*; because this Blood being once in the Heart, presses by it's own Weight upon this double *Valve*, and keeps it close and flat upon these Orifices; which confirms perfectly well the Office of the *Valve*, which is in the *Foramen Ovale* in the Heart of an human *Fætus*, the Disposition being entirely the same. The other three Holes lying on the right Side of the *Ventricle* of the Heart, are the

the Orifices of the four Arteries which come out of the *Basis*: Of these three Holes, that which is the most Left, is the Orifice of the Pulmonary Artery; that which is the highest, is the Orifice of the *Aorta sinistra descendens*; and that which is the most to the right Side, is common to the *Arteria Aorta dextra*, and to the *superior Aorta*. Each of these Orifices is furnish'd with two Semilunary *Valves*, which permit the Blood to pass without Difficulty from the *Ventricle* of the Heart into the Arteries, but hinder it's Return into the Heart. 'Tis a pure Illusion, to place these Holes in different *Ventricles*; they are all in one and the same Cavity; so that the Blood enters into this only Cavity, by the two Holes which are on the left Side, and goes out of this same *Ventricle*, by the three Holes which are on the right Side.

The second Thing remarkable in this Ventricle, is the Fibres of the Heart. They are of two Sorts; some are External, disposed under the common Membrane in several Plans, very small, but obliquely circular, extending from the *Basis*, but particularly about the Arteries, which serve them instead of Tendons or Points of Support, towards the inferior Circumference of the Heart: The other musculous Fibres which compose the Heart, are in a manner of several Columns, as those of the Human Heart; they are situated internally in both Sides, lying obliquely from the Right, where their Tendons are about the Arteries to the Left; which demonstrates that their Action is from the left to the right Side, where the Orifices of the Arteries lie open to let the Blood pass out.

It has been said before, that the two *Auricles* of the Heart of the Land-Tortoise of *America*, make externally but one continued Body; but that it has internally two Cavities, separated from one another by a musculous *Septum*. This *Septum* separates them so exactly, that there is not the least Communication of the one with the other; so that the Blood of either *Auricle* does not mix with that of the other, but in the Ventricle of the Heart. The right *Auricle* is as big again as the Left; all the Blood of the Animal (that of the Lungs excepted) passing thro' it to go into the Heart; the left *Auricle* receiving only the Blood which cometh from the Lungs, the Pulmonary Veins being very small. The internal Part of the *Auricles* are furnish'd with little musculous Columns, but particularly at their Extremities, situated in such a manner, that it is visible their Action tends to push the Blood against the *Septum*, where the Conduits, which convey it into the Heart, are situated.

There is in the Bottom of the right *Auricle* an oblong Orifice, by which the Blood cometh into it's Cavity from the great Reservoir of the Veins, situated on the back-part of the Heart. This Orifice is furnish'd with two Semi-lunar oblong *Valves*, disposed in such manner, that when the *Auricle* is relaxed, the Blood enters it's Cavity, but when contracted, they shut close to hinder the Blood from returning into the Veins: The Orifice of the Funnel, or the Conduit into the Heart, is to be seen against the *Septum*. The left *Auricle* hath exactly the same Structure as the right: 'Tis in the Bottom of this *Auricle*, that the Ori-
fice,

ifice, common to the two Pulmonary Veins, is to be observ'd, furnish'd with two semi-lunar *Valves*; and against the *Septum* to the Right, that the Funnel or Conduit into the Heart is situated, joining with the Funnel of the right *Auricle*. These two Conduits are separated from one another by the Continuation of the *Septum*, which divides the *Auricles* to the very *Ventricle* of the Heart, and is a Support to the Middle of the double *Valve* which covers their Orifices in the Heart.

The Vessels of
the Heart.

It has been said before, that from the *Basis* of the Heart of the Land-Tortoise of *America*, there goes out four great Arteries. Of these, the first which presents itself, (the Tortoise being turned upon it's Back) is the Pulmonary Artery: It is more on the left Side than the others, and is much bigger for the Space of an Inch: Then it divides itself into two Branches, the most apparent whereof cometh from the right Side of it's Trunk, and turns itself over towards the left Side, accompanying the *Aorta inferior sinistra*, till it hath pierced the *Pericardium*; after that, it unites with the left Branch of the *Trachea Arteria*, which it accompanies thro' all the Extent of the left Lobe of the Lungs. The other Pulmonary Branch going out of the left Side of it's Trunk, turns itself over immediately cross upon the other Arteries, from the right to the left, to join the *Aorta inferior dextra*, till it has pierced the *Pericardium*, where it joins to the right Branch of the *Trachea Arteria*, which it accompanies thro' the whole Extent of the right Lobe of the Lungs.

One Thing seems to me very remarkable in this Pulmonary Artery; it is this, That tho' it's Trunk, in going out of the Heart, hath more than twice the Diameter of the *Arteria Aorta sinistra*, yet the two Branches which it sends to the Lungs, have not either of them one Third of the Diameter of the *Aorta sinistra*. In the Arteries, which I have fill'd with Wax, the Trunk of the Pulmonary Artery hath between seven and eight Lines Diameter; the *Aorta sinistra* four and a half; and the Pulmonary Branches, after having pierced the *Pericardium*, have not either of them but one Line and a half Diameter: Nevertheless this Artery doth not produce any other Branch; all the Blood, which enters from the Heart into it's Trunk, is carried into the two Lobes of the Lungs, and no where else. The Reason of such Disproportion I cannot guess; but this is Matter of Fact, since it is the same in all: If I may be permitted to conjecture, it seems to me, that it may be attributed to the Alteration that happens to the Branches of the *Trachea Arteria*, when the Tortoise stretcheth forth his Head out of the Shell; for these Pulmonary Branches, making a Semicircle before they join with the *Trachea Arteria*, when the Animal's Head is drawn in, the Extension which happens to the Branches of the *Trachea Arteria*, when the Animal goes out of the Shell, turns these Semicircles into acute Angles; insomuch, that thereby the Passage of the Blood is somewhat interrupted, and consequently the Blood, which passes continually from the Heart into the Trunk, not being capable to return back,
because

because of it's Valves, must out of necessity dilate this Trunk more than the other Arteries, in which the Blood passes in an equal Passage.

And that which persuades me, that there doth not go into the Lungs of this Animal, more Blood than that Quantity which the Pulmonary Branches can admit by their small Diameter, and not the Quantity which the Diameter of their Trunk could furnish, is, that the Pulmonary Veins, which bring back all the Blood of the Lungs into the left Auricle of the Heart, have not either of them entirely two Lines Diameter, which is very proportionable to the Bigness of the two Pulmonary Branches of the Arteries.

The second Artery which goes out from the *Basis* of the Heart, is that which I call *Aorta sinistra*: It ascends, as it comes out of the Heart, together with the left Pulmonary, till they have pierced the *Pericardium*; after which it makes a large Turning, without any Support, towards the left Side, which gives it the Liberty to extend itself when the Animal stretches out of it's Shell, and to refold itself when it retires into it: After this, this Artery descends against the Back, where it gives some small Branches to the *Medulla Spinalis*; after that, it returns thro' the Lungs into the *Abdomen*, and it is here that it produceth a considerable Branch, which divides into two, of which one is distributed to the Liver, the Stomach, and the Intestines, and the other, turning towards the Right in the Middle of the *Abdomen*, unites to the *Aorta dextra*; so that these two Arteries are but one and the same Branch divided into two. This same *Aorta sinistra* continues afterwards to the lower Belly, to be distributed to the Kidneys, Thighs, and the Parts that are below. This left *Aorta* is much longer than the Right, because of the great Circle it makes when it cometh out of the Heart, to accommodate itself to the Motions of the Animal and to make Room for it's Head, which is placed under this Artery in the left Side, when he draws it into his Shell: And 'tis for that Reason that the left Branch of the *Trachea Arteria* is longer than the right. This Artery is also bigger than the right *Aorta*, because that it furnisheth a greater Number of Parts with Blood. It hath a distinct Orifice into the Ventricle of the Heart, and hath not the least Communication with the Pulmonary Arteries, neither in the Heart nor in any other Part. This doth not resemble at all the *Ductus Arteriosus*, in the Heart of an human *Fetus*.

The third Artery going out from the *Basis* of the Heart of this Animal, is that which I call *Aorta descendens dextra*. After having pierced the *Pericardium*, it sinks towards the Back; then returning thro' the Lungs into the *Abdomen*, where it receives the Branch of the *Aorta sinistra*, it is distributed to the Right Kidney, Thighs, Bladder, and Parts of Generation: So that I call these two Arteries, *Arteriae Aortae descendentes*, because they distribute the Blood to all the inferior Parts of this Animal, the same as the *Aorta descendens* doth in all other Animals.

The

The fourth Artery going out from the Heart, is the *Aorta ascendens*. It hath an Orifice in the Ventricle of the Heart, common with the *Aorta descendens dextra*: It appears in part under the *Aorta sinistra* coming out of the Heart, and ascendeth in a straight Line till it hath pierced the *Pericardium*; after which it divideth into three principal Branches, whereof the two lateral go to the fore Legs, and make the Carotid; the third ascends all along the *Trachea Arteria* towards the *Larynx*, and gives Branches to all the Parts of the Neck.

The Disposition of the Arteries which go out of the Heart being examined, there remain only the Veins which bring the Blood into it from all the Parts of the Animal: But first it is to be observed, that there are no Veins which terminate in the Heart; for all the Veins open themselves into the Auricles, which are, as hath been said, separated from the Heart.

There are two Ways to shew these Veins without Dissection: The first is to fill them with Wax, by syringing it into them by their Orifices in their Auricles; for if one syringes by the oblong Orifice in the *Auricula dextra*, all the Veins of the Body (except those of the Lungs) will be entirely fill'd; and afterwards by syringing into the oval Orifice in the *Auricula sinistra*, the two Veins of the Lungs will be full at once through the whole Extent of the *Trachea Arteria* in the Lungs.

The other Way is to wait till the Animal is expired; because the Heart losing insensibly it's Vigour, (it beating for the Space of 24 Hours) it has not then the Force to discharge itself of the Blood which comes from all Parts into these Veins, which then grow very turgid by the coagulated Blood collected in them: then you need only to turn over the Heart towards the Neck, cutting only the little Coronary Vein which comes out of the Substance of the Heart, to observe all the great Veins without Dissection: because they all come and end in a common Reservatory, situated across in the Capacity of the *Pericardium*, joining to the Auricles. And here one may observe a great Vein, or an irregular Reservatory: In the Tortoises I have dissected of 18 or 20 Inches long, this Reservatory was 10 Inches broad, and 18 Inches long. In this Reservatory the two Axillary Veins which come from the upper Parts of the Body, join one another, after having pierced the *Pericardium*, one on the Right Side, and the other on the Left. From the inferior Parts there join two large Veins, one on the Right Side, and the other on the Left of the inferior Part of this Reservatory; the first whereof is made up of all the Branches which come out of the Right Lobe of the Liver, which is very big; and the other consists not only of the Veins of the Left Lobe of the Liver, but also of a Vein which supplies the Place of the *Vena Cava*, and which I call the *Vena intestinalis*, because after it has received all the veins of the inferior Parts of the Animal, it runs all along the Intestines, from which it receives the Veins; and being arrived



arrived at the *Pylorus*, it passes cross the left Lobe of the Liver, and terminates in the common Reservatory.

Besides these four great Veins, there are three, and sometimes but two, coming from the middle part of the Liver, which are inserted into the Bottom of the Reservatory; as also the little Coronary Vein from the Heart.

All these Veins being thus re-united in one common Place, this Reservatory terminates upwards in a Conduit, which is inserted into the posterior Part of the Right Auricle, and opens into it's Cavity by an oblong Orifice, furnished with two long Semilunar Valves, which permit the Blood of the Reservatory to enter into the Auricles, but hinder it's returning from the Auricles into the Reservatory.

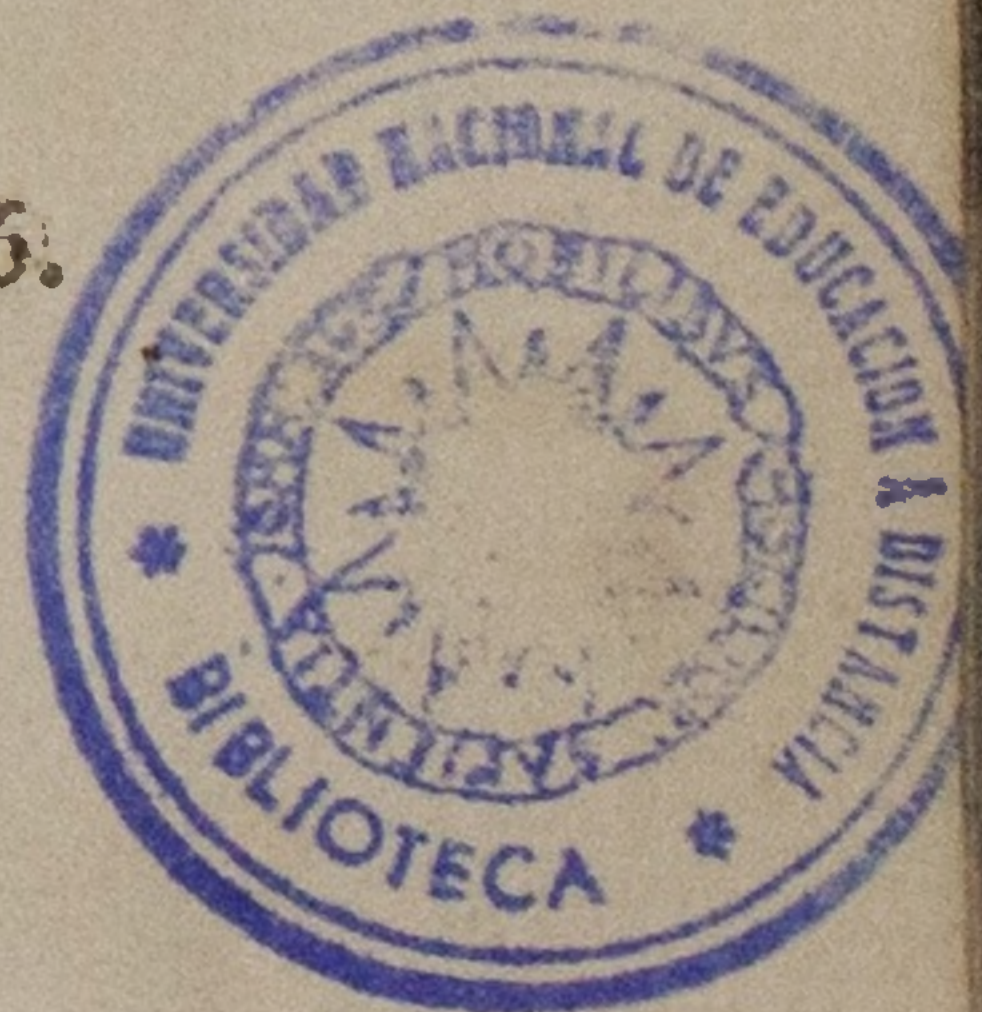
A little above the Reservatory, under the Left Auricle, the two Pulmonary Veins are seen: The Left, after having entered the *Pericardium*, is hid under the Axillary Vein, and does not separate itself from it but a little above the Auricles; from thence it bends to go and insert itself into the posterior Part of the Auricles. The Right Pulmonary Vein follows after the same manner the Right Axillary, which it quits after it has enter'd the *Pericardium*, to traverse almost all the Length of the Reservatory, and meet the Left Pulmonary about two Lines distance from the Auricles. These two Veins thus united, open themselves in the posterior Part of the *Auricula sinistra*, by a common Oval Orifice furnished with two Semilunar Valves; by which means they pour into this Auricle all the Blood that comes from the Lungs to the Heart.

By all that has been observed concerning the Structure of the Heart of the Land-Tortoise of *America*, and the Disposition of both it's Auricles and Vessels, how extraordinary soever it may appear, it is impossible to find out the least thing which may injure the Opinion of *Dr Harvey*, and all other Anatomists, about the manner that the Blood circulates in the Heart of an human *Fœtus*, and the Use of the Valve which is at the *Foramen Ovale*; which is, to permit the Blood to pass from the Right Auricle thro' this Hole into the Left, and to hinder the Blood's passing from the Left Auricle by this Hole into the Right. And I add further, that amongst all the known Animals, one could not chuse one whose Heart may be more proper to confirm this Opinion, than the Land-Tortoise of *America*, by reason of the Simplicity of it's Structure, and of the plain and distinct Manner in which all the Parts appear. Therefore if *Mr Mery* will give himself the trouble to examine a second time the Structure of the Heart of this Animal, he must acknowledge his Mistake and Errors.

Fig. 56.] *a, a, a*, The Heart. *b, b, b*, It's Auricles. *c*, The Trunk of the Pulmonary Artery. *d*, The Arteria Aorta descendens sinistra. *E*, The Arteria Aorta superior. *H*, The Arteria Aorta descendens dextra. *M*, The

VOL. V.

Fig. 56.



F, The Ligament that suspendeth the Cone of the Heart in the Pericardium, *G, G, G, G, G*, The Pericardium opened.

Fig. 57.

Fig. 57.] *a, a, a*, The Heart opened to shew the Parts of it's Ventricles. *b*, The double Valve covering the Orifices of the Ductus's from the Auricles. *c*, The Orifice of the Right Auricle *i*. *d*, That of the left H. *e*. The Orifice of the Arteria Pulmonalis *K*. *f*, That of the Aorta sinistra *L*. *g*, The Orifice common to both the Arteria Aorta dextra *M*, and the Aorta superior *N*.

Fig. 58.

Fig. 58.] *a, a, a*, The Auricles. *b*, The Right Auricle. *c*, The Left Auricle. *d, d*, The Musculous Septum that divides the Cavities of the Auricles. *E*, The Orifice of the Reservoir of the Veins. *F*, The Orifice of the Pulmonary Veins. *g, g*, The large Parts of the Funnels. *H*, The Musculous Ductus of the Funnels. *i, i*, The Reservoir of the Veins. *K*, The Left Axillary Vein. *L*, The Right Axillary Vein. *M*, The great Intestinal Vein. *N*, The great Hepatic Vein. *o, o*, The two small Hepatic Veins. *P*, The Right Pulmonary Vein. *q*, The left Pulmonary Vein.

Fig. 59.

Fig. 59.] *a*, The Heart of the Tortoise. *b*, The Trunk of the Arteria Pulmonalis. *c, c, c, c, c*, The Branches of the Arteria Pulmonalis accompanying the Bronchia in the Lungs. *d, d, d, d*, The Arteria Aorta descendens sinistra. *e, e, e, e*, Arteria Aorta descendens dextra. *f, f*, One Branch of the Aorta sinistra, which communicates with the Aorta dextra. *g, g*, Arteria Intestinalis. *h*, Arteria Aorta superior, or Ascendens. *i*, The Ligament that suspends the Heart. *K*, The Trachea Arteria, *L, L, L, L, &c.* The two Branches of the Trachea Arteria going to the Lungs.

The Anatomy
of an Ele.
phant. By
Mr P. Blair.
n. 326, p. 51.
n. 327, p. 117.
n. 358, p. 885.

XXIII. After this Animal had travell'd most Part of Europe, she came at last to Scotland, where after some Stay at Edinburgh, they conducted her to the North, and by long and continued Marches hasten'd to Dundee in their Return; the Beast, much fatigued, fell down within a Mile of Dundee: After many Endeavours (which prov'd ineffectual) to get her upon her Feet again, they digg'd a deep Ditch, to the Side of which she might lean to rest herself; but soon afterwards there fell great Rains; so that after lying a whole Day in Water, she died the next Morning, being Saturday the 27th of April, 1706.

The Animal lying in the open Fields, the great Heat of the Day, the Croud of People, the Time the Butchers took the flaying off the Skin, and the Shortness of the Time, being the last Day of the Week, makes this Discourse so imperfect. I had scarce any Time or Convenience so much as to see any thing of Moment, much less to enquire so nicely as the Subject requir'd. I examin'd, as well as I could, the Muscles of the Proboscis, view'd the Situation of the Viscera, took the Figure and Dimensions of the Liver, extracted the Ue-

rus and Bladder, and caus'd the Head to be cut off, which (with some other Parts I designed to have dissected) were brought to Dundee. On Monday I went to examine the Intestines, Spleen, and Kidneys; but the Intestines were dried, and their Figure and Structure quite spoiled by the Heat: The Time I design'd to have bestow'd in dissecting the Parts I had reserv'd (which would not keep because of the Heat) was taken up in excarnating, boiling, and taking care of the Bones: of which I shall give a full and exact Account, and as good a one of the Internal Parts, as the before mentioned Difficulties would permit. I shall first observe only, that the Epiphyses in this Subject separated from the Bones by boiling, as easily as those of an Human Subject would have done at the Age of 10 or 12; and yet the Keeper told me, she was 26 or 28 Years old; which is an Argument for the long Life of this Animal, which some say lives to 120 Years, others to 200, some to 300; nay, there are some who affirm they can live to 500 Years. I have nothing to say for the Truth of these Assertions.

I shall first take Notice of the external Shape and Dimensions, and then of the internal Parts and their Structure. That it is *Animal Vastissimum*, I agree with *Franzius*; but that it is deform'd, since those due Proportions laid down by the Author of Nature are as well observ'd in this as in any other Animal, I can hardly grant; for nothing can be deform'd but what swerves from a general Rule. It has a big short Head, short Neck, long Nose or *Proboscis* hanging almost to the Ground; a Back somewhat protuberant, a short and round Body, a long Tail, four great round Legs, like so many Columns supporting such a vast Weight; and short Feet, those before being broader and rounder, and those behind more long and narrow, each shod with 4 Hoofs; a little narrow Mouth, with two long Tusks proceeding from the Upper Jaw, one on each side of the *Proboscis*; 4 strong Grinders in each Jaw; small, yet piercing Eyes; and large flat Ears.

The external Shape of the Elephant.

The Dimensions are as follow: At the fore Leg she was 8 Foot high (A. A.) and 9 at the hind (B. B.) in Length 10 Foot (C. C.) and a Tail 4 Foot 3 Inches long (C. D.) round the Belly 14 Foot (E. E.) from the Top of the Head to the End of the *Proboscis* 8 Foot (F. F.) whereof the *Proboscis* makes up 4 $\frac{1}{2}$ Foot (F. G.) from the Forehead equal with the Eye to the lower Jaw, measuring backward, 27 Inches (H. H.) from the Top of the Head to the lower Jaw, measuring downward, 4 $\frac{1}{2}$ Foot (F. I.) The Ear was almost square in this Subject, and small in respect of those other Animals. Whether or not this Difference might have been in regard of the Sex, I know not. 'Twas in Length 19 Inches (K. K.) and in Breadth 17 (L. L.) The Eye (U) was not so small as Dr *Moulins* would have it; who says, they were no bigger in the Subject he treats of than those of a Sheep; whereas in this they are larger than those of an Ox. The Distance betwixt them, measuring across, was 26 Inches; between

The Particular Dimensions of the stuff'd Skin.

Fig. 60.

tween the *Anus* and *Vagina* $2\frac{1}{2}$ Foot; between the Dugs 1 Foot. The fore Foot measuring round the Extremities of the 4 Hoofs, 3 Foot $10\frac{1}{2}$ Inches (N. N.) whereof the external Hoof running obliquely forward was five Inches; the second on the outside, square before, was 5 Inches and 6 in Breadth, *i. e.* up toward the Skin; as was the third square also before, and $4\frac{1}{2}$ Inches (*c*). The Internal was more pointed than the External, and of the same Length; the hind Part of the Foot was cover'd with a tough thick Skin: The Diameter of the fore Foot, from the Right to the Left, was $14\frac{1}{2}$ Inches; from before to behind, $16\frac{1}{2}$ Inches. The Circumference of the fore Leg, at the upper Joint, was 4 Foot 3 Inches (O. O.) At the Articulation of the *Carpus* 2 Foot $6\frac{1}{2}$ Inches (P. P.) the Circumference of the hind Foot round the Hoof, 3 Foot 4 Inches (Q. Q.) It's Diameter from behind to before, $16\frac{1}{2}$ Inches; from the Right to the Left, 12 Inches. The Breadth of the outer Hoof, $4\frac{1}{2}$ Inches (*b*); the fore Hoof being Semicircular, $3\frac{1}{2}$ Inches, (*a*) the third and fourth Hoof 4 Inches each; both inner and outer Hoof go obliquely forward. The Circumference of the hind Leg is 2 Foot 2 Inches, (R. R.) These are the Dimensions of all it's external Parts, taken either from the Body, when it lay dead in the Field, or since from the stuff'd Skin, wherein for the most part they agree; only that by reason of drying, the Legs are smaller, and the Back not so protuberant.

The Cuticula
and Cutis.

As to the *Cuticula* and *Cutis*, Dr *Moulins* has already at large insisted most judiciously on both, and indeed he had good Opportunity to do so; for he had the Choice of any Part of the Skin he pleas'd, (to view it's Structure) that was not defac'd by the Fire; whereas I had not an Opportunity of making Trial of any of it green; what Accounts I can give are taken from it, as it now stands dry. I shall transcribe what of Dr *Moulins*'s Account I find agreeable to that I see in this Subject, and add my own Observations.

Dr Moulins's
Account of the
Scabs.

He says, ' He found the *Cuticula* cover'd all over with a strange sort
' of Scab, in many Places resembling old Warts, deeply jagged, and
' the carnous Fibres of the Muscles of Beef when much boil'd and
' transversly cut, but of a dirty tawny Colour. These Scabs (if they
' may be so called) both slit and look like short Pieces of Whale-bone;
' they did so firmly stick to the *Cuticula*, that they could not be pluck'd
' from it, nor the Parts of which they consisted (tho' they were much
' divided) from one another, without tearing it, and yet the *Cuticula*
' was very tough and thick.

The Length
in his Subject.

This is very lively express'd, and answers exactly to what I find in this Subject. He goes on, and says: ' The Length of these Scabs
' was in some above $\frac{1}{3}$ or $\frac{1}{4}$, but in other Places not above $\frac{1}{10}$ or $\frac{1}{12}$ of
' an Inch. The Cause of which Difference he takes to be the *Elephant*'s
' wearing, by rubbing or lying, some Parts of them, while others were
' slightly, or not at all worn.'

The Scabs of this Subject were not so long : for as the deepest I *In ours.* could find upon the *Cuticula* was not above $\frac{1}{2}$, so the thinnest was less *Fig. 91, 92.* than $\frac{1}{8}$ of an Inch ; but that is not material. As to his Reason why they are thicker in some Parts than another, tho' it may seem pretty good, yet I shall offer another by and by, as a no less probable Conjecture.

He says, ' He could find but very few Hairs without this Scab, *The Hairs in* ' but many within, and even with it. The *Elephant's* Inclination to *his.* ' itch, and to rub himself against whatever came in his way, kept ' those Hairs that were even with the outside of the aforesaid Scab, ' from appearing of any considerable Length. The Hardness of the ' Scab, keeping the Roots of the Hairs fast, did very much contribute ' to their wearing on the outside, as well as to their Preservation on ' that within.'

In our Subject the Hairs are every where pretty long, some 2, some *In ours.* 3 Inches ; (others in Places most subject to rubbing, as the Doctor observes) but $1\frac{1}{2}$ Inch, though indeed not so numerous as I find. There are Passages for them thro' the *Cuticula*. I know not what the Doctor means by distinguishing between those found in the *Cutis*, and those in the *Cuticula*, since I am convinc'd all arise from the *Cutis*, and penetrate the *Cuticula*. They are indeed black, and many of them stiffer and thicker than those in an Hog. As he by the Fire had occasion to observe some Pieces of the *Cuticula*, rais'd from the *Cutis*, so the Skin of this Subject is in many Places depriv'd of it, especially where the Beast lay most in the Water at it's Death ; and since these are means whereby to separate the one from the other, this may give occasion to enquire by what Means they adhere : But I must first consider the Structure of the *Cuticula*, and then of the *Cutis*. You know some have taken the *Cuticula* to be nothing but a certain Crust form'd of several Mucilaginous Particles, obducing the *Cutis*, &c. in the *Uterus* ; which after the *Fætus* is come to greater Maturity, is con- *The Structure* dens'd and form'd into a Skin, such as we see *Mucilages* and *Pultises* *of the Cuti-* have, when after boiling they are expos'd to the Cold : Others, that *cula.* the *Cuticula*, as well as *Cutis*, is compos'd of a *Congeries* of *Membranous Fibres*, intermix'd with a great many *Capillaries*, and endued with Pores fit for Perspiration : And there are Anatomists who assert, they have injected these Cutaneous Vessels in the *Cuticula* of a *Fætus*, as well as in the *Cutis* ; tho' when the Animal is more adult, these *Capillaries* not only escape the View of the naked Eye, but even of Opticks. That this has been the Structure of the *Cuticula* in this Animal is most plain and obvious ; for tho' I cannot determine it's Thickness, as Dr *Moulins* might have done in a recent one, yet now as it is dry, it seems to be of the Thickness of, or rather thicker than you see common Vellum, with it's inner Surface excavated, as a Woman's Thimble, (the Holes being much about the same Bigness, and dispos'd regularly) or in an Honey-Comb. Among the Interstices of

Fig. 91. of these Excavations, the Ramifications and Divarications of the Blood Vessels are obvious. At every two Lines or $\frac{1}{2}$ of an Inch distance, for the most Part are to be observ'd Protuberances compos'd of 5, 6, or 7 Columns joining, and making up a Pyramid or Cone; in the Top whereof is the *Pore* or *Ductus*, mention'd by Dr *Moulins*, through which the Hairs pass; they are nothing but the Interstices of the *Favi*, or Depressions, which arise in the *Cuticula*, and are impacted in the *Cutis*, for the better Reception of the Hair. And 'tis probable, that all the Hairs are cover'd over with thin Membranes, as Dr *Moulins* observes, from the Extremity of their Roots to the *Cuticula*; because having pulled out several of the Hairs, I saw them included within their proper *Involucra*, and doubt not but it was so with all the rest too, beside the common one which is both contiguous and continuous to the *Cuticula*. The Hairs are more loose, and the Pores more patulent and obvious in the *Cuticula* now dryed, than I suppose they were when recent; but whether these Pores were also designed for Separation of Vapours by Perspiration, or only to contain and convey the Hairs planted in the *Cutis* through the *Cuticula*, is what I shall neither contradict nor affirm. To the outside of this *Cuticula* adhere the Scabs, which I rather take to be a supervenient Distemper incident to this Animal, when out of it's own Climate, occasion'd by the Construction of the Pores from Cold, than any wise natural to it: And to this the Accounts of all Authors agree; who tell us, that there are two kinds of them, one of a more dark Colour, and another dusky and sad, having both their Skins of a very smooth and polite Surface; wherefore the Keepers of this *Elephant* with us, call'd it the *White Elephant*, in opposition to the black ones; whereof *Horace* says, *Nigris dignissima Barris*: But after they are affected with the Scab, this Distinction of Colours is not observ'd. Authors tells us, that the first Thing they do when they begin to tame them, is to anoint them with Oyl, whereby they keep their Skin smooth, soft and flexible, and relax their Pores so, that whatever gross Particles may fly off from their Blood, whose Constitution is now, perhaps, worse by the Alteration of Diet, and Hardships they undergo at taming, may not stick to the Skin, but be freely evaporated. And I am credibly inform'd, by such as have lived long in the *Indies*, that they take as much Care to keep the Skins of the *Elephants* smooth and clear, as we do with our fine Horses. Since then these Scabs are a Disease, and not natural to the Animal, it is reasonable I should enquire into the Cause of them; which to me seems to be à *Crassitie & Viscositate Sanguinis*, whose Particles, because of obstructed Pores, by a Cold too excessive for their Body, do not so easily fly off; but after they have pass'd the *Cuticula*, go no farther than it's Surface; and because of the *Viscosity* of their Texture, do so cleave to, and heap upon one another, that they appear under the Form of a Scab; which by the Evaporation of the humid Particles,

The Cause of
the Scabs.

cles, harden by Degrees, and by the Heat of the Sun are cracked, rent, and divided. That Coldness of the Weather will occasion gross and viscous Blood, there's none acquainted with the Distempers in these Northern Countries will readily deny; nor that most of these Distempers proceed from the Obstructions of *Capillaries* and *Pores*: And that this may be the Cause of these Scabs, I offer only this one Experiment; whatever Pieces of the *Cuticula* I observ'd where the Scabs were thin, there the *Favi* or Depressions were large and conspicuous; but where they were very thick, there the *Favi* were very small, and almost imperceptible; which plainly implies, that where-ever these Particles avolate freely, few adhere to the Surface of the Skin; but when their Force is inhibited by the Straitness of the Pores, they are unable to remove any further than they adhere to, and augment the *Moles* of the Scab. These are divided from one another by several *Rimæ*, or Rents, which may either be occasioned by the afore-mentioned Heat of the Sun, or by the different Posture the Skin is put in by the several Motions of the Body. Hence it is, that where the Skin is most wrinkled, these *Rimæ* are most frequent. It may be said that this Reasoning seems to contradict what Dr *Moulins* has asserted, *viz.* That this Animal has a very subtile Blood, abounding with a penetrating urinous Salt; which he proves from the Vivacity of the Species, from the urinous *Effluvia* which affected his Nostrils, and from the smarting of his Finger by the Blood, after it was cut. As to the first, that it is a very vivacious and spirituous Animal, both the foregoing Relation and the Account of all Authors make it apparent; but that does not hinder it's Blood from being incrassated by Cold and bad Diet, nor that these Scabs may proceed from this gross Blood. As to the second, tho' he might have been sensible of an abounding urinous Salt in that Animal, it doth not follow it should be so in all, and I am apt to believe it was extraordinary; for without doubt such a Burning as the poor Beast underwent, even to it's Death, must have alter'd the Constitution of it's Blood, and make it quite different from what it was; and 'tis probable, that it was at such Places as were most affected with the Burning, where he found this urinous Smell, and the smarting of his Finger. For my part, I observed the Blood of this Subject to be Styptick and Restricting: So that when my Hands were imbru'd in it, I could scarce bend a Finger; which Effect I have also perceived at the Dissection of Fishes, which all acknowledge to have viscous Blood. But it may be objected, that this our Subject dying *Morbid*, and of a languishing Distemper, the Blood of the one might be gross and viscous, and yet that of the other spirituous and subtile: I should be ready to acknowledge the Objection to be valid, if I did not understand both were affected with the same Scab, and by what appears, the other seems to have been more than this.

*The Scabs
divided into
several Ri-
mæ.*

*The Constituti-
on of the Ele-
phant's Blood.*

I proceed to the *Cutis*, whose inner Surface Dr *Moulins* observ'd, ' To abound with a great many Glands: When cut through, at
least

The Structure of the Cutis.

‘ least as far as the Roots of the Hair went, it was like the horny or
 ‘ callous Part of Brawn, and it’s outer Surface abounded with a
 ‘ great many *Papillæ*.’ I had not Opportunity to observe any of
 these; but am apt to believe all to be true: And first, as to the *Papil-
 læ*, I told you already, that the *Cuticula* was endued with a vast
 Quantity of *Favi*, or Depressions, wherein I doubt not but these
Papillæ were receiv’d, tho’ the Surface of the *Cutis*, as now dry’d,
 is smooth; and where the *Papillæ* seem’d to have formerly been,
 there are now rather Depressions than Protuberances. This is an
 Argument that there has been some kind of Liquor contain’d in
 these *Papillæ* or Vessels, as I may call them, which at the drying
 of the Skin are evaporated; and therefore I suppose this brawny
 Part of the *Cutis* to be a *Congeries* of *Ductus Excretorii*, running in a
 parallel Line from these Glands to the Vesicles, and conveying the
 Liquor to be contain’d in them, till it be evaporated by Perspiration;
 and these Vessels seem to have been both so big and numerous in
 this Animal, that they make up at least two Parts of the inner Sur-
 face of the *Cuticula*; the Blood Vessels and the Depressions together,
 scarce make up a third Part. They seem also to be lodg’d in the *Cutis*
 by one half, and in the *Cuticula* by the other; for in some Places
 of the *Cutis*, I observ’d the Depressions as numerous and seemingly
 parallel to those in the *Cuticula*; and that, notwithstanding the *Mem-
 branulæ*, where the Humour was included, which now being dry’d
 and collaps’d, may take up some Space in the Depression of the *Cutis*.
 By this Account both of the *Cuticula* and *Cutis*, I come to enquire,
 First, how the one should so firmly adhere to the other, when there
 seems to be no Communication by Fibres betwixt them, as appears
 by their easy Separation both by Fire and Water: Secondly, How
 considerable the Perspiration may be. As to the First, Since the *Cu-
 tis* and *Cuticula* are two distinct Membranes, their Cohesion seems
 to be mutual: First, these Pyramids, which receive the Hairs, are
 impacted in the *Cutis*, and closely surround their Roots; and
 then these *Papillæ* are impacted in the *Cuticula*, which so long as they
 are distended with the Humour fit for Perspiration, will not readily
 quit the Depressions in the *Cuticula*, unless the Humour be suddenly
 evaporated by Fire, or the Sides of these Depressions or *Cellulæ* be re-
 lax’d by Water; and there may be a certain Viscosity, which obduces
 the Surface of both, as it were so much Glue, which either the
 Fire may dry up too much, or the Water dilate; so that the one
 can be soon separated from the other, and the Hairs either be pulled
 from their Place, or quit their common *Involucrum*. As to the second,
viz. The Perspiration, I shall offer no other Calculation than what is
 already made by Dr *Moulins*, He says, ‘ The Pores must be both
 ‘ numerous and large for Perspiration, especially if we consider *San-
 ‘ storius* his Statical Observations of a Man’s insensible perspiring in a
 Winter’s

Winter's Day $\frac{3}{5}$ 50. and upwards ; which is something more than $\frac{1}{54}$ of an ordinary Man's Weight, supposing him to be 170 lb. and at this Rate we must suppose an *Elephant's* Perspiration to be vastly more ; but (as he says) 'tis probable, the Scabs might bar it from bearing Proportion to that of a Man's : So that whatever the *Elephant* might have perspir'd in an healthy State, we may reasonably suppose it to do much less, when attacked with this Disease ; which may be another Argument for the *Crassities Viscositas Sanguinis*, wherewith I alledg'd this Animal I dissected was endued.

I can determine nothing about the Thickness of the Skin, while recent ; but as it is dry, by an Incision made upon one of the Hips, it appears to be less than $\frac{1}{4}$ Inch, and of Substance not unlike to *English Bend* or Sole-Leather.

I had no Opportunity to observe, whether there were any cutaneous Vessels, but doubt not but there have been of them, and that in abundance ; 1. From the numerous *Glands* dispers'd all over it's inner Surface, which must have Blood-Vessels inserted in them : And, 2. From the abundance of *Ramifications* dispers'd in the *Cuticula*, proportionable to which, it is probable, they were also in the *Cutis*. The cutaneous Vessels.

I can say nothing about the *Panniculus Carnosus*, neither am I fully convinced of what is related by Dr *Moulins*, viz. That this Animal kills the Flies, by putting itself suddenly in a Posture to wrinkle the Skin on that Side that is attacked by them ; so that the Cracks are forced close together, and the Flies bruis'd ; for 'tis hard to conceive such a big Animal should all on a sudden be so nimble. I rather believe, that the *Proboscis* from before, and the Tail from behind, may supply the Defect of the *Panniculus Carnosus* (if it be wanting) : For if we consider the Length of each, we shall find they come near to meet about the Middle ; for the Body of this Subject being 10 Foot in Length, the *Proboscis* and Tail make up between them near 9 of it ; and what is wanting, the Air, by the Force of their Motion, is enough to expel the Flies, even when without their Reach. Panniculus Carnosus.

As to the *Fat*, whether by Reason of the extraordinary Leanness of this Subject, or if it be ordinary for *Elephants* to be endued with but little of it, I know not ; but I could not have believed so little Fat to have been in any Animal as was here ; for beside that there was neither a *Membrana Adiposa*, or conspicuous *Omentum*, there was not one Grain of Fat, either among the Interstices of the Muscles surrounding the Kidneys, nor round the *Anus* and *Vagina*, where 'tis usually found ; and, what is more, when I had spent near a whole Day in boiling the Bones in a Dyer's Vessel, without changing the Water, except that I supplied what was evaporated, there was not so much as a Drop of Oil that did swim upon the Liquor. Fat.

Dr *Moulins* takes notice of a very strong nervous Membrane, (which I confess I had not Time to remark, and therefore I give it in his own Words) which obliquely descended from the *Spina Dorsi* to Dr Moulins's Account of the Membrana Nervosa.

the *Sternum* and *Linea Alba*. ' This Membrane was very tough, and
 ' near as hard to be cut as Whalebone of the same Thickness ; which
 ' all along the Back, was about $\frac{1}{6}$ Inch, but nearer the End I tried it,
 ' the thinner I found it. This Membrane seem'd to terminate in the
 ' *Linea Alba*, as the Tendons of the Muscles of the *Abdomen* usually
 ' do. It's nervous Fibres are very distinguishable, and might easily
 ' be separated throughout their whole Length. This, doubtless, was
 ' to strengthen the Creature, and, perhaps, that the Weight of the
 ' *Viscera* contain'd in the *Abdomen* should not distend the *Peritonæum*
 ' and Muscles adjoining, so as to let them hang lower than was con-
 ' venient.' A like Piece of Mechanism I have observ'd in the Dissection
 of a *Porpoise*.

The Muscles
 of the Pro-
 boscis.

After the Skin was wholly remov'd, there being no Time to exa-
 mine all the Muscles of this huge Body, I applied myself particularly
 to those of the *Proboscis*. Wherefore the Body being supine, I first
 consider'd the Neck, and Upper or Fore-part of the *Sternum*, where I
 observ'd two Pair of Muscles to arise sharp and fleshy ; whereof two
 in the Middle, from a small Origin, were extended into large Muscles,
 running streight forward, and distinguished from each other by a white
 Line, till they came to the Point of the lower Jaw ; their other Side
 running obliquely outward, till they came over-against the Articula-
 tion of the lower Jaw with the Upper : From thence keeping the lower
 Part of the lower Jaw, they return'd to the aforesaid Point, in Figure
 not unlike the *Cucullaries* in human Subjects, with their Fibres running
 obliquely forward from this middle Line toward their external Part.
 This Pair serv'd to draw back the lower Jaw, and like the *Platysma*
Myoides, cover'd all it's other Muscles, with those of the *Larynx*,
Tongue, and *Pharynx*. On the Outside of this Pair arose two other
 Muscles, small at their Beginning, and in their Progress passing in be-
 twixt the *Os Zygomaticum* and Skull, adhering to the *Musculus Tempo-*
ralis, and ascending, run up below the *Meatus Auditorius*, half way
 betwixt the Orbit of the Eye and Top of the Head ; where becoming
 very thick and round, it pass'd over a sharp Angle of the Skull to-
 ward the Forehead ; whence descending from above the Eye, it came,
 and with it's Partner fill'd up that Hollowness of the *Os Palati* (*k*), and
 coming still lower, made up the back Part of the Trunk or *Proboscis*.
 Afterwards the Body being turn'd over, I had Opportunity to see the
Tax-Wax mention'd by Dr *Moulins* ; which arises from a *Spina* in the
 back Part of the Skull (*c*), whence running backward along the Sides of
 the seven *Vertebræ* of the Neck, it terminated betwixt the 6th and 7th
Vertebræ of the Back, becoming still thinner in it's Progress. It was
 about six Inches broad, pretty thick, and descended obliquely from the
 Top of the *Spinæ Vertebrarum* to above the Ribs, and cover'd all the
 Muscles which arise from the Neck, and support the Head ; assisting
 them, (as Dr *Moulins* rightly observes) because the Heads of Qua-
 drupeds, especially of this Animal, being more pendent, have more
 need

Retractores
 Proboscidis.

Fig. 62.

Tax Wax.

Fig. 67.

need of Supporters than the Head of a Man, where this Contrivance is wanting. Dr *Moulins* tells us, that it was placed edgways; the Reason of which may be, because of the *Spines* of the four last *Vertebrae* of the Back, which are four Inches broad; whence the *Tax-Wax*, running forward (where the *Spines* are narrow, or where there are no *Spines* at all, as in the three first *Vertebrae* of the Neck) in a straight Line to the Skull, the Space below it for the Muscles to move in must be the same at the Neck as at the *Spina*, where the *Epiphyses* keep their upper Sides at such a Distance. From above this *Tax-Wax* in the Neck, do arise two Muscles, thinner and narrower at first, but thicker and broader as they go to the Skull, where they firmly adhere to the Sides of a large *Sinus* in it's back Part (*b*), whence ascending, being lodg'd in the Depression upon the Top of the Head, and betwixt the Eminences (*d d*) they descend till they come over against the Hole for the Root of the Trunk (*a*), and become thicker and round, and in their whole Descent make up the Fore-part of the Trunk with the Extremity.

Elevatores.
Proboscidis.

Fig. 67.

Fig. 62.

Thus then the *Proboscis* is compos'd of two Pair of Muscles; one whereof makes up it's Back-part, which arises from the *Sternum*, and passes with straight Fibres in below the *Os Zygomaticum*; and from thenceforward, 'till it makes up the Body of the Trunk itself. Another Pair, which, arising from the Neck, passes over the Head, and descending makes up it's Fore-part. The Fibres of this Muscle descend in a straight Line, till they make up the Body of the Trunk, and then begins a strong tendinous Interstice, by which they are separated from their Copartners; whence their Fibres descend obliquely to another strong Interstice, by which on each Side they are separated from their Antagonists, where the same oblique Course of Fibres is again to be observ'd, that is to say, that the *Erectores Proboscidis*, (for so we may call these which make up the Fore-part of the *Proboscis*) (*g g*) unite in a tendinous Interstice (*b*), from whence the Fibres on each Side obliquely descend: So likewise the *Retractores Proboscidis*, for so we may call these which make up the Back-part of the *Proboscis*, have their tendinous Interstices running down the Middle of it's Back-part; from whence the Fibres obliquely descend, almost making an Angle of a *Demi-rhombus* on each Side in another longitudinal tendinous Interstice whereby the Fibres of the Antagonist Muscles are conjoin'd.

Fig. 88.

Thus you see a wonderful Contexture of four Muscles, so contriv'd as to perform all kind of Motions; for as either in the *Femur* or *Humerus*, from Flexion, Extension, Adduction, and Abduction, proceeds a circular Motion; so here when the Elevator and Depressor, or Retractor act together on either Side, then there is a lateral Motion: And when the Congener *Elevatores* and *Retractores* act, then there is either Elevation or Depression; and from these two, with lateral Motions on both Sides successively perform'd, proceeds a circular Motion. But this is not all; we see that any Part of the Trunk, either Root or

Extremity, or both at once, can be bended either upwards or downwards; and this, I conceive, is perform'd after this Manner. These Fibres thus obliquely situated, are divided into several *Fasciculi*, which are separated by several tendinous Intersections; and at the Beginning of each Intersection there is a considerable Branch of a Nerve from the hard Portion inserted, by which one, two, or more of these *Fasciculi* may be set in Motion, without any other Part of the *Proboscis* being concern'd.

Dr *Moulins* calls the *Proboscis* a prolonged Nose, both from it's Situation and Use in Smelling and Breathing. And I think I may with good Reason make an Analogy betwixt it and the Tongue: For besides that there is a great Affinity betwixt the Smelling and Tasting, since what's unpleasing to the Nose, cannot but nauseate the Tongue and Palate; infomuch, that the Nose may be called a Taster to the Taste: They likewise agree in this Animal, by reason of the Diversity of Motions in both, and few Muscles that perform them: And to make further Analogy with the Tongue and it; as the *Geneoglossis*, by lengthening it's Fibres from the fore and inner Part of the lower Jaw, whence it arises, to the Root of the Tongue, where it is inserted, stretches it forth: So the *Levatores Proboscidis*, by lengthening their Fibres from the *Tax-Wax* all along the Top of the Head to the Root of the Trunk, stretches it forth also: And as the *Retractores Proboscidis* can very well perform the Motions of pulling it in, *Analogous* to the *Styloglossis*; so the two Antagonists on either Side can pull it to the adverse Side, that it may perform the Actions of the *Ceratoglossis*, while the Congener *Retractores* can pull it to that same Side, where they act. When, I say, that the Fibres from before and behind descend obliquely from the tendinous Insertions at the Middle to those at the Side, I do not mean that they run simply so, but that the Fibres of each Muscle are dispos'd into different *Strata*, and that these *Strata* do intersect each other, like Lozenges, or as we see the Fibres in the *Musculus oblique Ascendens* intersecting those in the *Musculus oblique Descendens Abdominis*, and so on; that is to say, whereas one Series of Fibres seems to descend obliquely, the next underneath that ascends again, and so continues throughout the whole Thickness of each Muscle. As to the circular Fibres spoken of by Dr *Moulins*, I do not know I saw any, neither do I think them necessary for pulling up the Trunk, or diminishing it as to it's Length: For the great Distance betwixt the Origin of these Muscles, and their Insertion at the Extremity of the Trunk, the longitudinal Position of their Fibres till they come to make a Part of it, and the Space they have to act it, and to swell their Belly, and their oblique Insertion in these tendinous Lines, may be look'd upon as sufficient to perform this Motion; and 'tis observable for this End, that the Skin is divided into several *Plicæ* or *Links*, as we see in a Worm, when she draws up and shortens herself. Thus I conceive the forenam'd *Fasciculi* may at the Beginning extremely begin to be contracted,

tracted, then the *Fasciculi* next to them, and so in order, till they come to the Root of the Trunk ; by which successive Contractions the Bellies of all the Muscles begin to swell, and so their Fibres diminish as to their Length : And there needs no more for stretching forth the *Proboscis* thus contracted, but for the Fibres to refile to their former Position ; which it may do with the same Swiftnes, as we see a Bow doth by it's Elasticity when once it is shot.

These Muscles surround two large Cavities two Inches Diameter from the Right to the Left, and three Inches each from above to below, about the Middle of the *Proboscis* ; for as they proceed from the Skull they are very wide, according to the Capacity of the Hole in the Fore-part of the Skull, whence the *Proboscis* proceeds ; of which hereafter. They are divided by a strong *Cartilaginous Septum*, which runs straight from before to behind, along the Middle of the *Proboscis*. This is the *Septum* whereinto the Muscles situated in the fore and back Part are inserted. These Holes are Cartilaginous, all round obduced with several Nerves, whereof hereafter ; and endued with a great many Glands for separating a certain *Mucus*, wherewith the inner Surface is always bedew'd, to keep it moist, and preserve it from the Injuries of the Air it sucks in at Breathing. These two Cavities are of great Use, for they draw up and contain as much Water as serves the Animal at once, which afterward it emptieth into the Mouth, as it were from a Tunnel : They serve also for Breathing, Smelling, and uttering the Voice. The *Proboscis* is not equally great, but from thirty-eight Inches in Circumference at the Beginning, it becomes gradually smaller, till it be twenty Inches at the Middle, and at the Extremity eleven Inches. It has an hollow Cartilage, where these Passages terminate. Round this is a Cartilaginous Margin, which extends itself $1 \frac{1}{2}$ Inch before, and terminates in a Point ; and behind it has, as it were, an Hollowness, wherein this Point fixes itself, and takes hold of any Thing, as it were a Thumb passing in betwixt two Fingers, and keeps it during Pleasure. This Cartilage is of great Strength, and by it the *Elephant* can take up any Thing of great Weight.

The Cavities
of the Pro-
boscis.

Fig. 49.

I come next to examine the Vessels and Nerves of the *Proboscis*. I do not find this Animal endued with any particular Vessels for this Part ; but these here, analogous to those in other Animals, seem to be adapted for peculiar Uses. In searching for the Origin of the *Proboscis*, and how it proceeded from the Head, I separated the *Levatores Proboscidis* ; below which I observed four considerable Blood-Vessels, a Vein and an Artery from each Side, lying upon and descending in a straight Line above the foremention'd Cartilages, and dispersing their Branches *hinc inde* throughout the Substance of the Muscles, with two large Nerves accompanying them. I had not Time to trace their Origin, but do offer these probable Conjectures about them. The External Carotid Artery, which furnishes Blood to the Muscles of the Face and lowe Jaw, has already suffer'd so many Divisions and Sub-
divisions

It's Blood Vef-
sels.

UNED

divisions in the vast Mass of large Muscles in this Animal, that 'tis not probable there should yet remain a Branch so large and of so strait a Course, as to be thus distributed in this Part; and the Capillaries of the external Jugular are usually so dispersed throughout the extreme Parts whence it receives the Blood, that 'tis not to be suppos'd they should so soon form so considerable Branches, and these again unite into one Trunk at such Distance from the *Basis* of the Skull, where the two Jugulars are conjoin'd: And besides this, the Situation of the Carotid Artery and Jugular Vein is so low, and those Branches I saw were situated so high, that I can scarce think the one proceeds from the other. It remains then, that I should enquire from whence they come. 'Tis observable both in human Subjects and Quadrupeds, that there is an Hole below the Orbit of the Eye, in the *Os Maxilla Superioris*, through which the superior Branch of the second Division of the fifth Pair of Nerves passes, surrounding in it's Progress a Vein and an Artery; all which are dispersed in the Muscles of the Cheeks, Lips, and Nose, and furnish Branches for the Roots of the Teeth of the upper Jaw. This Hole is not so considerable in human Subjects, but larger in Quadrupeds, especially such as feed on Grass or Hay; insomuch, that by the Bigness of this Branch of the fifth Pair in an Ox or Hart, we may reasonably conjecture they have a partial Taste, and a most acute Smell by the upper Lip, the better to enable them to chuse their Food: For at the Dissection of a Calf's Head, you'll perceive both this Nerve and the Blood-Vessels much bigger than what might be thought requisite for furnishing either Blood or Spirits to this Part, were there not some extraordinary Use for both. Now in this our Subject there is an Hole in the *Os Maxilla Superioris* (*r r* Fig. 62.) (*m* Fig. 63.) (*s, s* Fig. 64.) so remarkable for it's Bigness, so commodiously situated, and so well guarded, that I have good Reason to believe it may be designed for Transmission of the aforementioned Artery, Vein, and Nerve, and that all these are distributed into the Trunk: For if we consider the Largeness of this Hole for this Branch of the fifth Pair, as it is to be seen in the inner Surface of the *Basis* of the Skull, whose Capacity is such, as to contain a Nerve of about twice the Bigness of what we suppose it to have been; if we again consider the *Crena* (*x x*) which passes betwixt the Hole for the second Branch of this fifth Pair, and the third (*i i*) and how the Hole for the *Arteria duræ Matris* (*k k*) is only separated from the Hole for the third Branch (*i i*) by a small bony *Septum*; we may suppose that this *Arteria duræ Matris* enters where the third Branch of the fifth Pair goes out, and sends up one Branch (*k k*) which immediately enters the *Dura Mater*; and another which runs forward in this *Crena* to the Hole for the second Branch of the fifth Pair (*b b*), and goes along with it, and passes out below the *Lamina* which frames the upper Part of the *Sinus* for the Orbit of the Eye (*S*) (2) and runs forward along with the Second Branch to this large oval Hole; where after

Fig. 62, 63,
64.

Fig. 85.

after it is come, it ascends obliquely in a *Crena*, to be still seen in the Bone, till it comes to the Root of the *Proboscis*, where it is dispersed as above; and the Vein returning by the same Hole, runs along with the other two, tho' it does not enter the Skull; but running backward, passes in below the aforesaid *Lamina*, and descends where the *Arteria duræ Matris* ascends. I cannot positively determine the Capacity of these Blood-Vessels at the Root of the *Proboscis*; but they were very conspicuous, and could admit of a Goose-Quill, tho' they were empty; and when they were full, I doubt not but they were above twice as big.

This extraordinary Part did not want for Nerves sufficient for it, no *It's Nerves.* more than Blood-Vessels: For first, it has the *Nervus Olfactorius*, whereof hereafter; whereby it is endued with a most acute Sensation of Smelling. 2dly, the aforesaid second Branch of the 5th Pair; which accompanying the Blood-Vessels, is with them dispers'd throughout the whole Substance of the *Proboscis*; by which it has so acute a Sensation of Touching or Feeling, wherewith this Member is more signally endued; and by which it avoids whatever is hurtful to it, as appears by that memorable Instance of Dr *Moulins*; who tells us, that such was the Care, in that Subject he treats of, for the *Proboscis*, that it thrust it two foot into hard Ground to preserve it from the Fire. 3dly, The hard Portion of the *Nervus Auditorius*; which tho' it be dispers'd in the Muscles of the Face in human Subjects, yet in Quadrupeds, such as Oxen, it continues undivided, till it comes to the Angle of the Lips; and here we traced it a good way, running forward above the Temporal Muscle, a little below the Ear, till it came to the upper Lip; whence it proceeded to the foremention'd tendinous Interstice, which runs down on each Side of the *Proboscis*, dispersing a Branch to each of the *Fasciculi* of *Fibres* already nam'd. This seems to be chiefly adapted for the different Motions of the *Proboscis*; for as we see in the *Musculus Rectus Abdominis*, that at each of the tendinous Interstices, whereby it's *Fibres* are several times gather'd together, a Nerve enters at the Beginning of each *Fasciculus*; so here the Muscles of the *Proboscis* being divided into several *Fasciculi*, each of them have a Branch of this Nerve dispers'd in them; and 'tis situated on each Side, that it may the more conveniently disperse it's Branches both to the *Fasciculi* of the *Elevatores* and *Retraētores* alternatively. The Head was so mangled at the taking it off, that we could not well find it's Origin, as it proceeded from the proper Hole; but it's Situation here, analogous to that in other Quadrupeds, removes the Suspicion of it's being any other than the hard Portion; tho' when I consider'd it's Bigness, being as great as one of my Fingers, and the small Hole thro' which it passes from the *Processus Petrosus*, I was in some doubt about it; but when again I began to consider it's Texture, I was soon convinc'd it must be that, and no other. 'Twas indeed very pleasant to behold how several small *Fibres* were knit together into one Bundle; and how several of these

these again were involv'd by common *Membranulae* into different *Fasciculi*, till at length all were included into one common Tunicle. We endeavour'd by Microscopes to view the Cavity of the Fibres, but could observe none: That which I suppose made it bigger, was, that when it pass'd thro' the Bone, the *Fasciculi* were more strictly coherent to one another, whereby they occupied a lesser Space; but no sooner had they pass'd it, than they began to be more loosely conjoined within the common Tunicle, by which the whole Nerve appear'd to be bigger.

An Analogy
betwixt the
Proboscis and
the Nose in
other Animals,
Eye, and
Tongue.

Thus signally is this Member endued with Instruments for the Performance of it's different Functions. 'Tis the principal Seat of two of the Senses, and partially partakes of the third: For by it the Animal smells; by it Feeling is perform'd, as by the Hands with us; and by it the fifth Pair of Nerves affords a partial Idea of the Taste, to what Food it takes hold of, before it conveys it to the Mouth; and it has a great Analogy to the other two Senses, viz. to the Eye, by it's three Pair of Nerves, namely, one for it's Seeing, analogous to the other for Smelling; one for it's pathological Motions, analogous to the acute Sensation, afforded to the other by the fifth Pair; and one for the Motion of it's other Muscle, analogous to the hard Portion of the other; and to the Tongue, as we have already shewn at large, by it's different Motions, and by it's partial Taste.

The Abdomen.

I come now to the *Abdomen*. Without having Time to consider it's Muscles, I caus'd it to be open'd longitudinally; whereupon the Intestines jetted out in a confus'd Mass; first the Paunches or Tripes, as I may call them, (being not unlike the *Omasum* and *Abomasum* of an Ox;) and then the smaller Intestines. Being earnest to employ what Time I had in viewing the other Parts, I let these alone after they were extracted, till *Monday*: But then, by the Heat of the Weather, they were all spoiled; so that I could not receive any Satisfaction of them, either as to their Structure, Figure, Dimension, or Number. The Figure Dr *Moulins* gives of a Part of the *Colon* and *Rectum*, seems to be pretty good; for I took a great deal of them, and stretched them out upon the Ground: They were about $\frac{1}{2}$ Foot Diameter; but I had not Time to take notice of their precise Length.

The Uterus.

Fig. 86.

I next applied myself to the Extraction of the *Uterus* and *Bladder*. I could not get the *Vasa Præparantia* preserv'd, and only got out the *Uterus* itself, with the *Cornua*, *Ovaria*, and Part of the *Ligamenta Lata*, (*a a*) of all which we see the *Figure*. 'Tis not unlike the *Uterus* of such Animals as bring forth several at one Litter, as they call it; for when I had instated it, I perceived several Protuberances to arise, (*e e*) as if they had been so many *Cellules*, such as Bitches, Cats, Hares, &c. have, for containing the several *Fætus's* with their proper *Placentæ* and *Involucra*; which might have determin'd me to believe, they bring forth more than one at a Time, had not Authors affirm'd the contrary. For whereas the *Uterus* of such as bring forth one at a
time,

time, is proportionably large, and the *Cornua* small; here the Body of the *Uterus* was so small (c.) that one would think it were nothing but a *Bivium* to the two *Cornua*: For after the Tube had pass'd the *Corona*, which is pretty strong and close, I observ'd the *Cornua* (f. f.) *It's Cornua.* to swell on every Side by Inflation, leaving a *Sulcus* in the middle (d.) and these different Protuberances to arise with Depressions, as so many Interstices betwixt them. This Furrow (d.) seem'd to me to point out the *Septum*, whereby the *Cornua* were divided from each other; and these Interstices to denote, as it were, so many Membranes, whereby these Protuberances were bounded and formed into *Cellules*, each communicating with one another. These Protuberances (e. e.) were regularly disposed, two or three in Number on each Side of the *Septum*; and though some of them be obliterated, yet the *Vestigia* of others do still remain obvious in the dried *Uterus*. I had a great Inclination to open one of these *Cornua* or *Cellules*, to know the Truth of what I suspected; but would not adventure, for fear of spoiling the Preparation. Each of the *Ovaria* was as big as a large Apple, with the *Ova* fitly distinguished by their proper Membranes; being for the most Part about the Bigness of a small Pea, and all involv'd within a common, thin, and pellucid Tunicle, thro' which they shone; but to defend them, there was provided a loose thick wrinkled Tunicle (i.), which I could remove at pleasure, it no wise adhering to the *Ovaria*; but fluctuated above them, and proceeded from the *Cornua* (g.) *Ovaria.* I open'd one or two of these *Ova*, and found them filled with a thin limpid Substance, not unlike to *Hydatides*, but that the Humour was more viscous; which is now evaporated in the dried *Uterus*, and the *Ovaria* quite collaps'd. The Extremities of the *Cornua* which received the *Ova* were very narrow; for when I had inflated the *Uterus*, it retain'd the Air for some Time, without passing immediately out by the *Cornua*; tho' afterwards when I had strictly tied the *Vagina*, I observ'd the Air did insensibly slide out, and now and then I could see small *Bullulae* arise toward the *Ovaria*. *Ova.* I could not see any fluctuating *Alæ Vespertilionum*, nor *Morsus Diaboli*; but do suppose, that the *Ova* are received into the Extremities of the *Cornua* by an *Hiatus*, below this loose *Involucrum*, which I said defended the *Ovaria*. I cannot determine the precise Length of the *Vagina* (b.), because I know not how much of it might have been cut off; nor the Situation of the *Uterus*, because the Body lay supine, and I was obliged to take the Assistance of Butchers at the taking it out. The *Vagina* was very small and narrow, not admitting above two or three Fingers. It's inner Surface was whitish, and moisten'd by a certain kind of *Mucus*, and all full of *Plicæ* or Wrinkles.

The *Bladder* is rounder than that of an Ox, and much larger than *The Bladder.* Dr *Moulins* would have it, for he says, 'tis much about the Size of an Ox Bladder; but I found, when inflated, it contained six or seven *English Gallons*: And I doubt not but I might have stretched it

out larger, had I had sufficient Instruments for inflating, for this I only did with my Mouth and a Tube. 'Tis indeed very strong, and the Vessels appear very prettily dispers'd through the Tunicles, which I could have easily separated, but did not design to lose it. The Ureters were about $\frac{1}{2}$ of an Inch Diameter, and I could have easily discover'd their Insertion, if I had not designed to preserve the Bladder. Both *Uterus* and Bladder were involv'd within a Duplication of the *Peritonæum*, so that I had much ado to get them separated.

Since I have gone so far in giving an Account of the Parts for Generation in the Female, I shall give Dr *Moulins's* Account of them in the Male, with my own Thoughts about them.

Dr Moulins's
Account of the
Male Elephant
he dissected
Musculi duo
Retractores
Penis, D.
Moulins.
Pag. 15.

' In searching for the *Testes*, he found two Muscles very like them, which he suppos'd to have been them, till he had traced them to the inner and lower Side of the *Ischion*, where he found them implanted: He traced the Tendons likewise, and found, that when they had gone singly near upon 4 Inches, they join'd in one, which went directly under the Middle of the *Penis*, and reach'd beyond a Crookedness he observ'd in it. This was in Length about 8 Inches, and terminated within 6 or 7 Inches of the *Glans*, having expanded itself into a Membrane. There was beside these a nervous Body, that began underneath near the aforesaid Tendons, about 8 Inches from the Root of the *Penis*, and reach'd (distinct from the Yard) 9 Inches, before it was inserted again in it, at a Place $5\frac{1}{2}$ Inches from the *Glans*.

Their Use.

' He is of Opinion, these Muscles in that nervous Body being so conveniently placed for that Purpose, that the *Elephant* is a Retro-mingent and probably Retrocoient Animal. The Crookedness and bending downwards he observ'd in the *Penis*, somewhat short of the End of the Tendon, and the Confession of those that were his Attendants, who told him, that when the *Elephant* would make Water, they observ'd him to unsheath the *Penis*, and bend it backwards, and so piss between his Legs outward, confirm'd him in that Opinion; by which, he says, Nature seems to prevent this unweildy Animal's wallowing in it's own Excrements.'

Remarks upon
his Observations.

Had our Author had the good Fortune to observe the *Erectores Penis*, as well as it's *Retractores*, it might have been of Service: For admitting there be such, (as I have no Reason to call his Authority in question) 'tis probable there must have been *Erectores* also, and that upon the following Accounts. First, because 'tis requisite the *Penis* of the *Elephant* be freed of this Retraction; that whereas it is brought back at the *Minētus*, it may be brought forward at the *Coitus*. 2dly, Because it is requisite that the *Penis* at the *Coitus*, be brought (if not altogether, yet) obliquely upwards: As we see when a Horse pisses, he first unsheaths the *Penis*, which by it's own Gravity declines, and if assisted by a more than ordinary Supply of Spirits, it tends a little forward;

but

but in the *Elephant* there is always a Supply of Spirits required at the *Minētus*, both to make the *Penis* penetrate the Sheath, (whose inner Orifice, as our Author says, was shut so close, that there was not Room for a Man's little Finger to get in, so that he was forced to divide it before he could come at the Yard) and endue it with a certain Rigidity, and to swell the *Retraētores*, whereby the *Penis* being render'd a little stiff, may be drawn back. Supposing then there be such *Ereētores Penis*, we must likewise conceive them to be of a greater Force and Bulk than the *Retraētores*; for if, according to our Author, the *Penis* at the *Minētus* be brought back far beyond the usual Posture of the *Penis* in other Animals, we may believe it also to be endued not only with Antagonist Muscles to these *Retraētores*, whereby to bring the *Penis* to such a Posture as we see in Horses, but also to make it ascend so far as is requisite for the *Coitus*. Besides it is to be remark'd, 1st, That the *Vagina* is not placed behind, a little below the *Anus*, as in a Mare, but below in a direct Line with the rest of the Belly, whereby there is a Necessity for the *Penis* to ascend. 2^{dly}, The *Ossa innominata* ascend obliquely, which must oblige the *Penis* to do so too. 3^{dly}, The Author's Account of the *Penis* itself, (for he says 'tis bigger than that of a Horse, but not so long) so that it can hardly be suppos'd both to bend backwards, ascend again, and enter the *Vagina* so far as is requisite.

As to the *Manner* of their *Procreation*, Authors differ very much. Some asserting that it is *Retrocoient* and *Retromingent*; amongst whom is Dr *Moulins*, from the Observation he made of the Situation and Structure of the *Penis*, which I have answer'd. Others observing the Distance betwixt the *Anus* and *Vagina*, and that the Dugs are situated between the fore Limbs, are of Opinion, that the Female is in a Supine, and the Male in a Prone Posture: Among whom is *Tavernier*, who tells us, ' That the Female gathers a great many Herbs and Weeds, and makes her Bed some 4 or 5 Foot high from the Ground, where she throws herself, and lies on her Back in Expectation of the Male, whom she invites by a peculiar Cry;' therefore perhaps it may be, that the Dugs are placed so forward to avoid the Pressure. A third Opinion is, that at the *Coitus*, the Female descends into a Ditch, and that the Congress with the Male is no otherwise with them, than with other Quadrupeds. As to the first, I can scarce believe it probable, because there can be no such Thing as a *Retrocoient* Animal; for that would quite invert the Order of Nature, and give a far different Motion to the Muscles of the Thighs, than they can be suppos'd to have from their Situation; and I am credibly inform'd by those who have been at the Pains to observe them, that Hares, Cats, Rabbits, &c. which are said to be *Retrocoient*, do copulate no other Way than Dogs, and other Quadrupeds; and that retrograde Posture we see Dogs in at that Time, is nothing but an Endeavour to get rid, when (by means of the swelling of the *Glans*) the Male and Female are too close together, and

and far from a Design of penetrating farther into the *Vagina*. As to the second Opinion, were it not for Mr *Tavernier's* Assertion, I should think it too unwieldy an Animal, and of too small an Inclination to lie down, to acquire such a Posture. The third Opinion is, that the natural Sagacity of the Animal disposes the Female to go into the Ditch, and both the Fore and Hind Legs seem to be so articulated as to favour this. For when the Female would bring her Body low, she has no more to do, but to stretch forward her Fore-Feet, and then the Articulation of the *Humerus* with the *Cubitus* will bend backward; and to bring back her Hind-Feet, so as to bend the Knees forward, by which she can bring the Fore-part of the Body so low, as to make the *Nates* protuberant, and bend the Hind-Legs, whereby to put the *Vagina* in a convenient Posture for the Reception of the *Penis*, according to that of *Aristotle*, *subsistit Fœmina clunibusque submissis, insistit pedibus ac innititur*; and elsewhere, *Flectit certe suos Posteriores Poplites modo Hominis*. Which of the two last Opinions may be true, I know not, but we have the Assertion of two famous Authors for both.

Dr Moulins's
Account of
the Testes.

‘ The *Testes*, he says, were not contained in a *Scrotum* or *Capsula*,
‘ but lay in the *Perinæum*, close joined on each Side to the *Penis*.
‘ They were neither of the usual Shape, Bigness, nor included in a
‘ *Processus* of the *Peritonæum*. Their Shape was very like that of a
‘ Chesnut. They were thicker on the Side that grew to the *Penis*,
‘ than on the opposite. They were flat and round, and not suitable
‘ to the other Parts of his Body, being no more than about 3 or 4
‘ Ounces in Weight. They were joined to the *Penis* by a great ma-
‘ ny, at least 100 Seminal Tubes, which may be properly call'd *Vasa*
‘ *Deferentia*, and which deposited the elaborated *Semen* in several
‘ *Rhomboid Cells*, placed in the Body of the *Penis*, which in this
‘ Creature was the common and only Repository, where the Seed
‘ could be found. These Cells were turgid with Sperm, and so were
‘ the Tubes: The latter were very large, receiving a Block-Tin Wire
‘ of an equal Thickness with the biggest ordinary Pins, or above an
‘ Inch, when the Tube was straight, as most were; but being pursued
‘ farther into the Body of the *Testes*, they became smaller and smaller,
‘ till they disappear'd. The Blood came into the *Testes* by the *Vasa*
‘ *Deferentia*.’

Our Author as he proceeds, is somewhat perplex'd; and therefore I chuse to continue in his own Words, that you may the better know his Thoughts of this Part. He says, ‘ Tho' these were small and
‘ disproportionable, yet he took them to be the *Testes*, nothing else
‘ outwardly appearing that contain'd Seminary Vessels; until he
‘ understood by Dr *Needham*, that his Description of the *Testes*
‘ of the *Elephant* did agree to the *Prostata* of a Bear: Upon
‘ which he mistook the *Testes* for the *Prostata*, there being a great
‘ Resemblance between these Animals; and having found two Sub-
stances

stances betwixt the Kidneys and Neck of the Bladder, which might very well be *Testes*, and which, 'till he discours'd that ingenious Gentleman, he did not know what to make of.' And then he proceeds:

The *Venæ Præparantes* were large: He divided that which was *Venæ præparantes*. inserted into the Emulgent lengthwise; and within a little more than an Inch of it's Infection he found many Valves, to the Number of about 8 or 10, of divers Shapes, all fitted to hinder the Return of the Blood into the variously divided Spermatick Vein, which here from 8 or 10 Rivulets became one great Channel. Within about an Inch of this, and somewhat more than two from the Kidneys, he found a Substance of the Shape of a Pear, but near three times the Bigness of a very large one. He was at a Loss to know what this might be, and confesses he can give but an imperfect Account of it, since the Butchers cut it out, and so it's Continuation with the *Testes*, *Penis*, and other Parts, could not be discover'd.

What he observ'd in it was, that the Spermatick Vessels enter'd but a little way into this Substance; but below the middle of it he found them more deeply placed, and their Branches grew so small, and less numerous to the Sight, as if here the Veins began. The inner Part of this Substance look'd of a palish, but somewhat muddy red Colour. 'Twas very spongy, not much more compact than the Lungs of young Animals. He doubts not but this Substance was designed to prepare the *Semen*; but by what Vessels it was brought to the *Penis*, or any other Repository, (itself containing none) he could not discover; neither could he find any peculiar Vessel, or *Ductus*, or any Thing that resembled that beforemention'd Substance, by which he might be directed in his Enquiry. It lies lengthwise from the Kidney to the *Testes*, with the biggest End lowest. He is of Opinion, from what he has heard from Dr *Needham* of these Parts, that these two Pear-fashion'd, now described Substances, were *Testes*; their Place, Size, Figure, and occasional Cutting the *Vasa Deferentia*, being the Occasion of his former Ignorance in this Point.

He could observe no *Vesiculæ Seminales*, nor any common Receptacle for the *Semen*, except the formerly mention'd *Rhomboid Cells* in the *Penis* itself; but doubted not there might be some still, tho' his being intent upon other Things made him neglect the Discovery of them.' Thus he ingenuously confesses his Mistake of the *Testes* twice, and he leaves them in doubt the third time: However this may serve as a Precaution to such as may have Occasion to dissect such a Subject as this hereafter.

The *Intestines*, *Uterus*, and *Vesica*, being extracted, I laid aside the two last, in order to a future Preparation, and went to extract the Liver, which takes Time in other Animals. Whether by the Haste made in taking it out, or not, the *Liver* of this Subject

The Liver.

ject

The Anatomy of an Elephant.

ject had any such *Membrana Hepar investiens*, as Dr *Moulins* speaks of, I shall not be too positive; but am ready to believe it had none, and that the *Membrana* mentioned by him is nothing but the proper Tunicle of the Liver, raised by Fire, as we shall see hereafter; and my Reason for thinking so, is, that I was very careful to have it taken out whole. 'Tis true the Intestines being taken out in haste, I had not so soon an Opportunity of observing the *Ductus Communis*; but I viewed the rest of the Liver exactly, and caused the Figure and Dimensions of it upon the Place to be took (being 36 Inches long, and 22 at the broadest Part) because it would not keep. I was indeed in great doubt, what to think of the *Vesicula Fellis*, when I did not find it. Both the *Vena Cava* and *Porta* were very large, and had their *Exit* and Entrance in the concave Part of the Liver, as you see. This had only one Lobe, but both the Veins dispers'd themselves, first into two large Branches, and then were subdivided there, as in the ordinary Manner. I open'd several, and found them differ in nothing from other Animals; the Substance being firm, as is usual, and *Glands* large and conspicuous; the external Surface smooth, and it's proper Tunicle firmly adhering to the *Glands*; which is all I observ'd in it. See the *Figure*.

Fig. 116.

But because Dr *Moulins* does tell us of a *Membrana Hepar investiens*, I shall give you his Account of it; as also of the *Bile* and *Porus Biliarius*, which I can give no Account of myself. He says, 'The Membrane that invested the Liver, was raised from it a considerable Way, as if it had been joined to it. Though this Membrane seem'd to be whole, and look'd like the *Cuticula* raised by a Blistering Plaister, yet there was no *Serum* contained in it; and where it seem'd to be intimately join'd to the Liver, by a gentle Pull it came off, without tearing any Thing that I could take notice of, as if it had been but very slightly fasten'd to the Liver; or rather as a Bag, which contained and exactly fitted it. He takes the Use of this to be chiefly to terminate the Capillary Vessels, and prevent the gleeing of serous Humours; and concludes, that he must wholly impute the clear in some Places, and in others that easy Separation of the Membrane from the Liver, to the Fire.' By all which it seems to be nothing different from the proper Membrane which I observ'd, and you see the Circumstance of firmly adhering and loosely investing.

His Account of
the Bile.

The *Bile*, as he gives an Account, was deposited at the End of the first Gut, $4\frac{1}{2}$ Inches below the *Pylorus*; from whence he traced the *Ductus Communis* to the Liver, to see the *Vesicula Fellea*; but it was wanting, and in the Place of it he found the *Porus Biliarius* coming out of the Liver, as the *Ductus Hepaticus* usually does. He observ'd likewise, that the *Bilis* found in that, differ'd both in Colour and Consistence from that he found in the *Ductus Hepaticus*; for the latter was of a clear

clear light yellow Colour, congeal'd like a Jelly, and the former of a dark Green, and somewhat more fluid than the Gall of an Ox.

I fail'd also to observe the *Pancreas*, because it was taken away with the rest of the Intestines; and therefore shall give Dr *Moulins's* Account of that too.

'The *Pancreas* was very long and large; for it reach'd from about the Middle of the Stomach to the *Jejunum*, which Space could not be less than 6 Foot. 'Twas a *Glandula Conglomerata*, as the *Pancreas* always is, and had it's *Ductus* so wide, that it could without Force contain one's little Finger. It open'd into the Gut, where the *Ductus felleus* did. whether both the Passages join'd into one before their Aperture into the Intestines or not, he has forgot. The *Succus* in the *Ductus* was not limpid, as it usually appears, but of a very dark green Colour, and yet very fluid, seeming to contain no viscous Phlegm.'

The *Spleen*, of which I had not Time to take the Figure, was in this Subject $3\frac{1}{2}$ Foot long: On the Backside it's Edge was somewhat curv'd, almost in Shape of an unbended Bow: On the Foreside, from a narrow Point at each End, it enlarg'd itself by Degrees, till it came toward the Middle, where the Vessels enter'd, where it was broadest. Whether the *Vena Splenica* went forth by one, two, or more Orifices, I cannot positively determine, it being cut off in haste; and when cut off, I saw it ragged for the Space of 4 or 5 Inches; which I conceive to be because of the Orifices of so many Veins. It was thin and flaccid; what Blood was press'd out of it, was blacker than any I had seen throughout the rest of the Body. If it had not been unwarily cut by several Slashes of the Butcher's Knives, I design'd to have blown it up and prepar'd it. I cut off a little of it, and pressed out of it venal grumous Blood from several of it's *Cellules*. It was in Breadth from 3 Inches toward the Extremities, to 8 Inches about the Middle.

The *Glandulæ Renales* were placed after the usual Manner: They were about 5 Inches long, 2 Inches broad, and oval, with a loose outer Coat, which I remov'd, as it had been a Sheath; within which was contain'd the *Gland* itself, being divided into several Lobes, like the Kidney of an Ox; from whose Interstices there passed several thin *Membranes*, which passing to the loose *Vagina*, kept it fast, and by which this *Vagina* was only coherent with it. It's Vessels were cut off so short, that I could make nothing of them. I cut it longitudinally, and found in it a Cavity, which could contain about two Ounces, all full of a black grumous Blood, in Colour much like that I observ'd in the *Spleen*. I shall not much insist upon the Use of these two *Viscera*, about which there is so much Debate; but only say in short, that it is probable, as the *Spleen* is to the *Liver*, so are these *Glandulæ Renales* to the *Kidneys*, that is to say, whereas the Blood after it is distributed into the Intestines by the several Arteries which proceed from the *Aorta*, is receiv'd by the Orifices of so many Veins, as serve to make

make up so many *Radices Venæ Portæ*; it is convenient this Blood should be animated by a new Supply of Spirits, the better to enable it to continue it's Circulation in the *Porta* through the Liver, and dispose it for the better Separation of the Bile; for which Use the Spleen seems to be adapted, both from it's Situation in respect of the Liver, the Venal Blood of the one entering the *Porta* for the other: it's Structure; *Mora* of the Venal Blood, after discharg'd from the Arteries: and a considerable Branch of a Nerve furnish'd to it: So the Kidney being a *Viscus* where there is a vast Separation of *Serum* requir'd, these *Renes Succenturiati* seem to be design'd for furnishing a new Supply of Spirits to the Venal Blood, after it has passed the Kidneys, and undergone this Secretion: Both which Uses, I doubt not, may appear from their Structure.

The Kidneys.

The Kidneys were of a large and proportionable Size, being one Foot in Length, and $\frac{1}{2}$ Foot in Breadth, of the usual Figure, much like that of a Man; their external Surface smooth, and equal with their external Coat, closely adherent to the inner Substance, without any perspicuous Lobes to be seen externally; but when I open'd one of them, I perceived 6 large *Carunculi Urinarii*. It's Substance was very obvious, and correspondent to the Structure usually observ'd in the Kidneys; *a. e.* the glandulous Substance externally was very conspicuous, for the Space of about $\frac{1}{2}$ Inch in Circumference; then began to appear the *Tubuli Urinarii*, first smaller and less obvious; then another Series larger, and a third still larger, till they began to surround each of the *Carunculi*, like so many Rays of the Sun. I had no Assistance of Microscopes, (for I open'd it in the Field on *Monday*) and therefore did not see so clearly the *Coalition* of the smaller *Tubuli* into the larger Ducts: But as it happens in all these Excretory Vessels, they did not appear branched and divaricated, as Blood Vessels usually are; but continued parallel to each other, till from the lesser to the greater, they at last emptied themselves into the common Receptacles. I am not positive whether there was one common Ureter, into which all the six *Carunculi* did empty themselves, or if each had a particular Branch of an Ureter, into which they were discharged; only I remember I saw no *Pelvis*, which for the most part happens where the *Carunculi* are very large. The Reason of my Uncertainty about the Ureters, is, that after I caus'd the *Thorax* and *Abdomen* to be open'd on the *Saturday*, I let alone the Kidneys till the *Monday*; but they being involv'd within a Duplication of the *Peritonæum*, and no Fat surrounding them, that Membrane was so dried up and stiff, that even the Butchers Knives were scarce able to pierce it: So that requiring the help of a Butcher, who assisted at excarnating of the Bones, he took out the Kidneys without any regard to the Vessels; for the *Renes Succenturiati* were taken out the Day before, when all the Parts were soft and flexible. And here in general I must tell you, that the Flesh of this Animal was for the most part so strong, that no Launcet I had,
how

how keen or strong soever, could do any Service : So that I was forced to make use of Butchers Knives, when I could not admit of their Hands.

I come next to the *Thorax*, where there was scarce any thing remarkable. One of the Lobes of the Lungs was open'd by the Butchers, and the other had nothing observable, but it's Bigness, which was proportionable enough. It did not adhere to the Ribs, as in Dr *Moulins*'s Subject ; but lay flaccid on the one Side of the Heart, as the other had done, before it was mangled, on the other Side ; so that I look upon this Adhesion of Dr *Moulins* to have been in a morbid State. At first I designed to have taken out the whole *Viscera Thoracis*, till the Butcher prevented me ; and as I began to direct him between the two first Ribs, I saw two large Glands, one situated on the Outside of each of the *Carotides*, as they passed out of the *Thorax* ; they were round, and near the Bigness of a Turkey Hen's Egg, each having a conspicuous Artery inserted, and a Vein passing from them. These I took to be the *Thymus* ; which, tho' seldom observ'd in adult Subjects, yet, perhaps, may at all Times be seen in such a large Animal as this. I cut off one of them with Part of the adherent Artery ; and could observe nothing at the opening of it, but several loose thin Membranes without, which I suppose to have supported and contained in the Cavity (whose Sides they describe as they run to and fro) a great deal of Fat, when the Animal was in good Case ; and a firm glandulous Substance within, without any Cavity. I shall not positively determine, whether these were actually the *Thymus*, or only adventitious Glands ; but because they were regularly situated, which seldom happens to adventitious Glands, 'tis probable they were. Their Vessels were proportionable to their Bigness, but I can say nothing to their Use. When I saw I could not extract the *Viscera Thoracis* whole, I traced one of the Branches of the *Aorta Ascendens* down to the Heart ; and was surpriz'd, when I cut it above, to see a fat-like Substance jet out of it ; and pulling it, I got upwards of two Foot in Length, of a *Polypus* adapted to the Capacity of the Artery, which was about $2\frac{1}{4}$ of an Inch Diameter. This *Polypus* was no wise fibrous, but, as it were, so much Fat moulded after such a manner, being not unlike the Blade of a broad Sword, near to $\frac{1}{4}$ of an Inch at the Middle, and much thinner at the Edges, tough and flexible, with some grumous Blood, not so firmly compacted, at the Extremity.

Thymus.

A Polypus in the Aorta.

When I came to the *Heart*, I saw all it's Vessels very large ; the *Bivium Aortæ* very considerably thick and strong. There was nothing about the Heart remarkable, except the Bigness, which was proportionable to the Body. The *Auricles* were large, and at the Left as well as the Right full of grumous Blood. At the opening of the *Ventricles*, I found them both fill'd with the same *Polypus* ; which strangely twisted itself in among the Valves, both *Tricuspides* and *Semilunares*, and also among the fleshy Columns, at the Bottom of each *Ventricle* ; which

Polypus Cordis.

here seem'd to be so many little strong round Muscles, some $\frac{1}{4}$, others $\frac{1}{2}$ and others near one Inch long, with a round fleshy Belly, and two Tendons variously situated, as you see in the Hearts of other Animals. These *Polypus*'s, from a massy Substance in the Middle of the Ventricle, sent forth to all Parts their Branches, which here and there twist-ed themselves round these fleshy Columns, their tendinous Insertions, and the tendinous Fibres of the Valves, with a wonderful Intricacy. In a Word, there was no Angle, no Corner nor Cavity, which the *Polypus* did not occupy: And yet so much was it disengaged from the Substance of the Heart, and 'twas so strong and tough, that by pulling it's grosser Part in the Middle, all the other Branches mov'd; and by cutting a few Parts of it, where it was most engag'd, and where the fleshy Columns were thickest, I got it out all together; and having stretch'd it out, did pleasantly behold these Ramifications, proceeding from it's grosser Part, like so many Thongs or Laces, whereinto a Piece of Leather had been cut, some broad and some narrower; but none very thick; of a yellow Colour, and fat Substance; each of them weighing one Pound, which I may safely say, was more Fat than was upon all the Body beside.

The Mouth.

Having but little time to take notice of the external Parts of the Head, either in respect of the Muscles which move it, the *Larynx*, *Pharynx*, or Tongue, or in respect of the Salivatory Vessels, which empty themselves in the Mouth; I only observe, that the Mouth is very little and narrow, in Proportion to the Body, and that upon these Accounts: 1. Because neither Lips nor Teeth are employ'd in gathering the Food, as in other Quadrupeds; so that the Mouth only serves to receive the Aliments from the *Proboscis*, which both gathers and conveys them into it. 2. The *Dentes Maxillares* are of such a Thickness, both in the upper and lower Jaw, but especially the latter, that they serve to render the Mouth narrow; nor need it be broader, because the Strength of the Grinders is such, that they can at once render the Aliments so small, that there is no need for the Tongue to move them to and fro' in the Mouth, in order to have them further masticated, as in other Animals; therefore is the Tongue small, short, and round, terminating in a Point, thick, and not thin and flat as in Oxen, with a soft smooth Surface, without any perspicuous *Papillæ*; by which it seems not to chew the Cud.

The short View I took of the Tongue, hinder'd me from observing that singular Structure mention'd by Dr *Moulins*. All I took notice of peculiar to it, was the firm Adhesion of the *Thyroides* to the *Os Hyoides*, which made me separate and preserve both; whereof see the *Figure*. As to what Dr *Moulins* says, it seems to me very improbable; and I am sorry the Head should have been so mangled at the cutting off, that I was neither able to receive, nor give any Satisfaction about it. However, I shall give his Account, and mention my Doubts.

Fig. 117, 118.

‘ The Passage, says he, to the Ventricle, was through a peculiar Hole, near the Root of the Tongue, and exactly in the Middle of that Part; which Hole was the Beginning of the *Œsophagus*: There was no Communication between this and the Passage into the Lungs, contrary to what happens in other Animals; for the *Membrana Pituitaria anterior* reach'd to the very Root of the Tongue, below the *Œsophagus*; so that it could emit no Voice by the Mouth, but by the Trunk. This *Membrana* had many Passages for the *Saliva*, usually separated there. There was between the End of the *Proboscis* and the *Larynx*, a *Membrana Pituitaria posterior*, which had many of the same Sort of *Ductus*.’

An Observation of Dr Moulins's, concerning the Passage from the Larynx to the Proboscis.

This, I confess, seems to depend upon particular Observation, and yet I cannot see how it can well happen; for every one is sensible, that the *Larynx* occupies the Fore-part, and the *Œsophagus* lies behind, between the *Vertebræ* and *Larynx*. Now how the *Œsophagus* can lie thus behind, and yet have such a Communication with the Mouth, as to hinder the *Larynx* from communicating with it, is to me a very great Doubt.

Remarks upon the foresaid Observation.

He proceeds, ‘ the *Aspera Arteria* was very large, and destitute of an *Epiglottis*, there being no Danger of any thing falling into the Lungs from Eating and Drinking, seeing there was no Communication between the *Œsophagus* and it.’ Here the difficulty still remains; for how can Aliments be ingested into the Mouth, and not pass over by the *Larynx*, as is said, before they enter the *Œsophagus*; that would imply, that the *Œsophagus* lies before, and the *Larynx* behind, which would quite invert all the Rules of the *Oeconomy* of Animals: Since then the *Œsophagus* must have in it's Descent pass'd in betwixt the Head and Lungs, and then penetrated the *Diaphragm* or otherwise, and after it had descended a little, must have turn'd aside and pass'd behind the *Larynx*, as the *Arteriæ Iliacæ* do over the *Venæ Iliacæ*, which, tho' by cutting off the Head, I could not observe, yet is what seems improbable to me; because then at the Deglutition, by the Pressure of the *Œsophagus* on the one Side, and the *Vertebræ* of the Neck on the other, ever and anon would the Animal be oppress'd with a Difficulty of Breathing when it took Food.

He says further: ‘ To the Outside of these Cartilages heound another grow, which was fasten'd to them, but so as to be capable of moving up and down, by the Help of some Muscles which were implanted in it. 'Twas strong on both Sides of the *Aspera Arteria*; but opposite to the *Œsophagus*, or on the underside it was very limber. This wanted about $2\frac{1}{2}$ Inches of coming round the aforesaid Cartilages, (*viz.* the *Cartilagine Aritænoïdes*, which made a *Glottis*, in Length, about $3\frac{1}{4}$ Inches, and in Breadth about $1\frac{1}{2}$ Inch about the Middle, whose Aperture was somewhat oval) on the upper Side, or that next to the *Œsophagus*. This seem'd to supply in some measure the want of an *Epiglottis*, in lessening the *Glottis* to prevent the creeping of Animals into it.’

proboscis hangs over : On each Side of which are the *Alveoli* for the Tusks : and behind, the Lower makes up all the rest of the Head, as to it's external View.

We shall begin the particular Description of the external Parts of the Head at it's Fore-part ; the Diameter of whose Upper-part is three Foot, the two Eminences are almost round (*d. d.*), and the *Sinus* in the Middle is 10 Inches from the Right to the Left, and two Inches deep (*e.*), from thence descending five Inches, the Bone is flat before, and begins to form an Angle on each Side for the Cavity, which contains the Muscles of the lower Jaw and *Proboscis*, between which Angles 'tis 11 Inches (*f. f.*), thence descending gradually, the Angles tend outward, till they come to the upper Production for the Orbit of the Eye (*g. g.*), where they are 17 Inches ; betwixt which is situated the Hole for the Root of the Trunk (*a*). This Hole runs across the Head, being from the Right to the Left 12 Inches, and from below to above on each Side 7 Inches ; for in the Middle it has a Protuberance where the *Cartilaginous Septum* arose, which descends two Inches, and terminates in an obtuse Point. Within this Hole are to be seen several of the *Laminae*, whereof the *Cellules* which run betwixt the two Tables of the Skull are compos'd (*b. b.*), of which hereafter, with the *Vomer* in the Middle (*i.*) whence the *Septum* of the Trunk arises. 'Tis pretty thick here, and is compos'd of two *Laminae*, with a spongy Bone in the Middle. At it's Upper and Fore-part it communicates with the *Os Cribosum* ; and you may see the several Perforations, through which a great many Branches of the *Nervus Olfactorius* pass, and cover the Surface of the *Cartilaginous Septum*. At it's Lower and Back-part, where it becomes gradually thinner, it divides the *Choana* into two ; whereof hereafter. At the Lower-part of this Hole the Bone becomes concave (*k.*), so that measuring from the Middle of the Orbit of the Eye on both Sides, which are $3\frac{1}{2}$ Inches distant, the Depression becomes two Inches deep. At the Middle of the Lower-part of this Hole begins a Suture, which runs down to the Extremity of the Bone (*m. m.*). These two Bones are articulated *per Symphysin*. Dr *Moulins* calls these *Ossa Maxillae Superioris* ; but I rather incline to call them *Ossa Palati*. They are 5 Inches broad at the Upper-Part, where they are articulated with the *Ossa Maxillae Superioris*, by Dr *Moulins* *Ossa Mala*, by the same kind of Structure (*n. n.*). From the Upper-part to the lower Extremity of this *Os Palati* (*b.*) it is 15 Inches. After they have quitted the *Os Maxillae Superioris* on each Side, they run down with an obtuse Angle ; being protuberant on their outer Side, they incline gradually toward the Suture in the Middle (*m. m.*) forming a Cavity $2\frac{1}{2}$ Inches deep at the lower Extremity, which is not so deep as at the Middle. 'Tis design'd for the *Proboscis* to rest upon, and the Eminences of each Side are for granting Space for the *Alveoli* ; whence the Tusks proceed (*o. o.*) which are improperly call'd Teeth, (and therefore this Bone which contains them should not be call'd *Os Maxillae*) since they only serve for

Of the Fore-part of the Skull.
Fig. 62.

for a Defence to this Animal, and should rather be call'd it's Horns. They are of different Bigness in different Animals, and the Male seems to have them bigger than the Female; *v. g.* The *Elephant* which was burnt at *Dublin*, had them much bigger than this which died here; which consists with the Knowledge of several in this Place, who remember to have seen both: And the Figure which *Dr Moulins* gives of them, even tho' broke, seems to represent them much larger than those in the Subject we have; which are very small, not exceeding the Bigness of an ordinary Cane, or not above one Inch Diameter, and straight, so far as they remain unbroke: So that I am not in a Capacity to affirm or deny the Assertion of *Aristotle*, who says, *Mares grandiores resimatosque habent, Fæminæ minores, & contra quàm Mares, vergunt enim deorsum, pronique deviant.* Perhaps it might have been so with these; and that the Keepers (that the Difference of the Sex might not be known, by their bending downward or upward) might have designedly broke them. Indeed there is great Difference between the Weight and Length of these, had they been entire, and those wonderful big ones, whereof Authors give us an Account. *Tentzelius* tells us, That the Length of those describ'd by him is 8 Foot; and he, with several others, tells us, that there are of them which weigh 100 Pound and upwards, some 140, others 150, and those he talks of were above 100 Pound; insomuch that *Tavernier* tells us, That in the *Indies* they make Posts of Doors and huge Pales of them: And 'tis memorable, which he says also, that the *Elephants* of the Isle of *Ceylon* have no Tusks, but the first which the Female produces: And this we have confirm'd by *Mr Knox*, in his Relation of this Island, that few of the

Of the Tusks.

Elephants there have Tusks, and those only Males. There is a great Debate among Authors, whether these shall be call'd Horns or Teeth. Those who would have them to be Horns, say, 1st. Because they rise from the Skull. 2. Because they can be polish'd, and brought into Form, which 'tis difficult to do with Teeth. 3. Because they fall off and grow up again, which the Teeth of no Animal do, except of Man. Such as would have them to be Teeth, tell us, that 'tis peculiar to such Animals as have the Hoof divided into two, to have Horns; and that Horns are always cavous or spongy within; whereas these are altogether solid. For the first Reason, that they rise from the Skull, tho' it be granted, yet it is after a different Manner from Horns; for they always either adhere to the Skull by a certain Articulation, if not cavous, as in Harts, or have a Protuberance arising from it, and filling up their Capacity, if cavous, commonly call'd the Flint. For the second, tho' it be granted they can be polish'd, &c. yet they are not capable of such Alterations, as Horns are by boiling, or burning in the Fire, such as being made flexible. Indeed, they seem more to agree by their Structure with Teeth; for they proceed from the Skull, and are planted in it *per Gomphosin*; having in these we are speaking of a large Cavity, about two Inches long, large according to the Diameter

Diameter of the Tusks, at first, but as they descend tapering gradually, till they terminate in a Point analogous to the Cavities in the Roots of the Teeth, and filled up with the same Kind of Substance, whereby they are kept firm in their Places. And as to their Structure, I doubt not but they have been compos'd of a mucilaginous Substance at first, as Teeth are; and that afterwards they augment by the Apposition of several *Laminae*, or *Strata*, according as the Animal increases in Years. Hence 'tis, that I suppose *Tentzelius's* Friend came to be convinc'd, that those Bones he treats of, were of an *Elephant* 200 Years old, by such Marks as these *Laminae*, which might have been taken from the Teeth. These *Laminae* are very obvious in the Subject we have, and the Smallness of the Tusks seems to be another Argument of her being young, according to their Term of Life. Whether they be call'd Teeth or Horns it matters not much; for if from their Substance we take their Designation, they may be call'd Teeth; and if from their Use in pushing, we may call them Horns; and to avoid any Debate, let them be call'd Tusks or Defences. They run in this Subject about 6 Inches high in the *Os Palati*, and adhere by a strong Ligament, as is already said.

We proceed to consider the Side of the Head. We said, that descending 5 Inches from the Middle of the Depression in the Fore-part of the Head, which is 7 Inches from the Top of any of these Eminences, it becomes to form an Angle (*a.*), and the Side of the Head becomes considerably depress'd, where the Muscle of the lower Jaw and *Proboscis* is lodg'd. This Depression from it's Beginning (*a.*) to the *Os Zygomaticum* (*b.*), (where it is $8 \frac{1}{2}$ Inches deep) is $14 \frac{1}{2}$ Inches distant; and from the Fore-part (*g.* *Fig. 62.*) to the *Orificium Meatus Auditorii* (*k.* *Fig. 63.*) is 13 Inches; also from the Upper Protuberance of the Orbit of the Eye (*f.*) to the Articulation of the *Os Zygomaticum* with the *Os Temporale* (*i.*) is $9 \frac{1}{2}$ Inches. At the Fore-part of this Depression is situated the *Sinus* for lodging the Eye; for 'tis improperly call'd Orbit, since only the Half of the Part where the Eye is lodged is bony: It has three remarkable Protuberances; one at the upper and Fore-part (*f.*), whence a strong Cartilage arises, and is inserted in another 7 Inches distant (measuring obliquely) form'd by the Articulation of the *Os Zygomaticum* with the *Os Maxilla* (*g.*) and a third in the Middle (*e.*), at $3 \frac{1}{2}$ Inches distant from each of the former. This Protuberance serves for the Insertion of the *Trochlea* of the *Musculus obliquus major*. The Bottom of the Orbit has another *Sinus* (*s.*), which conveys the *Nervus Opticus* to the Bottom of the Eye, the upper Part whereof is compos'd of a *Lamina* of the *Os Frontis*, which lies over the *Os Maxilla*: From beneath this *Lamina* not only proceeds the *Nervus Opticus*, *Motorius* and *Patheticus*, but also a considerable Branch of an Artery, Vein, and fifth Pair of Nerves, which running forward, pass through a large Hole in the *Os Maxilla* (*m.*), and are dispers'd in the *Proboscis*; whereof hereafter. This *Sinus* (*s.*), whose lower Side is

The Side of
the Head.

Fig. 63.

Sinus for the
Eye.

is form'd by a *Spine* running along the *Os Maxilla*, is 9 Inches long, $1 \frac{1}{2}$ Inch broad at the Middle, and one Inch deep ; but as it comes forward, 'tis enlarg'd as the Globe of the Eye increases.

The *Os Maxilla Superioris*.

Fig. 62.

The *Os Maxilla* is a very irregular Bone. At the Fore-part of the Skull it begins with a sharp Point (*p. p.*), having that Part of the *Os Frontis* which forms Part of the Orbit (*d. Fig. 63.*) on the one Side, and that Part of the *Os Palati* (*m.*) which forms the Hole for the Root of the Trunk on the other ; whence running 6 Inches, and inclining inward by a crooked Suture, it terminates in a Protuberance ; beneath which is a small *Sinus* ascending obliquely to the Hole for the Root of the Trunk (*n.*) fram'd by the Blood-Vessels as they go to the Nourishment of the Trunk ; from thence it runs obliquely backward, and is articulated with the *Os Palati* by a broad squamous Suture. From the middle Protuberance of the *Sinus* for the Eye (*d.*) it runs straight backward, being articulated with that Part of the *Os Frontis* which forms the aforefaid lower Edge of the *Sinus* for the *Nervus Opticus* (*s.*) for the Space of 18 Inches, where it begins to be overlaid with a *Lamina* of the Bone, which forms the Upper and back-part ; whence it descends 9 Inches, till it comes to the Root of the Teeth (*n.*) where we shall leave it, and return to the fore-nam'd Protuberance ; from whence having made up a Part of the *Sinus* for the Globe of the Eye, as is said, it runs backward 6 Inches, and is articulated (by a flat Suture (*g.*) which first descends $\frac{1}{2}$ Inch, then runs obliquely backward $2 \frac{1}{2}$ Inches) with the *Os Zygomaticum*. At it's Beginning 'tis $2 \frac{1}{2}$ Inches broad ; plain on it's inner, and convex on it's outer Surface ; bended, as it descends, like a Horn, and terminating in a Point. From the lower Part of this Suture it becomes much thicker ; and having fram'd a *Sinus* about 4 Inches long, it runs toward the Fore-part of the Skull. From this *Sinus*, as it has returned 3 Inches, is form'd the Side of an Oval Hole, which running from before to behind, is about $3 \frac{1}{2}$ Inches long, and from the one Side to the other two Inches. At the Side which is fram'd by the *Os Maxilla*, and toward the *Processus Zygomaticus*, 'twas two Inches thick ; and at it's other Side, it runs straight backward from the *Os Maxilla*, in a direct Line, with the great Cavity, which contains the Muscles that move the lower Jaw and *Proboscis*. This Hole is analogous to that in a Human Skeleton in the *Os Maxilla*, beneath the Orbit of the Eye ; and is larger in Quadrupeds, being destinated for Transmission of a Vein, Artery, and the superior Branch of the second Division of the 5th Pair of Nerves, which in those go to the upper Lip and Jaw ; but in this Subject, as I have shewn, 'tis probable they serve for the Nourishment and other Functions of the *Proboscis*. Tho' it be very observable, and of signal Use, yet 'tis so situated, that I was not capable to give such a View, as might afford a true Idea of it, in any of the Figures of the Head : However, I mark'd it (*r. r. Fig. 62.*) and (*m. m. Fig. 63.*) (*8. 8. Fig. 64.*) From this Hole the *Os Maxilla* inclines 6 Inches toward the Root of the Teeth (*n.*), where we leave it, and return to

The

The *Os Zygomaticum* (s.) (b.) (i.), which, as in all other Animals, serves for a Guard to the Muscles which move the lower Jaw. In Men, and several other Animals, 'tis formed of a Production of the *Os Temporale*, articulated with another from the *Os Malaë* by a particular Suture, called *Sutura transversa*: but here 'tis the most distinguished Bone of all the Head; for being twelve Inches long, and two Inches broad, 'tis articulated with the *Os Maxillaë* before, and running backward 6 Inches, it meets at it's upper Part with a Production of the *Os Calvariaë* (f.) as we may call it, which accompanies it's lower Part other 6 Inches, and then terminates in an obtuse Angle. 'Tis loosely joined with this Production; and 'tis probable that 'tis capable of considerable Motion, upon the following Accounts: 1. The *Sinus* in the back Part of the Skull, as shall be shewn, for receiving the *Condyles* of the lower Jaw, are larger than the *Condyles* themselves, by which they have a pretty good Space to move from the Right to the Left; and the Extremity of the *Os Zygomaticum* being their Guard on each Side at the outer Part, which way they move, these may be supposed to yield. 2. The lower Jaw is of such Weight, that it's Muscles must require a great Space to act in, and that may be conciliated by the Motion and Yielding of this Bone. 3. The Grinders of the lower Jaw are much longer than those of the upper, and therefore they require a greater Space to move in, for the better Performance of Mastication, (because the upper Jaw in this, as in most other Animals, is immovable) to which the Motion of this Bone must very much assist. Add to these, the Manner of it's Articulation; for it rests upon the Production of the *Os Maxillaë* before; and behind it moves, as it were, to and fro, upon the Production of the *Os Calvariaë*, which rests upon it.

The *Os Zygomaticum*.
Fig. 62, 63.

Fig. 63.

The back Part of the Skull is next to be considered: At it's upper Part the two Eminences, formerly mentioned, now appear more considerable, because of the intervening *Sinus*, which from two Inches deep, and ten Inches from the Right to the Left, becomes four Inches deep; for the Eminences (a. a.) approach (as they run backward) much nearer to one another; and the *Sinus* running obliquely downward, becomes still deeper, having a *Spina* (c) 6 Inches long, and one Inch deep. This *Spina* serves for Insertion of the Muscles which move the Head. The Bone on each Side of it is very rugous; which seems to be an excellent Contrivance, because there is such a deal of Strength required here in the Tendons, for supporting the Weight of the Head of this great Animal, 'twas requisite the Surface of the Bone, whence they arise, should be very unequal, that their Fibres may be the more firmly impacted therein. Here 'tis also that the *Tax Wax*, formerly mentioned, was inserted. By means of this *Spina* in the Middle, and the Eminences on both Sides of the *Sinus*, the Surface of the Bone is much more enlarged, and the Muscles, with their Tendons, are more capable to move the Head, either directly or obliquely to either Side, than if the Bone had been plain. After the *Spina* of

The back Part
of the Head.

Fig. 64.

Fig. 67.

Fig. 64.

the *Sinus* is ended, the Bone swells out toward the Back Part 3 Inches, and then descends $1\frac{1}{2}$ Inch, till it comes to the Hole for the Spinal Marrow (*d. d.*), and here the Bone from above the *Orificium Meatus Auditorii* (*f.*) on each Side, becomes protuberant 10 Inches (*e. e.*), till it comes to the *Processus Condylodes* (*c. c.*). This Protuberance has the same Office as the *Apophysis Mastoides* in other Animals, *viz.* for Infertion of the Muscles which bend the Head inward. The *Processus Condylodes* (*c. c.*) are $7\frac{1}{2}$ Inches distant inclusive; each of the *Condyles* being $2\frac{1}{2}$ Inches broad from the Right to Left, as they arise gradually from their outer Side, and from below to above arising (as it were femicircularly) 5 Inches long. The Hole for the Spinal Marrow (*d. d.*) at the upper Part, betwixt the *Condyles*, is 3 Inches broad, $2\frac{1}{2}$ Inches at the Middle, and two Inches at the lower Part, till at last it terminates in a Point. 'Tis $3\frac{1}{4}$ Inches long, and it's Margin about the Middle of the *Condyle*, is 2 Inches thick. Below these *Condyles* the Bone becomes more flat; infomuch, that tending inward there is a *Sinus* framed, above which the *Processus Styloides* arises (*g.*), being there articulated *per Synchronrosin*. This *Processus Styloides* is cartilaginous about one Inch (*b.*) at it's Base; whence arising hard and solid 4 Inches (*k.*) flat on it's Inside, and convex on it's Outside, being one Inch broad, it is afterwards divided, sending out another Bone $5\frac{1}{2}$ Inches long (*i.*), which bending toward the Skull, but outward from that Place whence it proceeded for the Space of two Inches, it becomes gradually smaller, till it terminates in a Point not unlike that Part of a Pen wherewith we write. This Bone is so situated in the *Basis* of the Skull, that it was impossible to give any Idea of it *in Situ*, and therefore I took the Figure of it a-part. Betwixt the *Sinus*, below the *Processus Styloides* and the *Condyles*, at $1\frac{1}{2}$ Inch distant, is situated the Hole for the Jugular Vein (*m. m.*), through which also passes the *Par Vagum* (See *n.* Fig. 85.) which being Oval, is $1\frac{1}{4}$ Inch long, and $\frac{1}{2}$ Inch broad. On the Outside of the *Processus Styloides*, is to be seen the Hole for the hard Portion of the *Nervus Auditorius* (*l.*). This is so near to the Root of the *Sinus*, that it could not be well shewn in the Figure. Betwixt the Origin of the *Processus Styloides* (*g. g.*), and the Hole for the Jugular Vein (*m. m.*), is lodged the bony Part of the *Aqueduct* (*n. n.*), which descends 5 Inches; 'tis $\frac{1}{2}$ Inch broad, and so flat that it could scarce be represented in the Figure. From thence is a *Crena*, whose Orifice is represented by (*o. o.*), where it's fleshy Part was contained, which communicated with the Palate; it descends 3 Inches obliquely inward. From the aforesaid Hole for the Jugular Vein (*m. m.*) is situated the Hole for the Carotid Artery, which is so large as to admit the Point of one's Little-Finger (*p. p.*). Descending in a streight Line from the *Processus Styloides* (*g.*) $3\frac{1}{2}$ Inches, you come to the Hole where the *Arteria duræ Matris* enters the Skull, and by which the 3d Branch of the 5th Pair of Nerves passes out: Here also the Vein, which returns by the great Hole in the *Os Maxillare*, from the *Pro-*
boscis,

Fig. 85.

boscis, (after it has past some Space beneath the *Lamina* which makes up the upper Edge of the *Sinus* for the Orbit of the Eye) passes out, and runs back to be joined with the Jugular Vein. These Holes are situated on each Side, betwixt the *Aqueduct* and the *Sinus* for Reception of the lower Jaw (*y.*), and are both received within a like *Sinus*, so that they could not be represented by an Orifice. The Bone for Reception of the *Processus Styloides*, as I have said, is depressed; and from thence, for the Space of two Inches, till you come to the Hole for the Carotid Artery (*p. p.*), it is raised from the *Aqueduct* (*n. n.*). From thence, betwixt the two Holes, 'tis gradually protuberant to the *Condyle*: From below this Hole (*p. p.*) streight downward, during the Progress of the two *Aqueducts* (*n. n.*), which are 3 Inches distant, 'tis depressed, till you come to the *Choana*, or Passage betwixt the Palate (*t.*) Fig. 62.

and the Root of the Trunk (*i.*). Between the two Holes for the *Arteria durae Matris* 'tis 6 Inches (*q. q.*). The Length of the *Sinus*, called in Human Subjects the *Glenoid* Cavity, measuring from that Part of it which is toward the Hole for the *Arteria durae Matris* (*q. q.*) till you come to the Extremity of the *Os Zygomaticum*, is $5\frac{1}{2}$ Inches long. This *Sinus* is scarce at all depressed; 'tis rather protuberant, with a semicircular Surface from above to below: 'Tis well enough guarded on both Sides; so that notwithstanding this protuberant Reception for the *Condyles*, yet their Dislocation is prevented by the Extremity of the *Os Zygomaticum* on the Outside (*x.*), and on the Inside, first by an Hollowness, and then by a rising in the Bone. And this Contrivance seems to facilitate the Motion of the Jaw very much: for had this *Sinus* been proportionally so deep (however superficial it may be) as in Human Subjects, it's Motion had not been so very free, as we see it is: For by this half-round Surface, the *Condyles* have the more Space to move backward, and the lower Jaw to be depressed, that it may move forward, and press the Aliment against the upper Teeth with the greater Force; the Muscles also prevent it's falling too much back, and the *Os Zygomaticum* it's inclining too much to either Side, as is observed. Above the big Process of the *Os Maxilla*, which is articulated with the *Os Zygomaticum*, is the *Orificium Meatus Auditorii* (*k*), which being Fig. 63.

Oval, is one Inch long, and $\frac{1}{2}$ Inch broad. Betwixt this external Orifice and the *Processus Petrosus*, the *Meatus* is 8 Inches long; whereof hereafter. By means of this great *Sinus* on each Side, the *Basis* of the Skull is so contracted, that from the Hole (*q*) down toward the Root of the Teeth (*3, 4.*), which is 9 Inches long, the Breadth is but $7\frac{1}{2}$ Inches. From the Extremity of the bony Part of the *Aqueduct* downward, the Base of the Skull is composed of cavous Bones, about $2\frac{1}{2}$ Inches thick, and a large *Sinus* in the Middle $3\frac{1}{2}$ Inches Diameter (*S.*) at the End of the *Sinus* for the fleshy Part of the *Aqueduct*, and at the Root of the Teeth $4\frac{1}{2}$ Inches. This *Sinus*, after 'tis become 2 Inches deep, terminates in the *Choana*. This Passage is 8 Inches long, and $2\frac{1}{2}$ Inches broad, with the *Vomer* in the Middle (*u.*) extending from hence to the Root of the Trunk 8 Inches. The back Part

Part of this *Vomer* is sharp and thin, but it's fore-part thicker, consisting of two *Laminae*. Dr *Moulins* is of Opinion, upon Observation of the Tongue, that the *Elephant* only breathes by this Passage, and not by the Mouth. I do not find that this Passage is proportionally more patent in this Animal than in any other, only it seems to be more direct; for as in other Animals this Hole communicates with the Root of the Nose, and the Bone gives the Air at it's Exit another Direction; so here the fore and back-part of the *Choana* are directly opposite: but then the Trunk itself gives the Air a quite other Direction than in the Bones of other Animals. Indeed there is one Argument which seems to strengthen Dr *Moulins's* Opinion, *viz.* That by the Trunk the *Elephant* sucks up any Liquor it has Occasion for, which it afterwards empties into the Mouth; and so by drawing in of the Air, it is able to keep in it's Extremity any Thing it takes hold of. However, the Objections advanced against this Opinion formerly, seem to be of greater Moment than these Arguments here proposed are for it. These two cavous Bones, on each Side of the *Choana*, are filled up from the two firm, solid, white, weighty Teeth (3, 4.) the back one whereof does not grind, but serves as it were a Wedge to keep that before firm in it's Place (5.). This Tooth runs obliquely backward 3 Inches from the fore Tooth. That Part of it which is without the Jaw-Bone is half-round, being 6 Inches in Surface from it's Root on the one Side to that on the other, very polite, as *Tentzelius* is pleased to term it, and smooth like Glass. How far this Tooth or the other may go up I cannot positively determine, neither give any Account of the Figure within the Bone, unless I had broke the Skull. However, I shall insist more upon the Teeth when I come to the lower Jaw; all I shall add at present, is, that their *Alveoli*, especially that which contains the hind Tooth, are as thin as can be imagined. The Length of each of the Teeth is 7 Inches. These Teeth are not alike on both Sides; for that on the right is but one Inch without the *Alveolus*, throughout it's whole Extent on the outer Side; and on it's inner, 'tis one Inch protuberant at it's fore, and two Inches at it's back-part; whereas that on the left Side is only one Inch protuberant before on the Outside, and three Inches behind, where it forms a Kind of Angle, as it is joined with the hind Tooth; and on the Outside 'tis $\frac{1}{2}$ Inch protuberant before, and 2 Inches behind. The Tooth on the right Side (2.) grinds with that of the lower Jaw, throughout it's whole Extent; whereas that of the left, after it has run back 6 Inches, runs up with an half-round Surface 2 Inches (5.) before 'tis joined with the hind Tooth. It would seem that this Difference betwixt the Shape, Situation, and Dimensions of the right Tooth from the left is not singular here; for Dr *Moulins* doth likewise take notice of it, in that which died at *Dublin*: for he says, 'The Length of the Teeth of the right upper Jaw is 4 Inches, but that of the opposite was but 3: The two outward or fore Teeth of the upper Jaw were somewhat longer than those

Teeth, or
Grinders of the
upper Jaw.
Fig. 64.

of the Under.' He takes no notice whether the hind Teeth of the upper Jaw grind or not: But here (as I have said) not only both the hind Teeth are free from grinding, but also part of the fore Teeth of the Left Side. These Teeth, as Dr *Moulins* well observes, are all *Molares*, being 2 Inches broad; that Part of them wherewith they grind is $6\frac{1}{2}$ Inches on the Right Side, and $5\frac{1}{2}$ on the Left. Their Surface, tho' flat, yet is very unequal; for they have alternatively placed (running from the Right to the Left) an Hollowness, and then an Eminence, and this Eminence is surrounded by a rough protuberant Border. There are nine of each of the Hollownesses, and as many Eminences, undulated, as they use to paint Sea Waves; which seems to quadrate with what Mr *Ray* says, *viz.* 'That these Teeth have 8 or 9 parallel undulate Lines in their Surface.' The Situation of these Teeth, for what I know, is peculiar to this Animal; for instead of running from above to below, as in other Quadrupeds, they run from before to behind, as in human Subjects, being placed at ... Inches Distance at the beginning or fore-part, and ... Inches at their hind-part. From the fore-part of these Teeth the *Os Palati* runs down ... Inches, having that Division in the Middle (whereof formerly) much enlarged (10.). This Bone, as to it's Thickness in this Subject, is correspondent to the Tusks, which are implanted in each side of it (as is said). It seems to be thus placed, upon two Accounts: 1. That it may answer to the Distance, or cover that Part of the lower Jaw which runs betwixt the fore-part of the Grinders above (*c.c.*) and the Process at it's lower and middle Part (*e.*). 2. That it may afford Space, as we formerly observ'd, Fig. 68. for the Trunk to rest upon, lest it should be obnoxious to the Mouth.

The lower Jaw is the only External Part of the Head, which comes now to be consider'd, consisting of one big Bone, and composed of it's fore and hind Part, and five Processes, *viz.* two *Condyles* (*a. a.*), two *Processus Coronæ* (*b. b.*), and one *Processus Menti* (*e.*); 'tis articulated with the upper Jaw, as in all other Animals, by a double *Arthrodia*. The two *Condyles* (*a. a.*) are 12 Inches distant inclusive; their Surfaces convex both from the Right to the Left, which is $3\frac{1}{2}$ Inches, and from before to behind, which is 2 Inches. They are received into the *Sinus* of the upper Jaw (*x.*), which, as I have said, is $5\frac{1}{2}$ Inches: So that they have Space enough to move at Mastication. The Neck, below the *Condyle*, is 3 Inches from before to behind at it's smallest Part; whence descending 3 Inches, it becomes 6 Inches broad (*b.*), and 2 Inches thick at it's back-part, where it forms an obtuse Angle; whence running forward at it's outer Side 2 Inches, it begins to form a *Sinus* for Insertion of the Muscles which move the Jaw. This *Sinus* running forward 4 Inches more, terminates in a sharp Edge of the Bone, which descends to make up the *Processus Coronæ* (*b. b.*). This *Sinus* is 8 Inches from above to below: At the upper-part of the *Processus Coronæ* 'tis 8 Inches broad from before, where 'tis sharp, to behind, where 'tis thick and obtuse; and at it's middle $9\frac{1}{2}$ Inches (*b. b.*) the

The Lower Jaw.

Fig. 68, 69.

Fig. 64.

Fig. 69.

the

Fig. 70.

Fig. 69.

Processus
Menti.
Fig. 68, 70.

the *Processus Coronæ* from above to below 6 Inches, with, as it were, a semicircular Edge, but somewhat more protuberant, where 'tis not so sharp as the Margin above. Now we come to the inner Side of the same Part of the Bone, where we find that descending 7 Inches from the *Condyle*, 'till we come a little below the foresaid obtuse Angle, there are the Beginnings of a large Hole (*b. b.*) $3 \frac{1}{2}$ Inches long, *viz.* from the first framing of it's *Sinus* to it's lower Part, and $1 \frac{1}{8}$ Inch broad. This Hole is for receiving the Vessels fit for forming and nourishing the Teeth, whereof hereafter: Here the Jaw begins to be about 4 Inches thick behind, being convex in it's back-part; whence running 4 Inches forward, it inclines about $2 \frac{1}{2}$ Inches inward, where it forms a large *Sinus* for Insertion of the *Musculus Masseter*, and whereof no *Idea* could be given in the Figure; for the Outside always obstructed the View of the Inside. This *Sinus* descends obliquely from the Neck of the *Condyle*, till it comes to the Root of the Teeth (*c.*) 9 Inches, which Space does not appear so large in the Figure, because of the Position of the Jaw; and from the fore-part of the *Coronæ* backward, till the Jaw become thick, $5 \frac{1}{3}$ Inches: From the back Part of the Jaw at the aforesaid obtuse Angle, till you come to the Point of the *Processus Menti* (*b.*) in a straight Line, is 27 Inches. The Arch of the back Surface from the same Angle, till you come equal with the Beginning of the Teeth, or lower Part of the *Coronæ* (*c.*), is $14 \frac{1}{2}$ Inches, from whence measuring outward from the Root of the Teeth, it is 3 Inches to the aforesaid lower Part of the *Coronæ*; from thence to the middle of the back Part 5 Inches; and from the Root of the Teeth at the External to the same Place at the Internal Part, is 16 Inches; and here the Jaw is about 4 Inches thick behind. At the joining of the two Teeth straight downward, 'tis $6 \frac{1}{2}$ Inches; and here it inclines gradually outward for above 3 Inches; whereas it's inner Surface is almost plain, or at least for the Space of 4 Inches, and then inclines 3 gradually outward below, forming an Arch in it's Progress. Straight downward from the lowest Part of the *Coronæ*, the Jaw is at the thickest (*c.*), and here it begins to run obliquely forward, till meeting with the same Part of the Bone from the other Side, it terminates in the *Processus Menti* (*b. Fig. 70. e. Fig. 68.*), which about 2 Inches runs obliquely outward, and seems very convenient for defending the Mouth from the Inconveniencies of the Trunk; which by it's Weight would press too much upon it, were it not defended both by that Part of the *Os Palati*, which runs down from the Teeth in the upper Jaw, upon which it leans; and by this *Symphysis* or *Processus Menti* (*b. e.*), which keeps it still inclining downward, and suffers it not to bend inward: Add also, that this Process may assist the *Proboscis* somewhat in it's Elevation, when the Animal bending the Head a little forward, may make the Point push or bear up the *Proboscis* from above it. As the lower Part of the Jaw in it's Progress forward, runs obliquely downward, so it's upper Part of the Root of the Teeth runs straight forward, or rather

ther

ther inclines a little upward (*c.e.*), so that whereas 'tis only 6 ½ Inches from above to below at the joining of the Teeth, now 'tis 7 ½ Inches straight downward, (and here it's Surface is more plain, for before 'twas convex, and, as it were, half round) but all along the Edge of the

Fig. 68.

Sinus for lodging the Tongue (*d.e.*), to the outmost Point of the *Processus Menti*, 'tis 9 Inches. Now we consider the inner Part from the Place where we left it, and find it still more plain; where measuring from below the foresaid joining of the two Teeth straight forward, 'tis 4 Inches on each Side, till both meet in a Semicircle (*f.*), about 3 Inches Diameter at the lower Part, and somewhat nearer at the Root of the Teeth. After it has run 2 Inches upward, it runs straight forward with a convex Surface 4 Inches thick; thence it ascends 4 Inches more to the Root of the Teeth (*d.*). This *Sinus* is for lifting the Tongue, which is very narrow and pointed. Thus having given a particular Account of the External Figure and Shape of the lower Jaw, we shall consider it in general. The *Condyles* are 12 Inches inclusive distant; whence the Bone running downward, and somewhat backward 3 Inches, forms an obtuse Angle which is 17 Inches exclusive distant from it's opposite; and here the Bone begins to swell to a considerable Thickness by Degrees: From thence descending gradually 8 Inches, 'tis 18 Inches distant; thence inclining obliquely forward 8 Inches more, 'tis 14 ½ Inches distant; inclining still more forward to the Base where the two Bones meet, the Bone still becoming thinner 'tis 9 Inches; from which on each Side, till you come to the *Processus Menti*, 'tis 7 Inches: thus far as to his back-part. Now to it's fore-part: First, there is the *Condyle* (*a.a.*), then there is a sharp Spine which runs obliquely to the *Coronæ* (*b.b.*), whence to the Root of the Teeth 'tis thicker, and of a semicircular Form: Opposite to this, the Bone begins to swell at it's outer Side, and becomes plain at it's Inner; that is to say, as to that which regards the Mouth, and that which doth not. It's Surface on both Sides is very polite and smooth, having a great many Holes for Immission and Egress of the Blood-Vessels, which nourish the Bone; and at it's fore-part, it has two large Holes for the *Maxillaris inferior* (*Z.A.*) or Branch of the 5th Pair of Nerves, which are dispersed at the Roots of the Teeth. Next we come to the inner Substance of the Bones, so far as can be guess'd, because the preserving of the Skeleton entire, has kept me from penetrating so far into the Knowledge of it, as my Inclination might have led me. Every one is sensible, who knows any Thing in *Osteology*, as well Human as Brutal, that immediately below the *Coronæ*, or thereby, there is a pretty large Hole in Proportion to the Animal, for the Emission of a Branch of the External Carotid Artery, Jugular Vein, and 5th Pair of Nerves, call'd *Maxillaris inferior*, which are dispersed in the Roots of the Teeth for their Nourishment, and for conciliating to them that lively Idea of Pain, which those affected with the Tooth-Ach are very sensible of; and that in this Hole in Sheep, Calves,

Fig. 68, 69.

Sinus for lodging the Tongue.

Fig. 69.

Fig. 70.

Fig. 70.

Fig. 61.

Maxillaris inferior.

The Rudiments of the Teeth.

Fig. 69.

Fig. 90.

Fig. 70.

Calves, and other Quadrupeds, especially such as are young, as also in Children before the 7th Year, and even afterwards for some Time, in the cavous Part of the Bone, where the Teeth do not penetrate the Jaw, there are Rudiments of Teeth to be seen cavous in that Extremity, which is toward the Base (in which the Ligaments that keep the Root fix'd are firmly impacted) and solid at the other Extremity; so in this Animal from the fore-mentioned big Hole, I observed several of these Rudiments of Teeth lying *Stratum super stratum*, or rather plac'd perpendicularly across the Bone of each other's Side, from the Hole, (*b. b.*) till the Teeth began to appear. Those that were placed nearest the Hole were smaller, not above 1 Inch in Breadth, and $\frac{1}{2}$ Inch in Length, *i. e.* from above to below, cavous, as is observed, at the lower or back-part, (for Reception of the Ligament, which is guarded by two thin hard *Laminae*) and solid at the other. Those nearest the Hole were two or three Times intersected by Membranes, whereby they could be disjoined. But after I had taken out several, I found no more such a Separation, but that from the Right to the Left they were wholly cavous: Each of them was invested by a membranous Tunicle, as it were a *Periosteum*, and had something like a cartilaginous Substance betwixt the two. Their Surface is very unequal at the Orifice where they receive the Ligaments and Vessels (*c.*), and as if they had been folded into several *Plicae*, and afterward taken asunder, from which there run several Ridges and *Sulci* (*b.*), from one Extremity to the other; where the Ligaments cease, they become extremely solid and ponderous, and at their upper Extremities half round, and sometimes formed into Digitations (*a.*). When they approach to that Part of the Bone at which the Teeth appear, they begin to quit the *Periosteum*, by which they were distinguished, and unite close together, so as to form one Bone. 'Tis observable, that at their upper Extremity there is a *Lamina*, which being convex toward the Jaw, and concave toward these Rudiments of Teeth, does, as it were, knit their solid Extremities together, from which 'tis also separated by an intermediate Membrane at the Beginning; but afterward that ceasing, this *Lamina* conjoins them at the Extremities, as they are at the Sides, before they appear without the Jaw. And thus I conceive these Teeth to be formed, and 'tis by these I am persuaded the Jaw becomes so ponderous and thick; and that which strengthens this Opinion is, that the hind Teeth of both Jaws (for I doubt not but these *Rudimenta Dentium* are in the upper Jaw also) before they come to grind, have their upper Parts semicircular; and that both before and after the Grinders are formed, the Lineaments of these *Rudimenta* appear plainly like so many Ridges (*d. e.*), having intervening Furrows, where they formerly had been distinguished by Membranes: And I suppose, tho' at the upper Extremity they are united into one compact Bone, yet at their lower Extremity they have still the same Hollownesses for Reception of the Ligaments and Vessels as formerly; which Opinion is

con-

confirm'd by *Tentzelius's* Account. The lower Jaw has 4 Teeth, 2 on each Side (*d. e.*) as well as the Upper, all Grinders, but no Incisors, or fore Teeth. The hind Teeth are 8 Inches distant, and the Fore Teeth not 4, betwixt which is placed the *Sinus* for the Tongue (*d. e.*) and 'tis observable, that from thence to the Bottom the *Sinus* is so contracted, as only to be one Inch broad (*f.*). The hind Tooth on the Right Side is 4 Inches, on the Left 5. The one half of their Surface, where they begin to appear, is semicircular, with the fore-mention'd Ridges and *Sulci* running transversely, 4 on the Right Side, and 5 on the Left. The other Half has 5 of those Eminences, where it grinds, (whereof formerly, when speaking of the upper Jaw) and 4 on the Left. Each of the fore Teeth is 6 Inches long, and has 6 or 7 of the fore-mention'd Eminences, and as many Depressions. The hind Teeth of *Dr Moulins's* Elephant seem to have been of an equal Length on both Sides, and much longer than the fore Teeth. 'Tis observable, that the Ridges at the Sides are correspondent to the Eminences where they grind, and the *Sulci* to the Depressions. The Teeth of the lower Jaw exceed those of the Upper about 2 Inches in Length; by which it appears, that the Motion of the lower Jaw must be very great in Masti-
The Teeth, or Grinders of the lower Jaw.

cation, and that the *Elephant* for the most Part moveth the Jaw from behind to before; and scarcely from one Side to the other, as in Animals, that ruminates, or chew the Cud. These Teeth are the most firm, solid, and weighty Bones of any Animal yet known, and are as good Ivory as the Tusks themselves. Before we quit the lower Jaw, I hope it will not be impertinent to enquire, whether or no these *Rudimenta Dentium* may be suppos'd in Process of Time to descend and expel those Teeth already form'd, and succeed in their Place; and if not, what may be their Use. For the first Question, 'tis true, Children have two Ranges of Teeth, tho' not equally solid, the second whereof expels the first at or about 7 Years of Age, and succeeds them, the first being only for so many Sheaths or Covers, whereby the second, being yet but a soft mucilaginous Substance, are defended from external Injuries, till in Process of Time they have attain'd to a convenient Hardness; and that there is a great Difference in the Teeth of some Quadrupeds, such as young Horses, whose Fole or Colt Teeth, as they are call'd, have some Marks, which are obliterated after a certain Period of Years; so that it would appear, if these Teeth are not expell'd, yet their Surface by Degrees is abraded, and instead of that their Roots are augmented, and the Teeth receive such an Alteration, as their Age is no more known by these Marks. I have already observ'd, that there are several Ridges and Furrows in the Teeth of this Animal, which seem to be an Evidence, that these *Rudimenta* have grown together and become one Tooth; but whether the *Rudimenta*, which have not as yet appeared without the Jaw, do ever expel these which have appeared, and succeed them, is the Question; no Experiment yet being made concerning the Production of those in this

The Osteology of an Elephant.

Animal. The Period of the Time that *Elephants* live, and the Age of this we treat of being unknown, we can give no positive Determination in this Matter: Yet I am apt to believe, these Teeth as well as the *Rudimenta*, have been *à prima formatione*, and that because, 1. The Jaw-Bone so firmly adheres to the Teeth on both Sides, so soon as they appear, and the Place of their Roots is so well known (by the *Al-Protuberance* on the Outside of the Jaw) to be enlarg'd within the *Alveoli*, that I do not see how they can be expell'd by a succeeding Set. 2. When one Set of Teeth expels the other, the second is usually below the first, and not placed in the same Rank, as these are; which obliges me to enquire, what may be the Use of these *Rudimenta*: Which I suppose to be, 1. To fill up the Cavity of the lower Jaw. 2. By their Weight to add Strength in Mastication. 3. That there may be so many different Bones to assist the Teeth in their Motion: And 4thly, To serve instead of a Wedge for keeping the Teeth firm in their Place. For the first, 'twas convenient the lower Jaw should bear an equal Proportion in it's Bigness to the Upper, and have sufficient Space for Insertion of the Muscles fit for it's Motion; and if of a proportionable Bigness, then either the Bone must be altogether solid, or cavous, and stuffed with some other ponderous Substance; for if spongy or cellulous, then would it have been too light, which would have been very inconvenient. As to the second, the Weight is of considerable Moment, for the more exact Attrition of the Aliment, which is here requisite, because the Tongue of this Animal is both small and polite on it's Surface, without those sharp cartilaginous *Papillæ* those Animals are endued with, whose Teeth are not sufficient to grind their Food. As to the third, I conceive that these *Rudimenta*, with their intermediate Membranes, may be the more helpful to the Teeth in their Motion (if they have any) or Pressure, than if the surrounding Jaw had been one whole continued solid Bone. For the fourth, hard and soft Substance alternately placed, is certainly more convenient for keeping any thing firm than either of the two alone; for had they been hard Substances that lay upon one another, then neither would yield to Pressure; and if soft, tho' they yielded, yet would they not so well retain the Pressure they receive, and keep any thing firm thereby, as if they had some intermediate Substance: In a word, be the Use of these *Rudimenta* what it will, the Teeth and they together have render'd this so ponderous as to amount to 45 lb. Weight. And thus we have ended the external Parts of the Head.

Inner Parts
of the Head.

Being come to the internal Parts of the Head, we shall proceed as in Treatises of *Osteology*, by taking notice of it's Structure, two Tables, *Diploe*, Figure, and Extent of the inner Table, *Fossæ*, Eminences, and *Foramina*; of all which in their Order. As there is no Animal in Proportion that is endued with a greater Quantity of Brains than Man, so there is none that seems to have less than the *Elephant*. In the one, 'twas so order'd by the Wise Governor of all Things, that they

they might be sufficient for the Generation of so many Spirits, as are requisite for the Performance of the Rational and Animal Functions; and in the other, had the Quantity of Brains been greater, the *Principia Nervorum* had been more divided; so that instead of being requisite, they had been vastly inconvenient, because the Nerves cou'd not so well receive the Spirits dispers'd in a greater Mass, as now, when contracted within lesser Bounds: And such a Contrivance as this being requisite, the interposing of such a vast Distance betwixt the two Tables of the Skull, as we shall come to give an Account of, is a stupendous Piece of Mechanism.

As we before observed, in the Bottom of the Hole for the Root of the Trunk there are several *Laminae* (*b. b.*) to be seen. These *Laminae*, taking their Origin from hence, run backward in a parallel, and sometimes oblique Line, to the second Table of the Skull, or that Part of it which invests the Brain: And these *Laminae* being either horizontally, perpendicularly, or obliquely placed, meet with, and intersect each other, forming intermediate Cavities or *Cellules* (*d. d.*) of different Magnitudes, Positions, and Figures, according to the Intergerine Walls or Sides, whereof they are compos'd: So that altho' Dr *Moulins*, and after him *Tentzelius*, seem to assert, that they were for the most part triangular, yet I have observ'd them quadrangular, pentagonal, hexagonal, and rectangular, and even sometimes irregular. These Cells run, as I said, from the outer Table, or external Parts of the Skull (*a. a.*) to the inner Table or Seat of the Brain (*b. b.*) and communicate with one another by pretty large Holes, either toward the inner or outer Table, and sometimes two meeting together in the Middle, frame a third. In a word, as there is no certain Rule observ'd in their Figure, so neither is there any in the Communication. The Distance they fill up between the two Tables before is 11 Inches, at the Side 8 Inches, toward the Back-part but 3 Inches, and at the Hole for the Spinal Marrow (*o.*) both Tables meet together; for the Brain is placed in the Lower and Back-part of the Skull (*Fig. 66.*). All these *Cellules* were empty, and only obduced with a thin Membrane. And here I cannot but take notice of what Dr *Moulins* observes, namely, That there are several Blood-Vessels pleasantly disseminated throughout the Surface of these *Cellules* with different Divarications; and *Tentzelius* says, he observ'd several Linaments of Vessels after the same Manner. This was not to be observ'd in ours at all, nor so much as the *Vestigium* of a Vessel to be seen; the Reason whereof, I suppose to be this: When the one was burnt in *Ireland*, and the other overwhelm'd with Earth in *Germany*, both suffering violent Deaths, could not but have vast Strugglings and Wrestlings, such as Dr *Moulins* says his had, and such as *Tentzelius* supposes that in *Germany* to have had also. By these violent Motions, the Blood could not but be propell'd with a vast Force from the greater Trunks to the smaller Capillaries, where it distended the Vessels, and render'd them

Fig. 62.

Cellules of the Head.

Fig. 65.

so perceptible to the View after the Death of the Animal; whereas this we treat of, having labour'd of a languishing Distemper for some time, as appears by the *Polypus's* found in the Heart and other Vessels, the Blood could not but be very languid, and scarce convey itself to these Capillaries: So that the Sides of the Vessels being collaps'd, they were render'd imperceptible: But that which is more remarkable is, that not so much as any of the *Sulci*, which these Vessels might have made in the *Laminæ*, do at all appear; and yet the *Sulci* were still very evident in the Bones found in *Germany*, with the Blood-Vessels containing the dry Blood strictly glued to them, and chang'd into a yellowish Colour, and that perhaps after Thousands of Years, as the same Author observes. Indeed upon viewing more narrowly the *Cellules*, I find all of their *Laminæ* endued with small Holes of an indefinite Number, and irregularly placed, thro' which these Vessels seem to have pass'd from one *Cellule* to another: So that tho' not so observable, yet no doubt they have been dispers'd thro' them in this as well as in other *Elephants*.

Use of the
Cellules.

We come next to enquire what may be the Use of the *Cellules*. There have been several Opinions advanc'd about them; as, 1st. That since the *Elephant* has been observ'd to suck up a great deal of Water by the *Proboscis*, that the Water, perhaps, is received into these *Cellules*, because of the Communication they seem to have with the *Proboscis*, and that thereby they cool their Brain in hot Countries, where they abound. 2. That since the *Elephant* has a very acute Sensation of Smelling, they think the *Nervus Olfactorius* is dispers'd (after it has pass'd the *Os Ethmoides*) throughout the fine Membranes that obduce the *Laminæ*, which describe these *Cellules*. 3. That these *Cellules* being interpos'd betwixt the two Tables of the Skull, they only serve to keep the Head from being too weighty. As to the first; admit the Water could be receiv'd into these *Cellules*, which from their Position at the Root of the Trunk, 'tis plain they cannot, there being no muscular Substance to expel these Waters, we cannot suppose this is their Use. As to the second; the *Nervus Olfactorius*, after it has pass'd the *Ethmoides*, does not at all communicate with these *Laminæ*, but penetrates the *Os Vomeris*, whence the *Cartilaginous Septum* of the *Proboscis* arises: So that these *Cellules* can be no ways assisting for that End, the Sensation of Smelling being chiefly perform'd in the *Proboscis*, and not by the Fibres of the *Nervus Olfactorius* dispers'd in these *Laminæ*, which are quite otherwise dispos'd here, than in Men, Dogs, &c. whose *Laminæ Spongiosæ* are so situated in the Root of the Nose; so that the Air must touch them before it reach the *Os Cribrosum*; whereas here the *Laminæ* are so situated, that the Air touches the *Nervus Olfactorius* as soon as it can touch them. The third is to me more probable, and Dr *Moulins* is of the same Thought, and that upon several Accounts; such as the Consideration of the small Extent of the Seat of the Brain, to which had the rest of the Head been correspondent, it would

would have had no Proportion to the Body ; nor could the Muscles, fit for moving the Head, have sufficient Space for their Insertion, nor the *Proboscis* for it's Origin ; so that there was a Necessity for interposing some Distance betwixt the inner and outer Table of the Skull. Now this Distance must be fill'd up with some intermediate Substance, and had that either been carnous or osseous, whether spongy or solid, or (as some think the *Sinus Frontales, Maxillares, & Basilares* in human Skulls are) mucous ; should either of these have occupied such vast Bounds, the Head would have been render'd too weighty. Therefore it is wisely order'd by Providence, that there should be only thin *Laminæ* of Bones, so dispers'd, that the outer Table of the Skull may be more strengthen'd for supporting the Weight of the Muscles of the Head, lower Jaw, and *Proboscis* adhering thereto, that it may have a Communication with the inner Table, and that the Space betwixt these *Laminæ* may be empty ; lest by any intermediate Substance, the Head had been too heavy, as is said, and the inner Table so burthen'd as to press too much upon the Brain, which might have disturb'd the *Oeconomia Animalis*. Analogous to this Structure we find in Oxen, which have the same *Cellules* betwixt the two Tables of their Skull, especially toward the Horns, whose Flints, as they are call'd with us, or the bony Substance, whereby that Part of the Horn which is toward the Head, is fill'd, is likewise cellulous, lest by their Weight, together with that of the Horns, they should prove uneasy to the Head : But lest by reason of these Vacuities, which are all placed in the Upper and Fore-part of the Head of the *Elephant*, (for the Brain and *Elevatores Capitis* are sufficient to depress it's Back-parts) it should be render'd so light, that it could not be equally pois'd or kept steady, the Teeth, both in the upper and lower Jaw, are render'd thus weighty to counterballance it.

We come next to consider the inner Surface of the Skull, where the Brain is lodg'd ; 'tis in Figure like an Human one, but more spherical, being from the Right to the Left 10 Inches, from before to behind 9 Inches, and from above to below at the *anterior Fossa* 7 Inches, betwixt the Middle 5 Inches, and at the *posterior*, or Seat of the *Cerebellum*, 4 $\frac{1}{2}$ Inches. It has 4 *Fossæ*, and 5 Eminences. The *anterior Fossa* (*b. b.*) is circumscrib'd by the Fore-part of the inner Table of the Skull before, and by the two *anterior* Eminences (*c. c.*) behind. Here the Brain sends forth it's greatest Production ; for at the Hind-part this *anterior Fossa* is depress'd straight down near 2 Inches, where the *Os Ethmoides* begins, which is of a singular Figure and Structure ; for from the Fore-part of the Seat of the Brain in the Middle, there is here, as in most Skulls, an Eminence which runs obliquely downward, till it begins to form the *Crista Galli* (*d.*), so call'd in human Subjects. This *Crista Galli* divides the *Os Ethmoides* into it's right and left Part ; 'tis pretty thick and broad at the Base, whence it arises from each Side, till it begins to form a *Crena*, which is perforated by 3 Pair of Holes ;

Inner Surface
of the Skull.

Fig. 85.

and

Os Ethmoides.

and then there arises a small *Spina* in the Middle (*d.*) ; at the fore Extremity whereof, it being further extended than the *Ethmoides*, there is another Hole. From this *Crista Galli* run on each Side several prominent convex Lines, some obliquely forward, others obliquely backward, others transversely ; each of which is branch'd out twice or thrice toward the Circumference, which 'twas impossible to express very lively in so small a Figure. These Lines have some few Perforations running from their highest Part, but most of them are betwixt their Interstices, where they are pleasantly dispers'd after some Kind of Order, which also we could not express in the Figure. The *Os Ethmoides* is not unlike a Heart, as they usually represent it, being narrower at the Hind-part, where the *anterior Fossa* runs straight down from the Fore-part of the *Sella Turcica* (*u.*), and broader at the Fore-part of the Bone, which runs obliquely upward from it ; 'tis from before to behind $3 \frac{1}{2}$ Inches, and from the Right to the Left 4 Inches: It's Circumference is not altogether circular. The Speciality of this Structure gives Ground to enquire into it's Reason, and the acute Sensation of Smelling, wherewith, according to all Authors, this Animal is endued. In most of other Animals, neither is this *anterior* Production of the Brain so great, the Perforations of the *Os Cribrosum* so many, nor it's Extent so large : But in Animals of an acute Smelling, besides the Perforations of the *Os Cribrosum*, there are several spongy *Laminae* which arise from it's lower Part ; each whereof is endued with Tunicles, wherein are variously dispers'd several Branches of the *Nervus Olfactorius* ; and these *Laminae* are set very near to one another, as it were the Teeth in a Comb, or the *Lamellae* in the lower Part of some Mushrooms. Both the Contrivance of the *Laminae* and their thick Disposal, are very useful for Sensation ; for whereas had this *Nervus Olfactorius* been still in one Trunk, the Volatile Saline Particles would have only acted upon such Filaments as compose the Surface ; whereas the Nerve being variously dispers'd into divers Branches, and these Branches differently dispos'd into several Surfaces, 'tis capable to receive Impression from as many Saline Particles, as there are different Branches and Surfaces, whereinto these are dispos'd : Add also, that the sharp Edges of these *Laminae* being toward the Air, they are more capable to divide the *Columna Aëris* suck'd in by the Nose, and give a greater Tension to the nervous Filaments dispers'd in them ; whereby the Sensation is communicated the more lively to the *Sensorium Commune* ; and 'tis observable, that such Creatures as have most of these *Laminae* have their Smelling the more acute. Now this Structure is only to be seen in those Animals, whose *Septum Intermedium*, and two Sides of the Nose, consist of Bones, at least so far as their *Laminae* are extended ; but it fares otherwise with our *Elephant*, whose *Os Ethmoides* is very thin, and has no *Laminae Spongiosae* adhering to it's Outside, nor a Bone for the *Septum*, or Sides to guard these *Laminae*, which would have been inconvenient ; for then the *Proboscis* could not have mov'd with the same Facility, even from it's Root, as it doth. Therefore to supply

supply this Defect, and still to continue the smelling so acute, if not more in this than in many more Animals, 'tis provided, that the *anterior Fossa* should be very deep, that the Production of the Brain in it might be the greater; and lest it's Surface should still be too small, there should be eminent Lines both in the *Vomer* and throughout the rest of the Bone, that there might still be more Space for branching out the Nerve, as it proceeds from it's Origin. There may also be another Reason alledg'd for these Protuberances, *viz.* because the Brain is more pendent here than elsewhere, they may serve as so many Columns to support it, lest by it's Weight it should lean too much upon the *Os Cribriforme*, so that the Origin of the *Nervus Olfactorius* being too much press'd, instead of a clear, might afford a very confus'd Idea of Smelling, and, that even within the Skull it may be so divided and dispers'd in this Animal, as it is used to be without it in others: So that the Defect of the *Laminae Spongiosae* without, is supplied by this Diversity of Perforations and Eminences in the *Os Cribriforme* within. Indeed in Horses there is somewhat of this Structure to be observ'd: The *Os Cribriforme* seems to be proportionally as large; it's Perforations as frequent; and the *Laminae Spongiosae* without, both few and thin set; by which that Creature has but an ordinary Sensation of Smelling, and only such as is convenient for the Choice of it's Food; because the *Nervus Olfactorius* has not such a Space wherein to be dispers'd as the *Septum* and Cartilaginous Sides of the *Proboscis*; which is so great, that scarce can a Particle of any odoriferous Substance escape the touching of some one or other of the nervous Filaments: Whereas in Horses, there being but a short Space betwixt the *Os Cribriforme* and the Nose, the additional Surfaces of the *Laminae Spongiosae*, and the Tension of the Bone of the Nose on both Sides, otherwise than in the *Elephant*, who has no Bone there at all, are very convenient to supply that Defect; for the more extended a Nerve is, the greater is it's Sensation, and a Bone is fitter for Tension than either a Cartilage or other soft Substances are. The *anterior Fossa* (*b. b.*) is from the Right to the Left 8 Inches, and from before to the *Nervus Opticus* behind $4\frac{1}{2}$ Inches, and of Depth, *i. e.* straight down from the *Sella Turcica*, or in the Middle betwixt the foresaid Holes to the Bottom of the *Os Ethmoides* on each Side 2 Inches. The two middle *Fossae* are bound before by the two *anterior* Eminences (*e. e.*), and behind by the two *Processus Petrosi* (*s. s.*). The Seat of the Brain is here 12 Inches Diameter (*r. r.*). In the Center between the two *anterior* Processes is the *first* Pair of Holes (*f. f.*) at an Inch Distance. These run obliquely between two small Eminences, where the *Glandula Pituitaria* was lodg'd, call'd the *Sella Turcica* (*u.*); and these two Processes are call'd in human Subjects *Clinoides*. This Pair of Nerves runs obliquely downward 6 Inches, and passes out below the *Lamina* on each Side of the Head (*s.*) which frames the upper Edge of the *Sinus* for the Globe of the Eye, being the second Pair, call'd the *Optick Nerves*. These two

Anterior Fossa of the Skull.

Fig. 85. Middle Fossae.

First Pair of Holes.

Fig. 63. Processes

Second Pair. *Processes* running $\frac{1}{2}$ Inch back on each Side, at the same Distance afford two more Holes passing in below them, which could not be shewn in the Figure; this is call'd the *Foramen Lacerum*, and thro' it pass the *third Pair*, or *Oculorum Motorii*; the *fourth Pair*, or *Pathetici*; the *Ophthalmick*, or *first Branch* of the *fifth Pair*, and all the *sixth Pair* (*g. g.*). The *third Pair* of Holes is at the Back of the two *anterior Eminences*, betwixt the first Pair and the external Part of the Seat of the Brain 4 Inches distant from each other (*b. b.*). They are the largest of all those in the Bottom of the Skull, except that for the Spinal Marrow, and have a peculiar Use, which I mentioned before, *viz.* that they are for the Transmission of the *superior Branch* of the *second Division* of the *fifth Pair* of Nerves, and a Branch of an Artery which proceeds from the *Arteria dura Matris* (*k. k.*); being separated from it by the bony *Septum* which passes betwixt it and the Hole for the *third Branch* of the *fifth Pair* (*i. i.*), runs along the *Crena* (*x. x.*), and passes out with the foresaid *second Branch* (*g. g.*). The *fourth Pair* of Holes then is for the Egress of the *third Branch* of the *fifth Pair* (*i. i.*) and Ingress of a Branch from the *Arteria dura Matris*; and the *fifth pair* is for the *Arteria dura Matris* itself (*k. k.*). The *sixth Pair* is for the Carotid Artery (*l. l.*), which is otherwise situated here than in Human Subjects; for in them it is betwixt the *Processus Petrosus*, and two *posterior Processus Clinoides*; whereas here 'tis betwixt the *Processus Petrosus* and Center of the Base of the Skull, to each Side about 3 Inches distant from each other. The *seventh Pair* is for the *Nervus Auditorius* (*m. m.*), being situated in the *Processus Petrosus* (*S. S.*). And here 'tis observable, that from the Side of the Hole where the Carotid Artery (*l. l.*) passes toward the *Os Petrosum*, there is an Hole which runs about $1\frac{1}{2}$ Inch outward, forms an Angle, and then passing by the Sides of the *Cavitas Tympani* (*e.*) runs straight downward and penetrates the Skull (*l.*). This I take to be the Hole for the hard Portion of the *Nervus Auditorius*, which does not here, as in other Animals, pass in at the Hole of the *Processus Petrosus* with the soft Portion; but as it proceeds from the Brain, goes along the Sides of the Carotid Artery to this Hole. This hard Portion, as I said before, was much bigger as we traced it running forward above the Temporal Muscle, and going to the upper Lip to be afterward dispers'd in the *Proboscis*. The *eighth Pair* is for the internal Jugular Vein, and *Par Vagum*, which passes out at the same Hole (*n. n.*). And the *ninth Impar*, is for the Spinal Marrow; of which already. And thus we have given an Account of all the Parts of the inner Surface of the Skull.

Eighth Pair.

A Hole for the Spinal Marrow.

Of the Ear, n. 358. p. 885.

In order to give a better Account of the *Ear*, I have now broke up the *Os Petrosum* of the Right Ear: But I first observe that the *Auris Externus* of this big Creature lies flat, and not protuberant as in other Quadrupeds, whose Cartilaginous Substance is capable of divers Motions perform'd by several Muscles, whereby the inner Ear is preserv'd from the great Violence of the external Air, which upon some

some Occasions might, perhaps, injure or break the thin and delicate Membrane of the *Tympanum*. It is also for this Reason that the *Meatus* is further guarded, by the Contortions and oblique Position of the Cartilage at the Orifice of the *Meatus*, which only admits of a determinate Quantity of Air, sufficient for the Vibration of the *Membrana Tympani*, by which a distinct Sound is conveyed to the *Sensorium commune*; whereas did the Air admitted exceed it's due Proportion, nothing but the confused Idea of a Sound would follow, such as resembles the rushing of Water, &c. or that Noise often observed, when, by a supervenient Cold, or the like, Obstructions are generated within the Ear itself. And in Man, because the *Auris Externus* is also flat, not only are these Turnings and Windings observable in the Cartilage at the Entry, but the *Meatus* itself is likewise obliquely situated, to prevent the aforesaid Inconveniencies. But there is no Need for such a Contrivance in the *Elephant*, whose external Orifice of the *Meatus* is patulent, open (scarce being guarded by the Cartilage) and straight, whose Length (it reaching from the external to the internal Table of the Skull) is sufficient to prevent the Accession of too great a Quantity of Air to the *Tympanum*; for in it's Progress most of the *Columnæ Aëris* beat against one or other of the Sides of the *Meatus*, insomuch that their Force is inhibited, and only so many as suffice to convey the Sound, can reach the *Tympanum* itself.

The *Meatus Auditorius* then is a long straight Tube or *Canule* situated horizontally, and reaching from the outer to the inner Table of the Skull, in Figure not unlike the Barrel of a Pistol, but somewhat oval, the Sides of whose Cavities are hard and solid, about the Thickness of a Half-penny, from whose outer Part several of the *Laminæ* betwixt the 2 Tables of the Skull do arise (Fig. 71.). It's Cavity is an Inch, or $\frac{3}{4}$ of an Inch Diameter, and Length $9\frac{1}{2}$ Inches; being somewhat enlarged as it arrives at the *Crena* for the *Membrani Tympani*. (Fig. 72.)

Meatus Auditorius.

Fig. 71.

Fig. 72.

This *Crena* is 2 Inches in Circumference, within which is the *Cavitas Tympani*, consisting of two different Surfaces; the one much deeper and cellulous, the other more superficial and smooth. The first runs perpendicularly down $\frac{1}{2}$ Inch from the *Crena Tympani*. It's Bottom is variously divided into several *Cellules*, not unlike a Honey-Comb, but irregularly disposed. It's bony *Laminæ*, by which these *Cellules* are distinguished from each other, are thicker at the Top than at the Bottom, they being 1 Line, 2 Lines, or $1\frac{1}{2}$ Line distant from each other, and about $\frac{1}{4}$ Inch deep. Could I have got it so well cleansed as I wished for, doubtless I might have observed their Communication with each other, by means of certain Orifices which serve to convey what superfluous Moisture is contained in them; for we may reasonably suppose, as in all other Cavities of the Body, there are certain Glands for separating proper Liquors convenient for the Uses designed; so here there seems to be a Necessity for separating a certain Quantity of Moisture, fit to lubricate the Muscles of the *Offices*, and facilitate their Motion;

Crena and Cavitas Tympani.

as also to preserve the *Membrana Tympani* from becoming too dry. This Dryness of the *Membrana Tympani*, and the Thickness of the Liquor separated by these Glands, is often the Cause of a Deafness in Human Subjects; especially those that are advanced in Age. This cellulous Structure of the *Cavitas Tympani*, seems to be very proper for receiving of the superfluous Humidity; and these Communications are requisite for conveying it from one Cellule to another, till it is emptied into the *Receptaculum Commune*, the *Aqueduct*, whereof hereafter.

Fig. 72.

This first or cellulous Cavity is two Inches broad, and reaches from the *Crena Tympani* to the *Foramen Ovale*, or Entry into the *Vestibulum*, which is shut by the *Stapes*. The second Part of this Cavity is more superficial (*Fig. 72. e.*), in Form not unlike a Pear from a narrow Beginning becoming broader and more superficial, terminating semicircularly, smooth in the Bottom, and having several incurvated Lines running across it; it reaches much farther than the *Vestibulum*, being one Inch five Lines from before to behind, and one Inch transversely where broadest. What superfluous Moisture it contains is discharged into the fore-named *Aqueduct*.

Beside the above-mentioned Uses for these two Cavities, *viz.* to receive and discharge the superfluous Moisture, they are also most beneficial and assisting to the Hearing: For, no sooner is the external Air modulated, and the *Membrana Tympani* moved thereby, than the Sound is conveyed by the *Ossicles* to the *Nervus Auditorius*, and the Undulation continued, first by the *Anfractuosities* of the first Cavity, and then by the *Gyres* and incurvated Lines of the second; so that we may easily account for the acute Sensation of Hearing, wherewith *Elephants* are said to be endowed: For as the tame ones are most exact in obeying their Masters Commands; so the wild ones are soon aware of what Traps or Snares are laid to catch them, by the tremulous Motion conveyed to their Ear from the cavous Parts of the Earth, where the Pit into which it is expected they should fall, is digged. It is easy therefore to explain whence the Acuteness of the Sensation of this Animal may proceed; for as the *Nervus Olfactorius* has a large Space and Bounds wherein to be dispersed, *viz.* the two Cavities of the *Proboscis*, which are both long and large, so that scarce any *Columna Aëris* can enter them, but some one or other of the Filaments of the *Nervus Olfactorius* dispersed in these Cavities must be touched, whereby the Idea of Smelling must be conveyed to the *Sensorium commune* in a more intense Degree, and the Animal soon become sensible of whatever approaches that is noxious or nauseous to it, and thereby is taught how to avoid it; so this Structure, for a quick Conveyance and long Continuance of the Sound, is a great Means both to make the *Elephant* soon receive the Sound, and have a deep Impression of it.

The Aqueduct.

The *Aqueduct* is a flat Tube or Pipe, whose Orifice is so situated betwixt the two fore-mentioned Cavities, that if there be any superfluous Humidity contained in them, it must need be discharged (at least in

in this Animal) into the Mouth; for as it is situated where the first Cavity terminates, so the second, from a broader and more superficial Beginning, must needs discharge it's Moisture, by it's more narrow and deeper Termination, into this Receptacle; also it descends directly towards the Mouth, passing through the Skull below the Hole for the Jugular Vein (*m. m.*) betwixt the Hole for the *Carotid Artery* (*p. p.*), and that for the *Arteria duræ Matris* (*q. q.*), whence descending (*n. n.*) it is joined with it's fleshy Part, which discharges itself into the Mouth on each Side, behind the back Part of the inner Teeth of the upper Jaw. This Situation of the Aqueduct makes it plainly appear, that it's Use is to receive the superfluous Moisture from the *Cavitas Tympani*; for besides the Glands above-mentioned, fit for separating such a Quantity of Humidity as may lubricate the Muscles, and facilitate both their Motion, and that of the *Officles*; the very Vapours that arise in such a Cavity as that of the *Tympanum* in this Animal, must at last be converted into a Liquor, and that must either again be received into the Blood Vessels, or otherwise discharged by such a Receptacle as this. Further, if there be a Necessity for Glands in the *Meatus Auditorius* without the *Tympanum*, to separate a certain Liquor, by which the acrimonious Particles of the Air are obtunded and hindered from being offensive to the Nervous Membrane of the *Tympanum*, (which must be of a most acute Sensation) and for moistening it, by which it the more easily receives the Vibration of the Air; so such Glands as these seem to be requisite in the *Cavitas Tympani* for the Uses above-named. And since what superabounds of this Moisture, cannot be discharged outwardly, as that of the *Meatus*, this Aqueduct seems to be most convenient for that Purpose. Some are of Opinion that this Aqueduct is also assisting to the Hearing, especially in Men; because it is generally observed that they who are deaf, open their Mouths wide, when they are desirous to hear more distinctly; but I see not how that can be; for tho' the Cavity of the bony Part of the Aqueduct, in most of Animals, is proportionally large enough, yet it's carnosous or fleshy Part lies for the most Part so flat, and it's two Sides are so collapsed together, that scarce any Air can be admitted, at least so far as to be subservient to the Hearing.

Fig. 64.

The *Officles* in this, as in other Animals, are three, or rather four in Number; for though I did not procure the *Os quadrangulare* of *Du Verney*, yet I have good Reason to believe it was there; because there is a conspicuous *Sinus* in the Extremity both of the *Incus* and *Stapes*, where they are articulated, so big as to contain the Head of an ordinary Pin; and when I consider the Angle which must have been formed by the Articulation of these two Bones, I look upon this small Bone to serve for the same Purpose as the *Patella* in the Knee, and *Sesamoide* Bones in the Fingers and Toes.

The four
Bones of the
Ear.

The *Malleolus* is an irregular Bone, and doubtless has been endowed with pretty large Muscles, because of the Rugosities, Protuberances, and *Sinus*'s observable in it. It has a protuberant Head (*Fig. 74.*)

The Malleo-
lus.

(1), four Lines broad, next to that a *Crena* or semicircular *Sinus* (2), after which the Bone is raised, affording a protuberant Margin to an oblong *Sinus* (3), for receiving the Head of the *Incus*, four Lines broad. The opposite Part of this *Sinus*, or back Part of the Bone, is convex, of an unequal rugous Surface, with a great many Protuberances and Depressions, for the Origins and Insertions of the Muscles, for the Space of five Lines; where it forms an Angle, from whence it becomes flat and smooth, being three Lines broad, and reaching four Lines to another Angle (5), where the *Manubrium Malleoli* begins, and where it becomes more round; from whence it gradually tapers to the Point, being six Lines in Length.

Fig. 75.

The Head of the *Incus* is four Lines broad (Fig. 75) (1), below which is the Neck or an oblique *Sinus* (2); next to that are two *Apo-physes* (3. 3.), one on each Side: These descending obliquely outwards, and becoming flat, meet in a Point (Fig. 77.) (5), whence ascending obliquely inward, this Production is joined to another small round one, like the *Manubrium Malleoli* $4\frac{1}{2}$ Lines long (6). This has the fore-mentioned small Excavation or half-round *Sinus* (7), which with the Extremity of the *Stapes*, I suppose to have contained the *Os Quadrangulare*, or rather *Orbiculare*, according to the Figure of the *Sinus*.

Fig. 76.

Fig. 77.

The *Stapes* differs much in Figure from the human one. From it's concave Extremity 'tis enlarged on each Side by two small slender Productions, not unlike the Processes of the *Vertebrae* of some Fishes (Fig. 76) (2. 2.), to which is joined the *Basis* (Fig. 77.), so thin almost as the Scale of a Fish: This was accidentally separated from it's two Sides, and remained in the *Foramen Ovale*, from whence I pulled it with a Pin: 'Tis Concave toward the *Stapes*, and convex toward the *Vestibulum*.

The *Foramen Ovale* lies so hid and obliquely in the Side of the *Cavitas Tympani*, that it could not be delineated in it's true Dimensions. Near to it is another Hole, oblong and sharp at both Ends, both which give an Entry into the *Vestibulum*.

Fig. 82.

The *Vestibulum* is of an irregular Figure (Fig. 82.) (a); 'tis for the most part three Lines from the one Side to the other, and perforated by eight Orifices, viz. five for the Canals of the *Labyrinth* (Fig. 81, 82.)

Fig. 81, 82.

(a), one for the *Cochlea* (Fig. 82.) (b), and two for the *Fenestrae* (b. c.).

Fig. 84.

The *Cochlea* is a long Cavity, consisting of three *Gyres* or *Meanders* (Fig. 84.) (d, e, f.) It's Orifice, where it proceeds from the *Vestibulum*, is but small: but it afterwards widens, so that the first Course of this Cavity is a third Part larger than the second (e), and proportionally the third is less than the other two (f), 'till it terminates in an Orifice (g) situated in the Top, for receiving a Branch of the soft Portion of the *Nervus Auditorius*, which accompanies and passes along all it's *Gyres*.

The Hardness and Solidity of the Bone (for which it may justly be called *Os Petrosum* in this Subject) was such, that I could not so exactly trace the three Canals or Ducts of the *Labyrinth*, so as to give a true Idea of the Manner of their several Turnings. But *Valsalva's* Figures of the Human

Human

Human Ear directed me so exactly, that I easily found out the several Orifices, and opened them so far as to find out the Situation and true Dimensions, by introducing a Hog's Bristle, then cutting it off, and stretching it out to the Scale. Thus, after laying open the two *Foramina* which gave an Inlet to the *Vestibulum*, I soon perceived the several Orifices, which, in so large a Subject, were pretty conspicuous. I first turned to the one Hand, and discovered the *Duct* of the *Colchea*; this I pursued all along the Protuberance (*Fig 73.*) (*d*), in doing of which, I laid wholly open the *Lesser Duct* of the *Labyrinth* (*Fig. 81, 82.*) (*d*): Then turning up the other Side of the Bone, I traced the soft Portion of the *Nervus Auditorius* divided into two Branches, one whereof was distributed into the *Colchea*, and the other to the *Labyrinth*. In filing the Bone a little farther, I opened a small Part of the *Middle Duct*, and in a short Time I discovered the *Ductus Major*; after which I measured their several Lengths, as is said.

Fig. 81, 82.

The *Labyrinth* then consists of three *Lineæ Semilunares* or incurvated *Ducts*, whereof the *Major* lies in that Part of the *Processus Petrosus* which regards the Seat of the Brain (*b*); this is twenty Lines, or one Inch eight Lines long. The *Medius Ductus*, one Part whereof regards the Orifice of the *Cochlea*, and the other is common with the *Major* for the Space of three Lines (*e*); this is fifteen Lines, or one Inch three Lines long: And the *Minor*, which regards the *Cavitas Tympani*, has one Orifice, which is near to the *Medius*, where it approaches the *Cochlea*, and the other near to the Orifice of the *Major*; this is one Inch long.

The Labyrinth.

Fig. 81.

The *seventh* Pair of Nerves, called in general the *Nervus Auditorius*, enters the *Processus Petrosus*, and is divided into the hard and soft Portions, as in other Animals. In this Subject I find one Canule entering the Bone from the Sides of the Orifice for the *Carotid Artery*, about three Lines Diameter (*e*) (*b*), from thence running forward for the Space of one Inch four Lines; then bending downwards one Inch, 'till it meets with the Orifice at the Sides of the *Meatus Auditorius*, by which it pierces the Skull, and passes outward. This Canule, after it is entered the *Processus Petrosus* for the Space of eight Lines, communicates with the Orifice, which usually enters the foresaid Process from the Base of the Skull: And both these Orifices, after they have accompanied one another about five Lines, are separated, and the soft Portion penetrates the Bone at two Places, as is said.

Fig. 74, 75.

I have now endeavoured to give such a Description of the *osseous* or bony Part of the Ear of this stupendous Animal, as I am in hopes may be useful for the clearing up of some *Phænomena* in lesser Subjects: At least we may hereby observe, what a Variety of Mechanism the great Author of Nature has thought fit to employ, in the several Parts of different *Species* of Animals. Thus both the external Ear of *Man* and of the *Elephant* lie flat, as being most convenient; for if they had been protuberant as in most *Quadrupeds*, how unsuitable would it have

have

have been in Man, who is the most perfect of all Creatures, not upon the Account of his Reason alone, but also as he is a Pattern for Beauty and the Symmetry of his Parts? and how unseemly would it have been in the *Elephant*, if his external Ear had stuck out, and been proportional to his other Parts; considering what an extraordinary Aspect he makes already by his Trunk and Tusks? but the Ears in these two Subjects differ by the Tortuosity of the Cartilage, and oblique *Meatus*, to prevent the Injury of the Air, by it's immediate Access into the inner Ear in Man; whereas in the *Elephant* the external Orifice is fully exposed to the Air; but then the Length of the *Meatus* hinders any more Air than is convenient from arriving at the *Tympanum*. We likewise see in the *Seal* and *Otter*, that those two amphibious Quadrupeds have no external Ear further protuberant than the other Parts of their Head; for had it been otherwise, their swimming and diving would have been much hindered: But it's two Sides are so collapsed, that no Water can enter in when in the deep, though it can receive sufficient Air when ashoar. The *cellulous* Cavity of the *Tympanum* in the *Elephant*, may well be compared to the *Apophysis Mastoides* in Man; and the second Cavity of a plain Surface seems to be analogous to the cavous *Mastoides* in *Sheep*, *Cats*, *Dogs*, &c. So that we see that whereas other Animals have but one Cavity for assisting the Vibration of the Air, and Continuation of the Sound in the *Tympanum*, this Animal has two, or a large one with two different Surfaces. The *Aqueduct* both by it's Figure and Position in this Animal does plainly shew us the Use of it in other Animals, which is to receive the superfluous Humours in the *Tympanum*, and convey them to be discharged in the Mouth.

n. 327. p. 126.

From the Head we go to the *Trunk*, which consists of the Spine, Ribs, and *Sternum*. The *Spine* is divided into the *Vertebrae* of the Neck, Back, Loins, *Os Sacrum*, and *Tail*. The *Vertebrae* of the Neck differing from each other in several Things material, I shall speak of them separately: Whereof,

The first Vertebra of the Neck.

Fig. 93.

Fig. 93.

The first called *Atlas*, has four considerable Cavities; two at the fore-part (*b. b.*), whereby it receives the *Condyles* of the Skull, and two at the back-part (*c. c.*), whereby it receives the Base of the following *Vertebra*; the first two are $2\frac{1}{2}$ Inches from above to below, and 2 Inches from the right to the left. It has a large Hole in the middle, divided into it's larger Part (*a.*), 3 Inches Diameter, which is for receiving the Spinal Marrow, and lesser, which receives the Tooth of the following (*b.*). Four Perforations, or two Pair of Holes at the Sides; one at it's lower and fore-part (*c. c.*), which receives the *Arteria Cervicalis*, or, *Vertebralis* from the Side of the Spinal Marrow, and conveys it to a *Crena* (*e. e.*) along which it runs, till it again penetrates the same Bone (*d. d.*), and goes out at the back-part; after which in it's Progress it perforates all the transverse Processes of the rest of the *Vertebrae* of the Neck, as is usual in other Animals. This *Crena* is guarded on it's Outside, or at the Extremity of the transverse Processes by a Protuberance,

rance, which runs toward the Skull $\frac{1}{2}$ Inch (*a. a.*) till it be equal to the Sides of the Hole for the Spinal Marrow. At it's upper and fore-part it inclines obliquely (*f.*) where 'tis 3 Inches thick, and at it's lower and back-part (*e.*) it has a Protuberance which is extended where it embraces the Tooth. This *Vertebra* is in Diameter 12 Inches (*a. a.*) The transverse Processes are in Breadth from above to below 2 Inches, and in Length at their lower Part 3 Inches.

Fig. 94.

The second *Vertebra* has remarkable in it, 1st, a large Protuberance called the Tooth (*d.*), which is received by an Hole in the former, and serves as an Axis upon which the Head is turned round. This Tooth runs forward from the Body of the *Vertebra* 2 Inches above, and $2\frac{1}{2}$ Inches below, tapering and terminating in an obtuse Point. 2. A large Protuberance arising from it's upper and middle Part (*a. a.*) like the *Processus Spinosus* in others, 4 Inches from the Beginning of the transverse Processes, two Inches broad at the Top, terminating in two obtuse Points, with a *Sinus* (*b.*) (larger at the back than the fore-part) in the middle. This Protuberance inclines forward toward the first *Vertebra*. 3. It's Body or back-part, and Base of the Tooth (*f.*) transversely $4\frac{1}{2}$ Inches, perpendicularly 4 Inches. 4. Two oblique Processes, by which 'tis articulated with those of the following, and betwixt which there are four Inches (*b. b.*) 5. Two transverse Processes (*g. g.*) each 2 Inches long. At it's fore-part on each Side of the Tooth (*d.*) are two Protuberances (*e. e.*), which are received by the two hind Cavities of the first *Vertebra*. This *Vertebra* is two Inches thick from before to behind, the Hole for the Spinal Marrow 2 Inches Diameter, those for the Cervical Artery (*f. f.*) $\frac{1}{2}$ Inch Diameter. Between the oblique and Extremity of the transverse Processes 'tis 6 Inches.

The second.

Fig. 96.

Fig. 97.

Fig. 96.

The third and fourth *Vertebrae* differ from this, 1st. In their four oblique Processes (*e. e.*) viz. two by which they are articulated with the preceding, and two with the following, which is common to those of the Neck, Back and Loins. 2. In their convex Body before (*b. b.*) and concave behind (*c. c.*), where they are received by, and do receive the preceding and following, which is also common to the other *Vertebrae*. 3. In their Eminencies at the Top (betwixt the oblique Processes) at $4\frac{1}{2}$ Inches distance (*e. e.*), betwixt which there is a Depression in the third, and a small Protuberance in the Midst of this Depression in the fourth. That transverse Processes (*f. f.*) are 2 Inches broad at the Extremity, from which they descend obliquely 3 Inches, having a Protuberance on each Side, betwixt which and the Body of the preceding *Vertebra* (*b. b.*) does proceed a Branch of the Cervical Artery, which it continues to do from betwixt all the other *Vertebrae* of the Neck, till it comes to betwixt the seventh of the Neck and first of the Back, where 'tis wholly spent. Betwixt the oblique Processes (*e. e.*) and transverse (*f. f.*) it is 4 Inches. The Hole for the Cervical Artery (*d. d.*) is here oval. The Bodies of these *Vertebrae*, are thinner below than the former: They are four Inches in

The third and fourth *Vertebrae*.

Fig. 98, 100.

Fig. 109.

Dia-

Diameter, being of the same Dimensions with all the other *Vertebrae* of the *Spine*, 'till you come to the *Os Sacrum*. Those in the Neck are more flat before, and those in the Back more protuberant. Besides those *Sinus's* in the Inside of the forementioned Protuberances in the Neck, there is likewise a *Sinus* betwixt the tranverse Processes of each *Vertebra* and it's Body, throughout the whole *Spine*, for Transmission of the several Conjugations of Nerves from the Spinal Marrow.

The fifth.

Fig. 102.

The fifth *Vertebra* is of the same Dimensions with the other two, and differs in nothing from them but it's Spinal Process, which from $\frac{1}{2}$ an Inch in the former, arises to $1\frac{1}{2}$ in this, being $\frac{1}{2}$ an Inch broad, and thin at the Extremity.

The sixth.

Fig. 104.

Fig. 109.

The sixth *Vertebra* differs from all the rest in it's tranverse Process, which is as far forward as the rest, and sends out another Process, which runs as backward; so that from the Extremity at the fore-part to that at the back-part, 'tis 3 Inches. It also sends another Protuberance obliquely outward $1\frac{1}{2}$ Inch (*i. i.*). At this Process the Cervical Artery passes out from the tranverse Process of the *Vertebra*, and only sends a Twig to the

The seventh.

Fig. 106, 107.

Seventh *Vertebra*, or last of the Neck, which differs from all the rest; 1st, In the Length of it's Spinal Process, which is augmented from 3 Inches in the former to 5 in this (*g. g.*). 2. In the Smallness of the Hole for the Cervical Artery (*d. d.*), this being the last perforated tranverse Process, as is said. 3. In a *Sinus* on each Side of it's Body behind (*i. i.*), whereinto it receives Part of the first Rib.

The Thorax.

The *Thorax* is divided into the *Vertebrae*, Ribs, and *Sternum*: There are 19 *Vertebrae*, correspondent to so many Pair of Ribs; they differ nothing from the former, except that their Body is more protuberant, that their Spinal Processes are augmented and diminished in their Length, according to their Situation, and that they have a *Sinus* in each Side, both before and behind, for Reception of their respective Ribs. For the Weight and Dimensions of their Spinal Processes, see the Table.

Ribs.

The Ribs are divided into the true (which are articulated with the *Sternum*) and false ones, with and without Cartilages. There are 8 Pair of true Ribs, 8 Pair false with, and three without Cartilages. The Cartilages here are soft, as in Human Subjects, and not bony, as in Oxen, Harts, &c. The Length of both the Ribs from the one Extremity to the other, and along their inner Surface, that you may the better know how much they are bended, with their Breadth at the Extremity and Weight of each Pair, shall be given.

Sternum.

The *Sternum* consists of four Bones; they are placed edgewise, being two Inches thick above, and sharp below: From the Fore-part to the Point of the *Cartilago Ensiformis* 'tis 25 Inches; whereof the first is 88 Inches long, and $4\frac{1}{2}$ Inches broad at the Articulation of the first Rib; the second $4\frac{1}{2}$ Inches long, and 3 Inches broad; the fourth 4 Inches long,

long, and $2\frac{1}{2}$ Inches broad; the rest of the Length is made out by the *Cartilago Ensiformis*.

The *Loins* consists of three *Vertebræ*, whose Spinal Processes are but short; their transverse Processes a little longer than those in the Back; which beside their Weight, (for which see the Table) is all that is material about them.

The *Os Sacrum* consists of five Bones; they are of a flat Surface before (B) each having three Processes (*viz.* two oblique, and one spinal, under which the spinal Marrow descends) behind. They are perforated before by 4 Pair of Holes, placed at their Interstices on each Side. It is 12 Inches long, and $7\frac{1}{2}$ broad, where 'tis articulated with the *Ossa Innominata* above, and 6 Inches broad at the lower Part See Fig. 110. and 111.

The *Vertebræ*
of the *Loins*.

Os Sacrum
Fig. 110.

The *Tail* consists of twenty-nine *Vertebræ*, whose Differences are to be seen in the Tables. From the *Os Sacrum* to the Eighth they have five Processes, *viz.* two transverse, two oblique, and one spinal, under which the spinal Marrow descends, sending forth a Conjugation of Nerves from betwixt each of them. From the eighth to the sixteenth, each has 4 Processes, *viz.* two longitudinal behind, betwixt which the Remainder of the spinal Marrow still descends, and two transverse: The rest have no Process at all, but are of a Kind of quadrangular Figure, having a Ridge which descends before and behind, and on each Side; being somewhat bigger at each End, and smaller at the Middle. All the *Vertebræ*, as well in the Neck and Back, as Tail, had Cartilages, which run betwixt each of them; they were about $\frac{1}{2}$ Inch thick in the Back, thinner in the Neck, and thicker proportionably in the Tail. These Cartilages I was obliged to supply with Leather in mounting the Skeleton.

The *Vertebræ*
of the *Tail*.

Since this is a Quadruped, we shall divide the Extremities into the Fore and Hind ones. We begin the fore Extremities at the *Scapula*, which is usually divided into it's Head, Neck, *Spine*, Processes, fore and hind Cavities, (*i. e.* these Parts before and behind the *Spine*) it's concave Part, which lies upon the Ribs, and it's convex or outer Part, and it's Margin. The Head (*a*) which receives the *Os Humeri*, is oblong, (because the Motion of the *Humerus* perform'd by this Animal, is rather Flexion and Extension, than Adduction or Abduction;) wherefore the Cavity being $5\frac{1}{2}$ Inches long, is only $3\frac{1}{2}$ Inches broad, and the Margin of the Bone arising from the Fore and Back-part (*b. b.*) makes it two Inches deep; for at the Sides, the Margin is equal to the Cavity. At the Back-part there are two Processes; that which regards it's convex Part is 2 Inches long, rugous, thick and obtuse; that which regards the concave, runs two Inches backward, where it forms an obtuse Angle; whence it ascends 3 Inches to the Neck: This has a sharper Edge than the former, being somewhat incurvated. Betwixt these two Processes is a rugous *Sinus* two Inches broad, ascending from the Cavity of the Head 3 Inches to the Neck, and rising somewhat in the

The *Fore Ex-*
tremities.
The *Scapula.*
Fig. 108.

Middle of it's Progreſs. The Neck (*c. c.*) is flat, being more obtuſe at it's Back-part, and where is the laſt nam'd Protuberance, and ſharper at it's fore, where is a little Protuberance toward the *Spina* on the convex Side, being more plain on the concave. Betwixt the firſt of the fore-nam'd Protuberances (*b.*) and the *Spina*, there is a *Sinus* which aſcends 4 Inches (*d.*), and from the ſame Protuberance (*b.*) to the Extremity of the *Proceſſus Coracoides* (*e.*) is $3\frac{1}{2}$ Inches. This *Proceſſus Coracoides* is that Part of the *Spina* (*e.*) which runs toward the Neck of the *Scapula*, but does not, as in Men, defend the *Humerus* from Diſlocation. 'Tis very rugous and convex before, but concave at it's Back-part, being $3\frac{1}{2}$ Inches broad at the Point, it aſcends 11 Inches, where 'tis raiſed 5 Inches from the Body of the *Scapula* (*f.*), it inclines a little backwards and aſcends 12 Inches more, till it be loſt where the *Epiphysis* begins (*g.*) being ſtill concave at the fore, and convex at the Back-Part. From the *Spina* (*f.*) it ſends forward a Production 8 Inches long (*h.*), 3 Inches broad at it's upper Part, two Inches about the Middle where 'tis crooked, and $1\frac{1}{2}$ Inch at it's lower Extremity where 'tis thin and ſharp; but at it's upper Part thicker and rugous, concave at the inner, and convex at the outer Side. This Proceſs ſerves to keep the *Musculi supra-spinati* within their Bounds, when they pull up ſuch a vaſt Weight as the fore Leg. As the *Spina* runs up 5 Inches from this Production, 'tis rugous and thick in it's Edge, from thence it becomes gradually thinner till it comes to the *Epiphysis*. The back and upper Part of the *Scapula* is very thin, and ſharp from the Neck (*c*) 16 Inches upward to (*m.*), from thence it aſcends 5 Inches to the Place where the *Spina* ends, and forms a very rugous and ſpongy *Epiphysis*, thick at the upper End (*l.*), thence it deſcends obliquely two Foot (*i.*), whence it's fore Edge runs obliquely in toward the Neck 10 Inches, being ſharp; thence it tends outwards and deſcends other 5 Inches till it comes to the Neck. All the upper Part of the *Scapula* from (*m*) to (*l.*) where 'tis thickeſt. and from (*l.*) to (*i.*) where 'tis thinner, except towards it's lower Part, is cover'd with an *Epiphysis* (as is ſaid) ſpongy and rugous, which ſeparated by the Boiling, is a further Argument that this Animal was young, according to their Term of Life; 'tis otherwiſe a very thin Bone and ſolid, except where the *Epiphyses* are.

The Humerus. The *Humerus* is a very irregular Bone; it's Head is in Circumference 2 Foot, having two remarkable *Epiphyses*, one whereby is articulated with the *Scapula* from before to behind, with a convex Surface 8 Inches, and from the Right to the Left $4\frac{1}{2}$ Inches, and another on the Outside riſing higher and ſharp about $1\frac{1}{2}$ Inch. Round this *Epiphysis* is 11 Inches, and from before to behind with a flat Outside $6\frac{1}{2}$ Inches. Betwixt the *Epiphysis*, which receives the *Scapula*, and this Protuberance is a *Sinus* about $3\frac{1}{2}$ Inches broad, and about $1\frac{1}{2}$ Inch deep; as it deſcends toward the Inſide it becomes deeper, and only 2 Inches broad: 'Tis for lodging the external Tendon of the *Biceps*, analogous
to

to a *Crena* for the same Purpose in human Subjects. The Neck of the *Humerus* is in Circumference 19 Inches, flat behind for the Space of 4 Inches; then forming an Angle and running obliquely outward 3 Inches, then passing forward below the utmost Protuberance 5 Inches, thence crossing the forenam'd *Sinus*, it runs back, first flat, then a little convex, 7 Inches. Below this outward Protuberance there is a Rugosity for the Infertion of the *Flexores Cubiti* $6\frac{1}{2}$ Inches long, and $3\frac{1}{2}$ Inches broad at the upper Part, and thence descending gradually, it terminates in a Point. At the lower Part of this Rugosity, the Bone is $13\frac{1}{2}$ Inches in Circumference, having 3 Faces; one at it's Back-part 5 Inches broad, somewhat depress'd from the Inside, then a little protuberant, as it tends outward; a second on the Outside, and 4 Inches broad; and the third on the Inside, $4\frac{1}{2}$ Inches broad, flat also. Here begins another considerable Rugosity, small and oblique from the Back-part of the utmost Protuberance of the *Humerus*, and becoming very rugous at this Place, continuing 6 Inches obliquely downward, and 2 Inches broad about the Middle. At the lower Part of this Rugosity the Bone is 18 Inches in Circumference, with it's three Faces otherwise disposed; that which was before terminated in an obtuse *Spina*, and where it was an obtuse *Spina* behind, now becoming flat. On the Outside begins a considerable *Sinus*, being the Continuation of the *Sinus* formerly mentioned betwixt the *Epiphysis Humeri* and the outer Protuberance, whence in it's Descent the Bone became depress'd; and now the *Sinus* is conspicous (3), being fram'd by an obtuse *Spina*, descending obliquely forward from the foresaid Rugosity on the one Side, and another obtuse *Spina* descending obliquely outward on the other. This *Sinus* (3) is 4 Inches broad from before to behind; thence measuring backward the Bone is flat $3\frac{1}{2}$ Inches; measuring from thence on the Inside, the Bone having form'd an obtuse Angle, is $5\frac{1}{2}$ Inches flat also. The *Spina* on the Fore-side, after it has descended $5\frac{1}{2}$ Inches, the Bone becomes flat; that on the Outside terminating in a considerable Protuberance, $4\frac{1}{2}$ Inches long, where the Bone has only two Faces, convex before, and concave behind, and 17 Inches round. Behind it's foresaid outward Protuberance is 7 Inches; it becomes $1\frac{1}{2}$ Inch depress'd in the Middle, where the *Sinus* for receiving the *Cubitus* begins. From the foresaid external Protuberance it descends in a straight Line 8 Inches, and from it's opposite Part at the Inside it descends obliquely backwards 5 Inches; and here the lower *Epiphysis* begins, where 'tis receiv'd by the *Cubitus* and *Radius*. This *Epiphysis* is 1 Foot $10\frac{1}{2}$ Inches round, being 3 Inches thick at the Outside and flat, and 7 Inches at the Inside and protuberant; betwixt which behind is a considerable *Sinus* $5\frac{1}{2}$ Inches broad, and $2\frac{1}{2}$ Inches deep, and before, another *Sinus* 7 Inches broad of the same Deepness. This *Epiphysis* is at it's lower Extremity and Inside, where it receives the *Cubitus* $5\frac{1}{2}$ Inches from before to behind; of a convex Surface, and 6 Inches at it's Outside, where 'tis receiv'd by the *Radius*. At it's Fore-part the *Sinus*

is not very considerable, but at it's Back-part deeper and narrower for receiving the *Olecranon*. At the Extremity of the *Epiphysis*, 'tis narrower, being only 6 Inches from the Right to the Left before, and $7\frac{1}{2}$ Inches behind. And thus I have given an Account of the most irregular Bone of the Body, being at it's external Part 30 Inches in Length, and 26 at it's Internal; having a large Head consisting of an *Epiphysis* receiv'd by a *Scapula*, a large Protuberance on the Outside defending it from Dislocation, and a *Sinus* betwixt the two reaching a good way back, thence descending to it's Neck, whence the Bone becomes flat (2) to about the Middle, descending on the Outside, flat also, with two Rugosities for the Infertion of the Tendons. Betwixt this Outside and Back-part, is a very large *Sinus* for the *Biceps*, which oblique Situation (3) is an admirable Contrivance for adding Strength and conciliating Length to this Muscle. Now the Shape of the Bone begins to be chang'd, for whereas it formerly reach'd from before to behind, now it reaches from the Right to the Left, and it's lower Extremity (4) becomes broader, whereas at it's upper Extremity it was rounder.

The Cubitus
and Radius.
Fig. 61.
The Olecra-
non.

The *Cubitus* and *Radius* are two Bones of a Singular Figure, the one lying above the other: We shall begin with the *Cubitus*, which is in Length from the Top of the *Olecranon* to it's Articulation with the Bones of the *Carpus* (5) 28 Inches. The *Olecranon* (1) from the Right to the Left, with a Surface somewhat convex, is $9\frac{1}{2}$ Inches; and from before, where it is articulated with the *Humerus*, to it's utmost Point behind, in a straight Line 7 Inches. This *Olecranon* as it descends, becomes narrower by Degrees, till it forms a *Spine*, which runs obliquely forward 13 Inches, where 'tis contracted from the foresaid $9\frac{1}{2}$ Inches to 3 in Breadth. Afterwards the Bone is enlarg'd on each Side, till it forms a convex Surface, which is received by, and articulated with, the *Humerus*. This Articulation is a *Ginglymus*, as in all other Animals, viz. the *Cubitus* and *Radius* together receive the *Humerus* on the Outside before, which on the Inside the *Cubitus* doth alone. Betwixt these two is a large Protuberance arising $2\frac{1}{2}$ Inches, which is also received by the *Humerus*. Measuring from the Extremity of the *Cubitus* and *Radius*, which receive the *Humerus*, on the Outside to it's opposite Part on the Inside, including the Back-part of the *Olecranon*, it is 10 Inches. Both the Bones from the Right to the Left, at the Articulation before, are 7 Inches. Then measuring round the *Cubitus*, below the Articulation, is $16\frac{1}{2}$ Inches. Here the Bone is flat before, from the Right to the Left 7 Inches; from thence obliquely backward to the foremention'd *Spine* beneath the *Olecranon* is 5 Inches on the Outside, and $6\frac{1}{2}$ on the Inside. At the lower Part of the foresaid *Spine* the *Cubitus* is in Circumference 11 Inches, viz. flat before 4 Inches, where it forms an Angle; thence running obliquely backward two Inches, forming another Angle; thence $1\frac{1}{2}$ Inch obliquely backward, where 'tis a little protuberant; and from thence obliquely inward $3\frac{1}{2}$ Inches. Round the lower Extremity of the *Cubitus*, and 3 Inches above

above the *Epiphysis*, it is 12 Inches; *viz.* from the *Radius*, $2\frac{1}{2}$ Inches; thence obliquely outward, with another flat Surface, $3\frac{1}{2}$ Inches; and from thence, with a convex Surface, round the Back-part 6 Inches. The *Cubitus* at the *Epiphysis*, from the *Radius* on the Fore-part to it's opposite Side on the Back-part, is 13 Inches; from the Upper-Part of the lower *Epiphysis*, where 'tis articulated with the external Bone of the *Carpus*, obliquely inward, is 5 Inches. This same *Epiphysis*, with convex Surface behind, from the Right to the Left is 5 Inches.

The *Radius* in Length, from the external and upper Part of the *Cu-* *Radius.*
bitus, on which it lies, and with which it is united, running obliquely inward, is 1 Foot $9\frac{1}{2}$ Inches. At it's upper Part it sends a Production outward $3\frac{1}{2}$ Inches, by which, with a Part of the *Cubitus*, it receives the external Part of the lower *Epiphysis* of the *Humerus*: From thence the Bone is contracted at it's Fore-part to $2\frac{1}{2}$ Inches; then descending $10\frac{1}{2}$ Inches, it becomes $2\frac{1}{2}$ Inches broad; thence it enlarges gradually till you come to the lower *Epiphysis*, where measuring from the Fore-part of the *Cubitus* to it's opposite and Back-part, the *Radius* is $8\frac{1}{2}$ Inches; thence you descend 3 Inches, to it's Articulation with the internal Bone of the first Rank of the *Carpus*. This Bone is quadrangular above, descending to about the Middle, it becomes more convex; from thence it is gradually enlarged, and during the whole Progress pretty free from the *Cubitus*, except where 'tis conjoin'd with it at it's Upper-part: At the lower Articulation, the one is only separated from the other by a Cartilage. The lower *Epiphysis* of these Bones is of a very unequal Surface, and tho' not separated from them by boiling, yet plainly distinguish'd by their Cartilages, which are not yet ossified.

The Fore-Foot (as the Hand in human Subjects) consists of the *The Fore-Foot.*
Carpus, *Metacarpus*, and Fingers, or rather Toes. The *Carpus* has 6 *Carpus.*
Bones dispos'd into two Ranges, differing in Figure from each other, rugous before, endued with several Holes for Transmission of Blood-Vessels, and of a convex Surface behind, having several Inequalities for Insertion of Tendons.

The external Bone of first Rank (1) is an irregular Bone, run- *External Bone*
ning forward with a convex Surface, till it meets with it's Copartner, *of the first*
 $5\frac{1}{2}$ Inches; passing in a more direct Line $3\frac{1}{2}$ Inches behind. It has *Rank.*
3 Faces: It's upper View, in the Figure, whereby it is articulated *Fig. 114.*
with the *Cubitus*, from behind to before is $2\frac{1}{2}$ Inches, from the Right to the Left $3\frac{1}{2}$ Inches. At the Fore-part it has a Prominence which is receiv'd by the *Cubitus*, from which the Bone declines as it runs backward, and forms a Depression about the Middle, rising higher at the Hind-part. At each Side, on the Right and Left, it receives the *Cubitus* by two superficial *Sinus*'s. It's second Face, whereby it is receiv'd by the second Bone of this Rank, runs from before to behind $2\frac{1}{4}$ Inches. It is very narrow, and only touches it's Copartner of the lower Part; for betwixt this and the other is a small Cavity, whose Surface

Surface compos'd by both Bones is unequal for the Insertion of Tendons, and perforated with several Holes for Immission and Egress of Blood-Vessels: It's lower Surface is articulated with the outer Bone of the second Rank by a *Ginglymus*, *i. e.* behind it has a *Sinus* for receiving that below it. About the Middle it has a small Prominence which is receiv'd by the other, and both are conjoin'd by a plain Surface behind. From before to behind it is 3 Inches, and from the Right to the Left 4 Inches, being $1\frac{1}{2}$ thick. It has three Protuberances; one larger at it's Outside, more obtuse; one lesser below that, more sharp, extended a little farther to cover a Part of the outer Bone of the second Rank; and a third on it's Inside towards it's Copartner: Besides these, it has another small Face at it's upper and back Part, which runs 2 Inches from the Right to the Left, and $\frac{1}{2}$ an Inch from above to below, being also conjoin'd obliquely with the back Part of the *Cubitus*. This Bone weighs 6 $\frac{3}{4}$.

The Second.

The second Bone of the first Rank (2) is of the same Thickness with the former, being articulated with the *Radius*; it is 3 Inches from the Right to the Left before. At it's Middle it has a *Sinus* on each Side; one towards the former, making up with it the forenam'd Cavity, the other on it's opposite Side, where it receives the third Bone of this Rank; so that here 'tis only 2 Inches Diameter, and further back but $1\frac{1}{2}$ Inch: From behind to before it is 3 Inches, and behind 'tis articulated with the *Radius* by a *Ginglymus* also, for before 'tis receiv'd by a small Production of the *Radius*; about the Middle it receives the *Radius*. This Bone weighs 5 $\frac{3}{4}$.

The Third.

The third Bone of this Rank (5) is only articulated with the former at the Side, where 'tis receiv'd into the fore-nam'd *Sinus*, above which it is also receiv'd by the *Radius*. It runs $1\frac{1}{2}$ Inch higher than the former, and as much lower; so that it is $4\frac{1}{2}$ Inches from above to below, making up almost the whole Inside of the *Carpus*. It terminates above in an obtuse Point, from thence it becomes still broader, so that 'tis 3 Inches from above to below. At it's lower Part it rests upon the second and third Bone of the second Rank: It weighs 3 $\frac{3}{4}$.

*The first Bone
of the second
Rank.*

The first Bone of the second Rank (3) in it's fore and outer Side follows the same Progress with that above, being 6 Inches from behind to before, where 'tis conjoin'd with it's Partner; and from before, at the Articulation with it's Partner, to behind 4 Inches; from the Right to the Left behind, where it is broadest, 3 Inches. It's Surface behind is unequal for the Reception of Tendons. It is articulated above with the first Bone of the first Rank, and with three Bones of the *Metacarpus* below, and at it's Inside with it's Partner of the same Rank. It's Articulation above is *per Ginglymum*, as is said, *i. e.* before and behind 'tis receiv'd by that above, and at the Middle it receives it: It is $2\frac{1}{2}$ Inches thick before. It weighs 6 $\frac{3}{4}$.

The

The second (4), which is much like to it, as being receiv'd by the *The Second.* second above after the same Manner, is 3 Inches on it's convex Surface, and $2\frac{1}{2}$ Inches transversely at it's Middle. At it's Outside, being the Inside of the Foot, it mutually receives the

Third (6) which runs obliquely backward 2 Inches from the for- *The Third.* mer: It has four Surfaces for Articulation: one where 'tis join'd with the third Bone of the former Rank; the second where it is joined with the last nam'd Bone: In Conjunction with the former it receives the *fifth* Bone of the *Metacarpus*, and at it's Outside the *sixth*. It terminates in an obtuse Point behind, and has a *Sinus* betwixt the Articulation of the Bone of the *Metacarpus* and it's Extremity. The *second* weighs $6\frac{3}{4}$, and this 4.

There are six Bones in the *Metacarpus*, per *Ginglymum longum*, viz. *Bones of the* they are receiv'd above by the Bones of the second Rank of the *Car-* *Metacarpus.* *pus*, and below by the Toes. They are all of much about the same *Fig. 61. G. 8.* Figure, but not of an equal Length; somewhat flat before, and both convex behind; broader at the upper and lower Extremity where they touch one another, and narrow in the Middle.

The first on the Outside is 3 Inches long, and $4\frac{1}{2}$ Inches round it's Middle, and articulated with the external Part of the outer Bone of the second Rank of the *Carpus*; in Weight $3\frac{3}{4}$.

The second is 4 Inches long, and $5\frac{1}{2}$ Inches round it's Middle; flat before, and more convex behind; and articulated with the Middle of the foresaid Bone of the *Carpus*. It weighs $4\frac{3}{4}$.

The third is 5 Inches long, flat also before, and 7 Inches round it's Middle; articulated with the foresaid Bone of the *Carpus*, and occupying most of it's inner Surface. It weighs $6\frac{3}{4}$.

The fourth is 5 Inches long, and 6 round it's Middle. This occupies the largest Part of the middle Bone of the second Rank of the *Carpus*. It weighs $6\frac{3}{4}$.

The fifth is $4\frac{1}{2}$ Inches long, of the same Bigness with the former; and occupies a Part both of the middle and of the internal Bone of the second Rank of the *Carpus*; and weighs $4\frac{3}{4}$.

The sixth is $3\frac{1}{2}$ Inches long, and $5\frac{1}{2}$ Inches round it's Middle; and occupies the external Part of the second Bone of the *Carpus*; and weighs $3\frac{3}{4}$.

Each of the Toes of the Fore-Foot consists of two thick short *The Bones of* Bones; whereof the first of the external Toe is $5\frac{1}{2}$ Inches round, and *the Toes of* $1\frac{3}{4}$ Inch long; the second about 1 Inch broad, and $\frac{1}{2}$ Inch long; weigh- *the Fore-Foot.* ing $2\frac{3}{4}$. The first Bone of the second Toe is 2 Inches long, and $6\frac{1}{2}$ *Fig. 61. G. 9.* Inches round; the second is $1\frac{3}{4}$ Inch from the Right to the Left, and $\frac{1}{2}$ Inch from above to below; weighing $3\frac{3}{4}$. The first Bone of the third Toe is 2 Inches long, and $7\frac{1}{2}$ Inches round: The second Bone is divided into two in this Subject, in Figure not unlike an Ox's Hoof, whether it be a *Lusus Naturæ*, or peculiar to all other Animals of this Species I know not. Weight $4\frac{3}{4}$. The first Bone of the fourth

fourth Toe is $2\frac{1}{2}$ Inches long, and $5\frac{1}{2}$ Inches round: The second Bone is in Figure not unlike the former, but not divided; from the Right to the Left two Inches, and from above to behind 1 Inch. Weight $4\frac{3}{4}$. The first Bone of the fifth Toe is $2\frac{1}{2}$ Inches long, and $4\frac{1}{2}$ Inches round: It's second Bone is in Figure like the former, but less, and divided. Weight $3\frac{3}{4}$. The first Bone of the sixth Toe is 2 Inches long, and $4\frac{1}{2}$ Inches round; bigger at the upper and becoming narrower at it's lower Extremity, wherewith a very small Bone is articulated, and weighs $1\frac{1}{2}\frac{3}{4}$.

The *Ossa Sesamoidea*.

All these are besides two *Ossa Sesamoidea*, which were affix'd to the lower Part of the lower Extremity of each Bone of the *Metacarpus*; each being about an Inch long, $\frac{1}{2}$ Inch broad, protuberant at the lower Part, and concave at their upper, or that Side whereby they are articulated with the *Metacarpus*; separated from each other by a *Cartilage*, which did run down in the Middle of this lower *Epiphysis* of the Bone in the *Metacarpus*. These *Ossa Sesamoidea* were very useful for supporting the Foot; for about their Middle did all the four Hoofs of the Fore-Foot terminate. They weigh each $\frac{3}{4}$ ii.

The hind Extremities consist of the *Ossa Innominata*, the Thigh-Bone, the two Bones of the Leg, and the Foot.

The *Ossa Innominata*.

Fig. 110, 111.

The *Ossa Innominata* consisting, as in other Animals, of two large Bones, articulated behind with the *Os Sacrum* on each Side, and before with each other *per Synchondrosin*, as 'tis call'd, each may be divided, as in human Subjects, into the *Ilium*, or upper and external Part, *Os Pubis*, or lower and fore Part, and *Ischium*, or lower and back Part: Tho' strictly speaking, these Bones here should only be divided into the *Ilium* and *Pubis*, there being no remarkable Part above them which deserves to be pointed out by the Name of *Ischium*. Both these *Ossa Innominata* join'd together, make up the *Pelvis*, which in Circumference is 4 Foot 6 Inches. From the *Os Sacrum* above B, to the upper Part of the *Os Pubis* below C, it is 18 Inches, and from the Right D, to the Left E, 17 Inches. The *Os Pubis* at the Articulation is from above C, to below F, 12 Inches; betwixt the two outer and lower Extremities of the *Ilium*, from the Right G, to the Left H, is $3\frac{1}{2}$ Foot; from the *Os Sacrum* above, along the Margin of the *Os Ilium*, down to the foremention'd utmost Point, is 2 Foot $9\frac{1}{2}$ Inches G, H, and from that same Point H, to the *Acetabulum* which receives the *Femur* K, 1 Foot. This *Acetabulum* is in Circumference, round the external Edge, 18 Inches. The Breadth of the *Os Ilium* from the external Edge H, to the Side of the *Pelvis* E, is 13 Inches. Round the Neck of the *Ilium* above the *Acetabulum* M, M, is 14 Inches. The Height of the *Ossa Innominata*, from the upper Part of the *Ilium* to the *Acetabulum*, 22 Inches. The Breadth of the *Os Pubis* from the Articulation with it's Partner, to the Outside N, N, 8 Inches. The Length of the oval Hole for the *Musculus Marsupialis* O, O, $5\frac{1}{2}$, it's Breadth 4, it's Circumference 13 Inches. Betwixt the

The *Pelvis*.

Fig. 110.

the lower and utmost Extremities of the *Os Pubis* behind, R, R, 17 Inches. These *Ossa Innominata* are flat before, standing almost perpendicular with the two lower and utmost Extremities of the *Os Ilion* G, H, bending forward, having the *Os Pubis* ascending obliquely, convex before, where join'd together, concave behind. This Ascent of the *Os Pubis* is a farther Argument, that this is no Retrocoient Animal.

The *Femur* is 3 Foot long with it's upper *Epiphysis* (1.) in Circumference 15 Inches; the Neck below it is 13 Inches; the Breadth from the great *Trochanter* (2.) on each Side 10 Inches; below this *Trochanter* in Circumference 18 Inches; about the middle 12 Inches; round above the lower *Epiphysis* 16 Inches; round the lower *Epiphysis* itself (3.), from the *Patella* (4.) on the Outside to the opposite Part on the Inside 18 $\frac{1}{2}$ Inches. It's Diameter, where articulated with the *Tibia* behind is 7 Inches; having two Protuberances, whereof the external is 2 $\frac{1}{2}$, and the internal 3 $\frac{1}{2}$ Inches. The internal *Epiphysis*, which is received by the *Tibia*, is from before to behind 7 Inches, and the external 5 $\frac{1}{2}$ Inches. The *Femur* is in general a long straight Bone, having a big round Head (which in this Subject is separated from it's Body by a Cartilage, is still an Argument of the Youth of the Animal) receiv'd by the *Ossa Innominata* (1.). A large *Trochanter* on the Outside, where the Bone is broadest; from thence in it's Descent it becomes smaller, flat before and behind, and thicker on the Inside than the Outside, near to an equal Bigness, till it comes to the lower Extremity, where 'tis enlarg'd into two big *Epiphyses*, which are receiv'd by the *Tibia*, with a *Sinus* in the middle about one Inch deep, and as much Diameter. It sends forth a large Protuberance before, which is received by the

Femur.
Fig. 61. L.

Rotula, or *Patella*, a Bone of a very rugous Surface considerably protuberant on the Outside, being from above to below 8 Inches, and from the Right to the Left 6 Inches. It is articulated with the *Femur per Ginglymum*, having a Cavity on each Side which receives, and a Protuberance in the Middle receiv'd by, the *Femur*.

Rotula.

The *Tibia* is in Length, measuring behind, 22 Inches; it's Circumference at the upper *Epiphysis* 19 Inches, and at the Neck 17 Inches. Before, it has a large Depression for facilitating the Motion of the *Patella*; of a very rugous Surface, for Insertion of the *Extensores Tibiae*. 'Tis almost semicircular before, and flat behind: It's Circumference about the middle is 9 $\frac{1}{2}$ Inches, and at the lower Extremity, where it again meets with the *Fibula*, and where it receives the *Astragalus*, 12 Inches.

Tibia.

The *Fibula* is 21 Inches long; 5 $\frac{1}{2}$ Inches round above, where receiv'd by the *Tibia*; 3 Inches about the middle; and 5 Inches at the lower part, where it receives the *Tibia*. It's *Epiphysis* which forms the external Ankle, or *Malleolus*, measuring from before to behind along it's outer Surface, is 5 $\frac{2}{3}$ Inches.

Fibula.

The Bones of
the Hind-Foot.

Astragalus.
Fig. 115.

Talus.
Fig. 113.

Os Naviculare.
Fig. 115.

Os Cunei-
formia.
Fig. 115.

The Bones of
the Metatarsus.

The Bones of the Hind Foot consist of those of the *Tarsus*, *Metatarsus*, and Toes. The *Tarsus* consists of 6 Bones, whereof

The first is call'd *Astragalus* (1.). This is articulated above with the *Tibia*, having a Depression in the middle 3 Inches, which receives, and two Protuberances at the Sides, which are receiv'd by, the *Tibia*, $3 \frac{1}{2}$ Inches. It receives the *Talus* below with a Surface 4 Inches Diameter. On the Inside it sends forth a large Protuberance; and on the Outside both it and the *Talus* are receiv'd by the external *Malleolus* for the Space of 2 Inches. Before, 'tis receiv'd by the *Os Naviculare* during the Space of $4 \frac{1}{2}$ Inches. It is in Weight 6 $\bar{3}$.

The *Talus* (a.) is a very irregular Bone; it is protuberant behind from the *Astragalus* $4 \frac{1}{2}$ Inches. This Protuberance is in Circumference at the Extremity 10 Inches, and at it's Neck 8 Inches: Below, it is very rugous on the Inside. It sends forth a Protuberance which is received by the *Astragalus*, as in Human Subjects. It has three remarkable Surfaces; viz. one upon which the *Astragalus* rests, at it's upper Side; one at the fore-part, articulated with the *Os Cuneiformia*; and the Outside, for the *Fibula*. It weighs 1 lb.

The *Os Naviculare* is 10 $\frac{1}{2}$ Inches in Circumference, one Inch thick, concave behind (2.) where it receives the *Astragalus*, and convex before with it's different Surfaces (3.), viz. one whereby it is articulated with the Bone of the Toe on the Inside, and one for each of the three *Wedge-like* Bones. It weighs 4 $\bar{3}$.

The Bones of the second Rank of the *Tarsus* are called the three *Wedge-like* Bones, two of which are articulated at the back-part with the *Os Naviculare*, as is said, and the third partly with the *Talus*, and partly with the *Os Naviculare*; each of them is about one Inch thick; that on the inner Side (4.) is the least, being from the right to to the left one Inch thick, in Weight $\bar{3}ijfs$: The middle 2 Inches (5.) in Weight $\bar{3}ij$; and that on the Outside (6.) $3 \frac{1}{2}$ Inches, in Weight $\bar{3}ijj$. This last has two Surfaces at the fore-part, whereby 'tis articulated with the two utmost Bones of the *Metatarsus*. The middle Bone of the *Tarsus* being only receiv'd by the middle Bone of the *Metatarsus*.

The external Bone of the *Metatarsus* is very irregular: It is articulated behind with the external *Os Cuneiforme*, where 'tis about two Inches from above to below; from whence (it's external Surface being very rugous) it becomes gradually smaller; being somewhat concave below, and protuberant above, till it terminates in a round Extremity. In Weight $\bar{3}ijfs$.

The second is a short thick Bone, 8 Inches in Circumference, and $2 \frac{1}{2}$ Inches long; in Weight $\bar{3}ijfs$. This receives the first Bone of the Toe, which is $4 \frac{1}{2}$ Inches in Circumference, and 2 long; and receives the second Bone of the same Toe, being 3 in Circumference, and $1 \frac{1}{2}$ long; greater at it's upper, and smaller at it's lower Extremity, to which is affix'd a small Bone. These weigh $\bar{3}ijfs$.

The

The middle Bone of the *Metatarsus* is the largest of all those belonging to the Toe, being 7 Inches round, and 5 long; $\text{z} \text{iiij}$ in Weight. It receives the first Bone to the Toe, which is $4 \frac{1}{2}$ Inches round, and $2 \frac{1}{2}$ long; to which also is join'd another small Bone to make up the Extremity: in Weight both $\text{z} \text{iiij}$.

The two Bones of the *Metatarsus* remaining are thin, broad, and irregular; the first whereof is $2 \frac{1}{2}$ Inches broad, and $2 \frac{3}{4}$ long; weighing each $\text{z} \text{j}$, to which also adheres a small Bone, as in the former Toe, but less. The second and last of the *Metatarsus* on the Inside is two Inches broad, and as much long, thin like the former, having a small Protuberance adjoin'd instead of a Toe. The Bones of the 4th Toe weigh $\text{z} \text{jfs}$, and the 5th $\text{z} \text{j}$.

I designed to have compar'd more particularly the Bones now describ'd, with those of *Tentzelius* and *Dr Moulins*: But since both those Treatises are extant, and since I have already insisted so long upon these, I shall only observe, in a few Words, that *Tentzelius* tells his Friend, That in digging in a Hill near *Erfurt* in *Germany* for a fine white Sand, there were found several huge Bones, first mistaken for a Giant's; but upon Tryal, and the Perusal of *Dr Moulins's* Treatises, known to be the Bones of an *Elephant*: And that among the rest there were found the Head 42 Inches Diameter; two Tusks $2 \frac{1}{2}$ Spans large, and 8 Foot long; four Grinders, each, 12 H ; the *Humerus* 4 Foot $2 \frac{1}{2}$ Spans; the *Vertebra* of the Neck, each 4 Spans in Circumference, and 2 Spans high; the *Ossa Innominata* $2 \frac{1}{2}$ Foot long; with the Head of the *Femur* inserted in the *Acetabulum*, and Part of the *Tibia* 22 Inches at the biggest, and 17 at the smallest Part: That they were obliged to dig 24 Foot deep, before they could get out the Head; that the Bones lay in such a Posture, as betoken it's being overwhelm'd, or having had great Strugglings while dying; viz. the left fore Foot stretch'd forward to the Side of the Head, which lay towards the North, the Right inclining backward under the Body; the Left hind Foot drawn in toward the Body, and the Right distorted here and there, out of it's Natural Posture. From all which he concludes this to have been the largest *Elephant* that ever was seen in *Europe*; and that it could be brought hither by no other means than the Flood, both from the preternatural Posture of the Body, and from the different *Strata* of Earth lying above it, without the least Sign of having been digg'd to bury it.

Comparison
of these Bones
with those
treated of by
Tentzelius.

The Osteology of an Elephant.

A TABLE containing the particular Dimensions of the Vertebrae and Ribs, and Weight of all the Bones of the Elephant.

The Bones of the Head.				lb.	The Vertebrae of the Tail.			
Upper Jaw	_____	66	Numb.	oz.	Length.	Breadth.		
Lower Jaw	_____	45			Inch.	Inch.		
			1	10	2	6		
			2	8		5 $\frac{1}{2}$		
			3			5		
			4	6		4 $\frac{1}{2}$		
			7			4		
			8	5				
			9	4		3 $\frac{1}{2}$		
			10			3		
			11	3		2 $\frac{1}{2}$		
			13	2 $\frac{3}{4}$				
			14	2 $\frac{1}{2}$		1 $\frac{1}{2}$		
			15			1		
			16	1 $\frac{1}{4}$		2 $\frac{1}{2}$		
			17	1				
			18			1 $\frac{2}{3}$		
			20			1 $\frac{1}{2}$		
			21			1 $\frac{1}{4}$		
			22			1		2 $\frac{1}{4}$
			23	$\frac{2}{3}$				2
			24					1 $\frac{3}{4}$
			25	$\frac{1}{2}$		$\frac{1}{2}$		
			29	$\frac{2}{5}$				

The Vertebrae of the Neck.				
Weight.	Length of Spinal Process.			
Numb.	lb.	oz.	dr.	Inch.
1	1	13		
2	1	6	4	
3		13	4	$\frac{3}{4}$
4		13	4	$\frac{1}{2}$
5		14	4	1 $\frac{1}{2}$
6		14	6	3
7	1			5
	7	10	6	

The Vertebrae of the Back.

Num.	Weight.			Leng. of Spinal Process.	Breadth of Extrem.
	lb.	oz.	dr.		
N ^o				Inches.	Inches.
1	2	4		8	2
2	2	2		12	3 $\frac{1}{2}$
3	2			13	4 $\frac{1}{2}$
4	1	5			
5	1	4	2	12	3 $\frac{1}{2}$
6	1	2	3	11 $\frac{1}{2}$	3
7		15	6	11	
8		14		10 $\frac{1}{2}$	2 $\frac{1}{4}$
9		14		10	
10					
11					
12		13		9 $\frac{1}{2}$	2
13				9	
14					$\frac{1}{2}$
15				6 $\frac{1}{2}$	1 $\frac{1}{2}$
16				6	2
17				5	
18		2		4 $\frac{1}{2}$	
19		4		3	
	20	8	7		

The Ribs.

Weight.	Leng. of Inner Surface.	Leng. betw. Extrem.		Breadth of Extrem.
		Feet.	Inch.	
lb. oz. dr.	Feet. Inch.	Feet.	Inch.	Inches.
1 13	1 5	1	4	4
12 4	9		8	3
1 1 2	11 $\frac{1}{2}$		10	
5	2 2	2		
8 4	6		3	2 $\frac{1}{2}$
2 3			3 $\frac{1}{2}$	
1 5	8		3 $\frac{1}{4}$	2 $\frac{1}{4}$
4 6	10		4 $\frac{1}{2}$	
3			5	
15	9		3	
14 4	7			
13 4	5		1	
12	4			
10 6	4 $\frac{1}{2}$	1	11 $\frac{1}{2}$	
9			10	1
5 5	1 9		8	
5	8		7	
3 2	5		4 $\frac{1}{2}$	
2 1				

The Vertebrae of the Lions.

	Weight of Ribs.	Tail
1	13 4 3	
2	12 7	
3	11	
	2 5 3	

16 15 6	
16 15 6	
33 15 4	
4 2 7	1 scr.

The Skeleton of the Elephant consists of the Bones of

The Head, divided into those of the

lb. oz. dr. scr.

Upper Jaw, viz.

	{	Calvaria, or upper and back-part	1				
		Frons, or upper and fore-part	1				
		Two Maxillary Bones	2				
		Two Bones of the Palate	2				
		Two Zygomatick Bones	2				
		Two Styloid Processes	2				
		Two Tusks	2				
		Four Grinders	4	66			
		Lower Jaw	1				
	{	Four Grinders	4	45			
			21	111			

The Trunk composed of the
Spine, consisting of the *Vertebrae* of the

	{	Neck	7	7	10	6
		Back	19	20	8	7
		Loyns	3	2	5	3
		<i>Os Sacrum</i>	5	4	0	0
		Tail	29	4	2	7 1
		Ribs, 19 Pairs.	38	33	15	4
		<i>Sternum</i>	4	3	0	0
			105	75	11	3 1

The Fore Extremities,

	{	Scapula	2	19	8	0	0
		Humerus	2	16	0		
		Cubitus and Radius	4	15	0		
		Carpus, Six on each Foot	12	3	12		
		Metacarpus	12	3	4		
		Toes	24	2	3		
		<i>Offa Sefamoidea</i>	24	0	6		
			80	60	1		

The Hind Extremities,

	{	{ <i>Offa Innominata</i> , viz.				
		{ Ilium	2	28	0	
		{ Pubis				
		Femur, or Thigh Bone	2	16	0	
		Tibia and Fibula, or Leg and Spit-Bone	4	13	4	
		Patella, or Knee-Pan	2	0	12	
		Tarsus	12	5	10	
		Metatarsus	12	1	6	
		Toes	20	1	2 1/2	
			54	66	2 1/2	

Summa Totalis.

			260	312	14	7	1
			260	312	14	7	1

This is the Total Sum of the Weight of the Bones.

I come

The Method of
Mounting
the Skeleton.

I come now to describe the Method I us'd in mounting the Skeleton ; and because Dr *Moulins's* Way of nailing a Plate of Iron to the Roof of the Mouth, in which the Iron Rod that ran through the *Vertebrae* of the Neck was fasten'd, would have been inconvenient, by spoiling the back-part of the Skull, obstructing it's View, and making the Head look too much forward, which was the Fault of his Skeleton, as represented by the Figure I contriv'd another, which is as follows.

Connexion of
the Head.

There was an Iron Rod made about the Bigness of one for a Bed, as long as the *Elephant*, from the Forehead to the Point of the Tail, being 14 Foot, which passed in at the fore-part of the Skull above the Hole for the Root of the Trunk, and ran back amidst the fore *Cellules*, passing along the lower part of the Seat of the Brain, and going out at the lower part of the Hole for the Spinal Marrow ; and lest the Inconveniency of it's Weight (as Dr *Moulins* fear'd) should happen to break the tender *Laminae*, there was another Rod of the same Bigness, which pass'd in at the one Side of the Head, where the Depression is for Infertion of the Muscles of the lower Jaw and *Proboscis*, and ran through the *Cellules* at the Side, going transversely along the lower Part of the Seat of the Brain, below the former, and passing out at the other Side ; by which this Rod, from the Right to the Left, eases the Burthen of the other, in supporting the Head on both Sides, as well as the other did before. And lest any of these should slide out, I caus'd to be screw'd a Piece of Iron upon each Extremity of that which pass'd from the Right to the Left, and upon the fore-end of that which did run from before to behind. Afterwards the second *Vertebra* in the middle of it's Tooth, and all the other following *Vertebrae*, were perforated in the Center of their Bodies ; and to make the Head still more steady, the Base of the Skull was twice perforated on each Side of the Hole for the Spinal Marrow ; and a strong Wire being pass'd through these Holes, it ran from the Right to the Left above the Rod, and kept it firm, lest it should have bended, and suffer'd the Head to incline too much downward by it's Weight.

The Connexion
of the Lower
Jaw.

Fig. 64.

The joining of the lower Jaw, which is perhaps the most ponderous Bone in any Land Animal, was next to be consider'd ; therefore two Wires were passed in at about one Inch distant from each other, running from above to below, to that Part of the Base of the Skull (*y.*), which is for the Reception of the *Condyles* ; and the same two Wires having pass'd through two Holes, made from before to behind in the *Condyles* themselves, both Extremities of the Wires were made to meet together at the upper and outer Part of the *Condyles*, and so twisted and made firm. Being still suspicious that this would not be sufficient to support such a vast Weight, and fearing lest either the Base of the Skull or the *Condyles* might come to suffer, there was a Wire brought round the Margin of the so-often mention'd great Hole in the *Os Maxilla Superioris*, which being folded, was twisted several times toward the *Processus Coronae* in the lower Jaw (*b.*), where there were two Latchets,

Latchets, or Foldings of Wire plac'd in the inner Side; the folded Wire from the *Os Maxilla*, was brought in betwixt them, and a Pin pass'd through all three, to be taken out at Pleasure. And lest these should not still be sufficient to support it's Weight, there was provided in the third Place a folded Wire from behind to before in the *Symphysis Menti* (*b.*), which passing in betwixt the two *Ossa Palati* (*b.*) a Pin was put across them, to be taken out at Pleasure; which is such a Relief to the *Condyles*, that without making use of the Wires running from the *Os Maxilla* to the *Processus Coronæ*, we found it sufficient to support the Weight of the Jaw; and 'tis so much the more convenient, that by pulling out this Pin, the lower Jaw can be brought back and forward, to shew the Spectators it's considerable Weight.

Fig. 70.
Fig. 61.

Being obliged to saw the Skull, in order to take out the Brains, for fastening the upper part of it, there were two wires plac'd at the back-part of that which is below the Division; into which are linked two other Wires, which reach to that Part above the Division, and are there receiv'd into two Foldings of Wire plac'd there on Purpose. The same Contrivance is also observ'd before; so that this upper Part may either be laid back, to shew the Structure and Contrivance of the *Cel- lules*, or taken altogether off, as seems good.

Connexion of
the upper
Part of the
Skull.

The *Vertebrae* being all perforated, my next Care was to have the Ribs match'd and join'd; in order to which, having first suited them in Pairs and fitted each Pair for it's *Vertebrae*, I caus'd to be perforated each of their *Epiphyses* twice from above to below, (once toward the fore, and once toward the back-part) and the transverse *Processes* of the proper *Vertebra* opposite to the Holes of the Ribs, after the same Manner; and then perforated the Extremity toward the *Vertebrae*, and the *Sinus* of the *Vertebrae* (corresponding to the Rib) in towards it's Body: After which a Wire two Inches long was fasten'd in the Body of the *Vertebrae*, and Extremity of the Rib, and then both were brought together; which being done, the Wires were put into their respective Holes in the transverse *Processes* and Ribs, and both the Ends of each of the two last Wires being brought together at the upper Part and Interstice betwixt the Ribs and transverse *Processes*, were twisted and made firm. Thus I continued to do throughout all the nineteen Pairs.

The Joining of
the *Vertebrae*
and Ribs.

After this, I provided some Jumps, or Leather, such as Shoemakers use for the Heels of Shoes, because the Bend or Sole Leather us'd in mounting the Skeltons of other Animals, could not be so conveniently fitted to it's Thickness. Having wetted and beat this Leather, it was shaped according to the Bigness of each *Vertebra*, perforated in the Middle, and put upon the Rod alternatively, first the *Vertebra*, and then the Leather, to supply the Defect of the Cartilages, which were all lost in Boiling, as usually happens, and was beat so close, that the oblique *Processes* of the *Vertebrae* might meet. This was continued till all the *Vertebrae* were upon the Rod, all along to the *Os Sacrum*; and because the

Leather, in-
stead of Car-
tilages.

the first *Vertebra* is nothing concern'd with the Rod, 'twas convenient to pass a Wire betwixt the Skull and it on each Side, that it might not remain loose, but be fixed to the *Condyles*, by twisting and making fast the Wire.

Connexion of
the *Ossa Inno-*
minata.

I come next to the *Ossa Innominata*, which had been disjoin'd in Boiling, both before or below at the *Os Pubis*, and above or behind at the *Os Sacrum*. I made two Rods of Iron to pass transversely from the one Side (the one above, and the other below) through the *Os Sacrum* to the other. These were riveted on the back Side at both Ends; and then having perforated the *Os Sacrum* from above to below through the Middle of it's Body, it was also put upon the Rod for the Spine, which was a very difficult Task, because the Rod being thick, was uneasy to bend, and the Situation of the *Os Sacrum* requir'd it to be bended precisely betwixt the last of the *Vertebrae Lumborum*, and the *Os Sacrum*. Neither was it easy to perforate the *Os Sacrum* itself, being obliged to make a Drill on purpose, there being no other Bone in the Body that requir'd one so long. After this, I proceeded to put on the Bones of the Tail, and their sham Cartilages alternatively, as they followed in order, till all the Rod was filled, on whose Extremity another Piece of Iron was screw'd, to keep all firm and secure.

Connexion of
the Sternum,
and mounting
the Thorax.

Afterwards a large Wire was passed from the fore to the hind-part of the *Sternum*, whereby all it's Bones were fix'd to one another; and to them were joined Pieces of Bend-Leather to supply the Cartilages, which had been first mangled by the Butchers, and then lost in the Boiling. These I fitted to the Articulation of each Rib, whereto they were join'd; and perforating the Extremities of the Ribs twice, I pass'd two Wires betwixt the sham Cartilages and them, bringing the two Ends together, twisting and fastening them on the Inside, by which all the *Thorax* was mounted. And lest the Ribs thus fix'd at both Extremities should be too ready to move from before to behind, and *è contra*, each of the Ribs was perforated above toward the Back, and below toward the Belly, for receiving of Foldings and Latchets of Wires to be fasten'd in them. Then I provided two big Wires, each being folded twice, the Length of the *Thorax*; one of which being pass'd through the last Rib, it's two Parts being brought together, they were twisted several times, till it was brought opposite to the Latchet in the next Rib, within which the one Parr was pass'd, the other continuing without, and then twisting again, till it came to the third; it was so continued throughout all the Ribs, both above and below, to keep them firm and at a due Distance.

The Joining
of the Sca-
pulæ.

Next, I took the two *Scapulae*, as belonging to the upper Extremities; and lest they should be too weighty for the Ribs, if nail'd to them, as is usually done in other Skeletons, I thought fit to perforate both of them opposite to one another at their upper Margin, and to pass a good big Wire through one of the Perforations, which being folded, was twisted for the Space of 20 Inches, *i. e.* from the *Scapula* on the one Side,

Side, straight over the Back, passing in betwixt two of the *Vertebrae*, till it came to that on the other, where it was fasten'd. Afterward both the *Scapulae* were fastened, by bringing two folded Wires from the Outside of each *Scapula*, through the first and third Rib, in whose Inside they were fix'd; then was the Head of the *Scapula* perforated through the Margin which guards the *Humerus* at the fore and back-part.

The Head of the *Humerus*, opposite to the Middle of the Concave Part in the *Epiphysis* of the *Scapula*, was four times perforated, twice toward the Inside, and twice toward the Outside; whereunto were put two folded Wires, whose Extremities were fix'd below at the foresaid inward and outward Part, and into whose Foldings a large Pin pass'd from the Margin of the *Scapula* on the one Side, to that on the other, (to be pull'd out at Pleasure) for suspending of the *Humerus*. Connexion of the *Humerus*.

The *Cubitus* and *Radius* were join'd with the *Humerus*, thus: the *Cubitus* was perforated twice in the back-part, at the Beginning of the *Olecranon* on each Side; where two Extremities of Wires being fix'd and riveted, they were brought through the upper-part of the said *Olecranon*, and then twisted, till they came to the *Humerus*, which was perforated from the back-part, where the Depression for receiving the *Olecranon* is, to the fore-part above the *Epiphysis* receiv'd by the *Cubitus* and *Radius*; through which Holes, made pretty large, the Wires thus twisted were pass'd, the one to the *Radius* on the Outside, and the other to the *Radius* on the Inside; where they were introduc'd, and brought out at the back-part of the *Cubitus*, below the *Olecranon* on each Side, where their Extremities were riveted $2 \frac{1}{2}$ Inches below their Insertion: by which means the Flexion and Extension can be easily shewn, because the Wires have sufficient Space to move in their Passage through the *Humerus*, these Holes being made bigger on Purpose, as is said. The lower *Epiphysis* of both *Cubitus* and *Radius*, having been separated by Boiling, as I have formerly observ'd, I was forc'd to perforate each of them below toward the *Carpus*, and pass a Wire obliquely upward, whereby to secure them: And because the *Radius* is distinct from the *Cubitus* below, there was a Wire passed from the one to the other, and riveted at each Outside. Cubitus and *Radius*.

In joining the Bones of the Foot, I took special Care to hide the Wires that none might appear: For doing whereof the *Cubitus* was twice perforated in the back-part of the *Epiphysis*, about 1 Inch above the Articulation with the Bone of the *Carpus* on the Outside, and the *Radius* in the Inside and Back-part, after the same Manner. Both which Perforations were continued through the two Bones of the first Rank of the *Carpus*. Afterwards the External Bone was perforated a third time; all which run from above to below, to the first, second and third Bone of the second Rank. Which being done, two folded Wires were passed in at the four Holes of the back-part of the *Cubitus* and *Radius*, where their Duplicatures were formed; and the fifth Wire The Fore-Foot.