

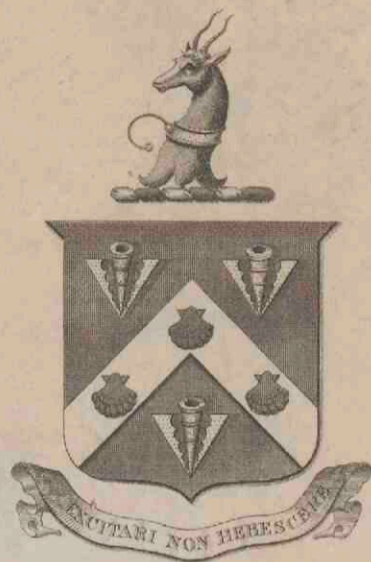


The anatomy of an horse : containing an exact and full description of the frame, situation and connexion of all his parts, (with their actions and uses) exprest in forty nine copper-plates : to which is added an appendix, containing two discourses: The one, of the generation of animals; and the other, of the motion of the chyle, and the circulation of the bloud

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William Orme Foster.



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THE
ANATOMY
OF AN
HORSE.

CONTAINING

An exact and full Description of the *Frame, Situation*
and *Connexion* of all his *Parts*, (with their *Actions* and *Uses*)
expressed in Forty nine Copper-plates.

To which is Added

An APPENDIX,

Containing two Discourses :

The one, of the

GENERATION of ANIMALS;

And the other, of the

MOTION of the CHYLE,

AND THE

CIRCULATION of the BLOOD.

By ANDREW SNAPE, Jun. Farrier to His MAJESTY.

LONDON,

Printed by M. Flesher for the Authour, and are to be sold
by T. Flesher at the Angel and Crown in S. Paul's
Church-yard. An. Dom. 1683.

T O

His Most Sacred Majesty,

CHARLES II.

KING of Great BRITAIN,

FRANCE and IRELAND, &c.

May it please Your Majesty.

NOTHING could have excused, or induc'd me unto, the Presumption of this Address unto Your MAJESTY, if Your Royal Bounty towards me, had not made such an Application my Duty. For being a Son of that Family that hath had the honour to serve the Crown of this Kingdom in the Quality of *Farriers* for these two Hundred Years, and being my self retain'd by Your MAJESTY's Favour in that capacity;

The Eistle Dedicatory.

As these hereditary and personal Engagements were the first Motives that put me upon dissecting of Horses, that I might be more capable of serving Your MAJESTY in my Station; so do they entitle Your MAJESTY to the Discoveries I have made, as being but the effects of such Obligations. And I do the rather flatter my self with the hope of Your MAJESTY's Pardon in this Particular, in regard that this Essay has something in it that is *new*, and withall of *Publick* and *Common Benefit*, which Your Royal Goodness hath been pleased upon all occasions to Honour with Your Princely Encouragement and Approbation. For the Intention of publishing this Treatise being to instruct Farriers in the Frame, Situation and Use of the Parts of an Horse, which is the Subject of their Care; They will thereby, I hope, become more skilfull in applying and administering proper Remedies to the Distempers of that Generous Animal, which yields Your MAJESTY and Your Subjects that great service both in Peace and War.

May

The Epistle Dedicatory.

May God Almighty long continue Your MAJESTY'S Gracious Reign over a Loyal and Obedient People: And that Your MAJESTY will vouchsafe Your Royal Pardon for the boldness of this Dedication, is the humble Petition of

Your MAJESTY'S

Most Loyal and

Obedient Subject

and Servant,

A. Snape.

The Introduction.

THERE is nothing gives a greater check to the progress of an Art, than to believe it is already perfected by those that have gone before us, and so to content our selves with their determinations: For had our ancient Artists been thus supinely credulous, and thought it sufficient to have traced their predecessors, limiting their wits within other mens bounds, never had time brought to light such discoveries in our Profession, nor had the mysteries of our Art been so far communicated to posterity as they already are.

This consideration induced me to make an attempt for the cultivating and improving our Art to a greater perfection than it had as yet attain'd to: In order to which considering the several parts of it, and observing that our profession has such a correspondence with that of a Physician, that they differ not at all saving in the subject they act upon; I begun to think, who-soever would excel in the knowledge of the one, must arrive at it by the same method as the others do. Now he that once bends his mind toward the practice of Physick, first applies himself to the study of Anatomy, to understand all the Parts (with their actions and uses) of that Body which is to be the subject where-upon his Art is to be exercised; without which no wise man will think him capable of that profession. And yet how rare amongst the greatest part of those that think themselves no mean Farriers, is the knowledge of that Creature they practise upon? whereas it is plain, seeing they know not the situation and use of the parts, they can make but wide guesses at the seat or nature of the distemper, and so must administer their Medicines at random and at all adventures, and be in the most opprobrious sense Horse-doctors.

Nay I will be bold to say something more (which I hope I may speak without the envy of Physicians, for whom I have a profound respect) that in some regards Anatomy is more neces-

The INTRODUCTION.

sary to Farriers than to them, in order to find out diseases: For besides the pulse and the urine, and the pathognomonick signs (as they call them) of each distemper, they are assisted in their enquiry moreover (not to say chiefly) by the complaints and relations of the Patients themselves: whereas a Farrier having to do with a dumb creature, must be very curious in his knowledge of the parts with their offices, and of the sympathy or consent that one part hath with another; or else, seeing all his information must be of his own hammering out, he's like to make but a short discovery of the distemper.

How necessary the knowledge of the parts is to the discerning of diseases.

Now there are two things chiefly necessary to the judging or discerning of a disease, namely the Affection or distemper, and the part Affected or distempred; the signes of which are many, but especially from the action of the part affected: As for example, he that knows the action of the Stomach to be concoction or digestion, if the concoction be impaired or hindred, he may easily judge that the Stomach is ill affected. So likewise he that knows the situation of the Liver to be on the right side, and the Spleen on the left; if the right side be sore or do swell, he cannot but know that the Liver and not the Spleen is affected, and will therefore apply his remedies accordingly. Now he that is ignorant of the parts of the Body shall ill know either the situation or action of either these parts mentioned or any other: and there is no way to come to the understanding of them but by Anatomy.

Seeing then the profit and necessity of understanding Anatomy is such and of so great use to us, I thought I could not spend my time and endeavours on any thing more conducing to the advancement of our profession, than by applying my self unto it in the first place; wherein having none that have gone before me or shew'd me the way, I hope all ingenuous men will be favourable to my undertaking, and not be over severe Censors of any Imperfections they may possibly meet with in the following Treatise; and I hope also that having broken the Ice, as we say, all deserving Artists will be excited to Emulation.

This Treatise then designing to teach the Anatomy of an Horse, we must in the first place let you know what Anatomy is: "It is an opening or cutting up of the Body of any Animal or living Creature whatsoever, whether frequenting the land or water, whereby

The INTRODUCTION.

*“whereby the knowledge of the frame of its body, and the use of
“its parts may be attained unto.*

Now this knowledge may be obtained two ways, namely by How it is taught. Inspection, or by Instruction; both which ways are very necessary, but the first is the more certain, though the latter carrieth more grace and state.

The first, which is Inspection, is to look into either the Figures of the parts of Horses onely, or into the bodies of Horses themselves.

The latter, which is Instruction, is by the Voice of a Teacher or Instructor, or by the Writings of famous and renowned men.

As to the Figures of the parts, they are thus far necessary, The Figures of the parts how far necessary. viz. they daily represent to us such parts as we have not the opportunity to see in the bodies themselves: For it is not easy to find in all places (nor at such times when we stand in most need of them) such a store of dead bodies as is necessary for us to practise upon; wherefore to supply the want of such bodies, I do think these Figures usefull, and have therefore accordingly by a curious draught or delineation represented to you such observations as are made in true dissections, not by copying out every part, but chiefly those that are most necessary for us to understand, omitting those of less consideration, lest I should make this Volume swell too big, and become too chargeable, whereby such would be discouraged from buying it, for whom I chiefly intend it.

But although I approve of these Figures as necessary, to be by A Caution. us, upon occasion; yet this caution I must give to the Student, that he do not trust too much to these Copies, as I may call them, without practising upon the original body it self: For as it is not possible to make a good Commander by viewing onely representative Armies, without practice and experience in real Engagements; so is it vain for you to think to attain to the exact knowledge of Anatomy by minding the Figures onely.

Neither would I have any that undertakes this study to be discouraged, for fear they should not get such bodies as I have

The INTRODUCTION.

mentioned (I mean Horses bodies) sufficient for them to practise upon; for they may, to supply the want of such, take the bodies of Asses or Mules, of Sheep and Oxen, Hogs or Dogs, any of which come near the bodies you desire, especially as to the situation and use, as also hidden motions of the Internal parts: for if those motions be the same in Beasts as in Men, as by a very worthy * Authour they are affirmed to be, (who saith that the motions of the Heart, the Arteries, the Midriff, the Brain and Guts are the same in Beasts as in Men) they must certainly be the same in one Beast as in another.

* See Doctor
Crooke, lib. I.
chap. 9.

The method
of Anatomy. Next we come to shew after what manner you are to take in hand the dissection of any of these Creatures, and that you must not doe confusedly nor disorderly, but with due course of proceeding. For the doing of which take these following Rules.

First then, you must begin with that which is best known and most easie, which are the external or outward parts; for as much as the knowledge of them is most necessary, as to Cures Chirurgical: and these parts are commonly distinguished into two kinds; one of which are called spermatical and solid, which are supposed to be bred of seed, and such are Bones, Gristles and Ligaments; and the other sanguineous, said to be generated of bloud, as Muscles.

I shall not in this place give you any particular instructions for the anatomising any of these parts, referring you for them to the book it self: onely advertise you of this, that when you desire a Body for examining the solid parts, the bodies of old and lean Horses are the fittest, in regard the flesh and fat will not so much hinder, nor hide the parts from you, as in fat Horses they will.

You are also to observe that there is a two-fold way of proceeding in dissection: The one is where there is a plenty, the other where there is a scarcity of dead bodies. If there be a plenty, then you may look into the Muscles of one, into the Entrails of another, and into the Vessels of a third, &c. not mattering though you spoil one part in discovering another: but where they are so scarce that you can get but one body and that seldome too, then if you would see all in that body, great skill must be used to shew every thing in its order and place.

Now

The INTRODUCTION.

Now order of dissection requires that you should first begin with the Head, it being the most noble and excellent part; next to that the Chest, and lastly the Belly: but this (as I have said) is not to be done where there is but one body, for there you must begin with those parts that are most subject to Corruption, wherefore you must first cut up the Lower Belly, then the Chest, and lastly the Head; both which ways are often used; the first being called the way of dignity, and the other of diuturnity; the one being more noble, and the other of a longer durance.

I shall not here treat of any of the parts contained in these three Regions or Venters, but will leave them till I come to speak of them in their order in the following Treatise, my design being to be as brief as may be, and not to repeat any thing over several times, as I have seen some Authours have done. Therefore I shall put an end to this Introduction when I shall have informed you, that all the parts which fall under the Anatomists knife to be examined are commonly reduced to two heads, namely, simple or similar, and compound or dissimilar.

Those that are generally accounted simple parts, are in number ten, namely, a Bone, a Gristle, a Ligament, a Membrane, a Fibre, a Nerve, an Artery, a Vein, Flesh and Skin. These are called simple or similar, because every particle of them is of the same name and substance; as every part of a bone is bone, &c.

The division
of the parts,
into
1. Simple,

Yet three of these ten, though they are generally accounted simple parts, if strictly taken cannot be truly reputed so; for first, Veins are made of a coat, fibres and valves; secondly, Arteries are made of two coats or skins different from one another; and for Nerves, their inner substance is medullar or marrowey, and the outward, membranous or skinny: so that of truly similar or simple parts, there are onely seven, namely, Bones, Gristles, Ligaments, Membranes, Fibres, Flesh and Skin.

The Dissimilar or compound parts are those, which, contrary to the simple, may be divided into several particles or parcels of unlike or different substance and denomination: As
for

2. Compound;

The INTRODUCTION.

for example, A Leg may be cut into several pieces, yet not into several Legs, but into Flesh, Bones, Veins and other things which it is compounded of; whereas, as was said, a similar part though it be divided into parcels, yet those are still like one another, and of the same nature: for suppose a Ligament be cut into many pieces, every piece partakes onely and truly of the nature of a Ligament, and all remain what they were before, their length or other accident onely excepted.

Thus much for the Introduction, wherein I mainly intended to shew the method of Anatomy, and to hint the reason of my undertaking; It now remains that I address my self to the Work it self, which shall be writ with the greatest plainness its nature is capable of, that I may thereby attain to that wished end I set before me, namely, the benefiting of my Reader.

THE

THE
ANATOMY
OF AN
HORSE.

BOOK I.

Of the Lowest Belly or Paunch.

CHAP. I.

Of the Parts investing the whole Body, and first of the Hair.

BEFORE I take in pieces this Goodly Creature, It will not be amiss if I first give you an account of all these Parts as they lie in order, beginning with that which first appeareth to our View, and that is the Scarf-skin adorned with hairs, wherein (as in a Case) Nature hath wrapped this stately Beast; besides which there are other four, that, with this, are *common* to the whole body, which are, first, the true skin, which lieth next under it; then the fleshy pannicle; under that the fat; and lastly the common membrane of the Muscles. Besides these five, there are other Investing parts, but they are onely *proper* to particular parts of the body, to which I will speak in their due place, and onely of the *common* ones here.

First then I will begin with the *Hairs*, because they meet first with the Sense. They are said to be ingendred of a clammy and earthy Excrement of the third concoction, so that themselves are reputed not so properly to be called parts of the body, as Excrements. They are void of sense and of animal life, yet they have a vegetative life, such as Plants have, to which they owe their growth.

*Whereof
Hairs are
ingendred.*

These



In Feilds nor Pastures, Woods nor Forests wide,
 Does any Beast So Noble as this Reside. ~
 His Nostrills raise a Tempest when he blows;
 His Feet produce an Earthquake when he goes.

Runs he? the swiftest Winds behind retire, ~
 whilst from his Eyes flow streams of flaming fire.
 Wouldst know his Parts? the following Book peruse,
 Which shews of each the Figure, Seat and Use.

How nourished.

These Hairs are by some thought to have for their *nourishment* a proportionable quantity of that juice of which they are generated, continually ministred unto them. Others think that the Hairs being hollow and porous are nourished as the Feathers of Fowl are, and that is by blood; for if one pull off a Feather from a young Bird that is unfledged, a pretty deal of its stem will appear bloody. But though we should grant that the matter of their nourishment were made of blood, yet certainly it must be very much altered and degenerate from its own nature, before it can be adapted to the hair, seeing the hair of a Man's head (for example) grows not onely in living persons, whose blood runs briskly in their Arteries and Veins, whereby it is kept from corruption, but also in the dead, in whom the whole mass of blood is devoid of all nutritive power, as has been often observed in bodies preserved unburied. But whatsoever the humour be that nourishes them, it is thrust through the skin by the pores thereof, the action and heat of the body assisting thereunto, where the purer part of it enters the roots of the hair, but the more earthy not being able to enter such almost unperceivable pores, is driven out amongst the hair where it becomes dust; which dust is that that is brought forth with the Curry-combe when a Horse is drest. From hence then it is, that a Horse, though he be never so well dressed one morning, and never so clean kept till the next, he shall notwithstanding be as full of dust as he was the morning before; for the cleaner the skin of a Horse is kept, the more open are its pores to transmit a more plentiful nourishment to the hair, whence also there is a greater collection of this excrementitious dust.

How the Hair comes to fall off.

And hence may be gathered a reason of the *shedding* of the hair, which is observed to happen in many Horses that have ill keeping, such as your Cart-horses that seldom have any labour bestowed upon them, for want of which dressing, to remove the dust which lieth upon the mouths of the pores or at the roots of the hairs, the passages, through which the juice should come that nourishes the hair, are obstructed or stopped, and so like dead Leaves from a Tree in Autumn they drop off, or as untimely Fruit falls before the season of the year requireth it.

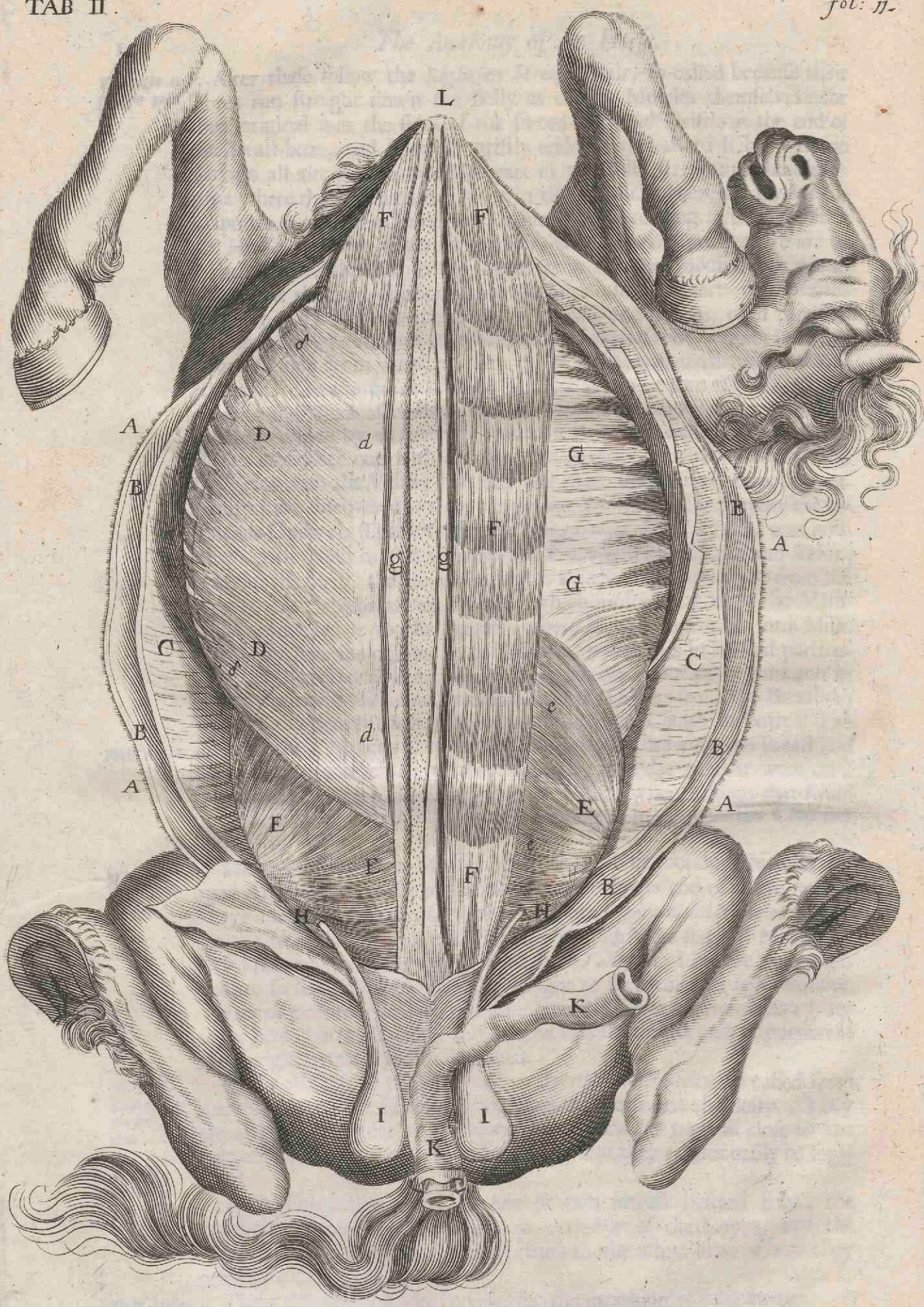
Reasons for the different colour of the hairs.

As for the *Colours* of the hairs, they are various, according as is the humour which doth predominate in the body: for such as the humour is which is driven forth towards the skin for their nourishment, such will the colour of the hair be. As for Instance:

If the choleric humour doth most predominate, then are the hairs of a black, a Sorrel or a Chestnut colour; If blood most predominate, then will the Horse be a bright Bay or Roan; If flegme, then the Horse will be of a milk-white or yellow-dun; If melancholy, then will the Horse be of an Iron-gray or Mouse-dun. Thus much for the colour of the hairs, next I come to the use of them.

Their use.

The *use* of the hairs is, first, to cover the skin; secondly, to defend it; thirdly, to be an ornament to it; and lastly, as I have before shewed, to suck up that excrementitious superfluous juice which through the pores of the skin is sent from all parts of the body to them.



C H A P. II.

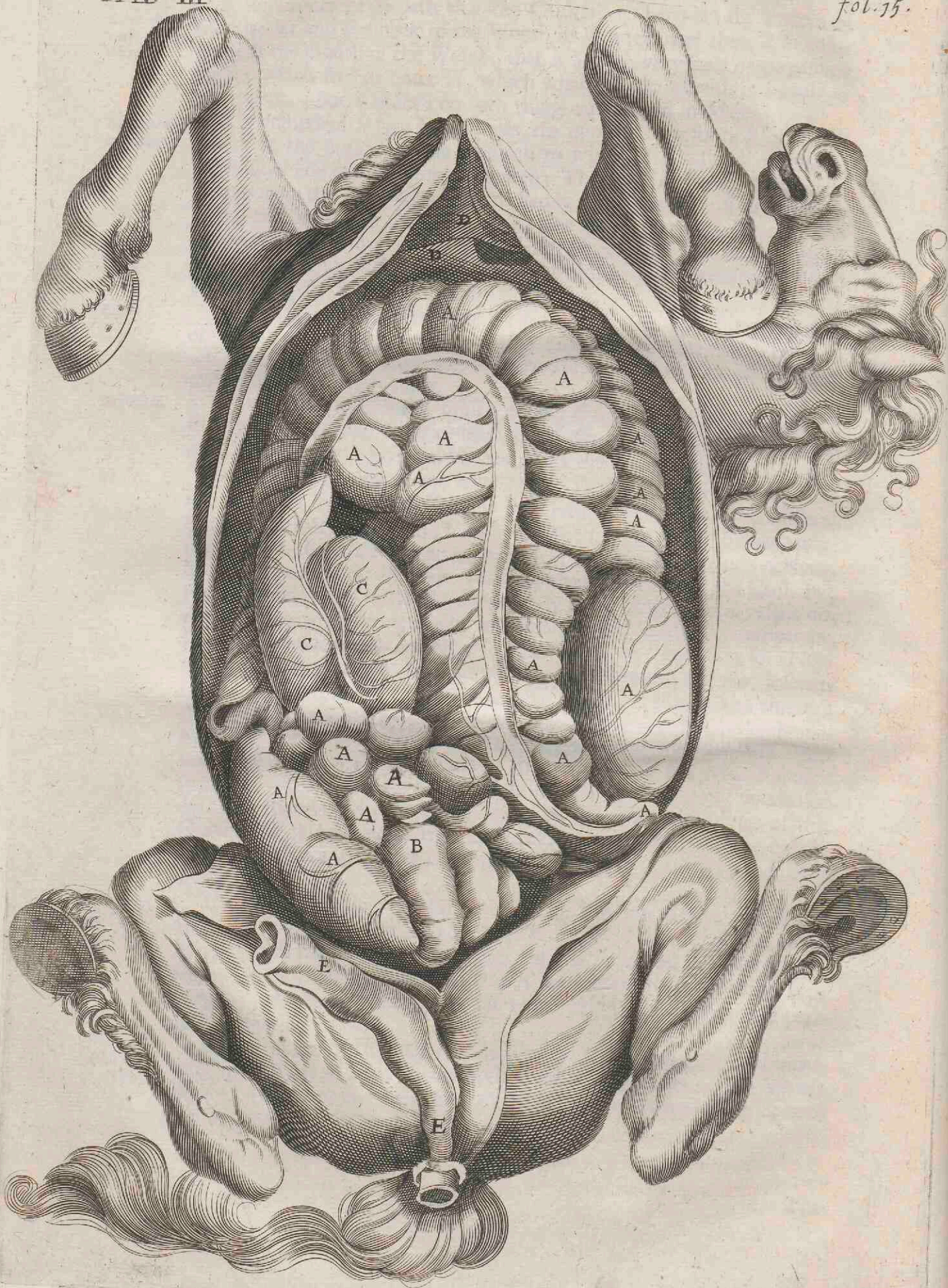
Of the Cuticle or Scarf-skin.

THE Hide on which the hairs already spoken of do grow, consists of two Skins, the outer of which is called the *Scarf-skin*, serving to defend the Body from outward Injuries, and for that intent is of it self Insensible, that it may the better indure the violence of the weather, or other harms which many times happen to it. And for that cause, Nature hath so ordered it, that if at any time it happeneth to be rubb'd off, as often it is by an ill Saddle, and many other ways, it groweth again without a scar or blemish, provided the Parts under it (as particularly the true Skin) be not also violated; for they being spermatical Parts, or made of Seed, cannot easily be restored, which is the reason that most Wounds will not heal up without a scar. Now this Scarf-skin having its matter (of which it is made) from the true Skin and the Vessels that terminate in it, which are of all sorts, both Veins, Arteries and Nerves, none of which reach any farther than the true Skin, it is apparent that this Skin is without sense, it being their office alone to communicate both life, sense and motion to all parts of the Body. And that this Skin is void of sense, may be seen by the cutting of it; as thus, If you cut onely through this Skin, when you go to Rowel a Horse, you shall not find the Horse move for it, neither will it bleed; but if you cut so far as to touch the true Skin under it, you will find him both stir and bleed, for then you touch the little threads of the Vessels, and by violating them, you cause the Horse to feel pain, and also blood to issue forth.

The Scarf-skin.

The use of this Skin, besides being a covering to the whole Body, is to cover the mouths of those small hairy Vessels already spoken of, that the blood, spirits, or other ichorous or watery Matter do not issue from them, which otherwise they would. Yet its Pores are so large as to permit the vapourous moisture that is thrust out of all parts of the Body to it, to pass through them, either in the form of sweat, or by insensible transpiration. These Pores being many times obstructed or constringed by a sudden cold taken after hard riding, by giving the Horse cold Water too soon after it, or by washing him too high in cold Water when he is hot, the Vapours are thereby hindered from coming forth, and so are detained between the two Skins, and there generate evill Distempers, or at least fall from thence into the Limbs, and there cause Inflammations and breakings out, which we call *Grease in the heels* or *Scratchers*.

Its use.



C H A P. III.

Of the Cutis or true Skin.

The true
Skin.
Its substance.

Under this Scarf, lieth the *true Skin*, which the Latines call *Cutis*. Its *substance*, as I have before shewed, is said to be spermatical, such as being once lost, cannot be restored as formerly it was, but is reunited by a cicatrice or scar, that is bred of the dried and constringed flesh under it; which is the reason no hairs will grow upon that part of the Skin where the scar is, because it is callous and destitute of Pores in which they should grow. This Skin doth encompass the whole Body as well as the Scarf, and hath the same passages for the receiving in, and letting out, for the ease and relief of the Body, as that hath.

Vessels.

It hath for its nourishment, life, and sense, *Vessels* of all sorts, Veins, Arteries and Nerves, divaricated and branched through it in the smallest hair-like threads, all which terminate in it, none of them being inserted into the Cuticle.

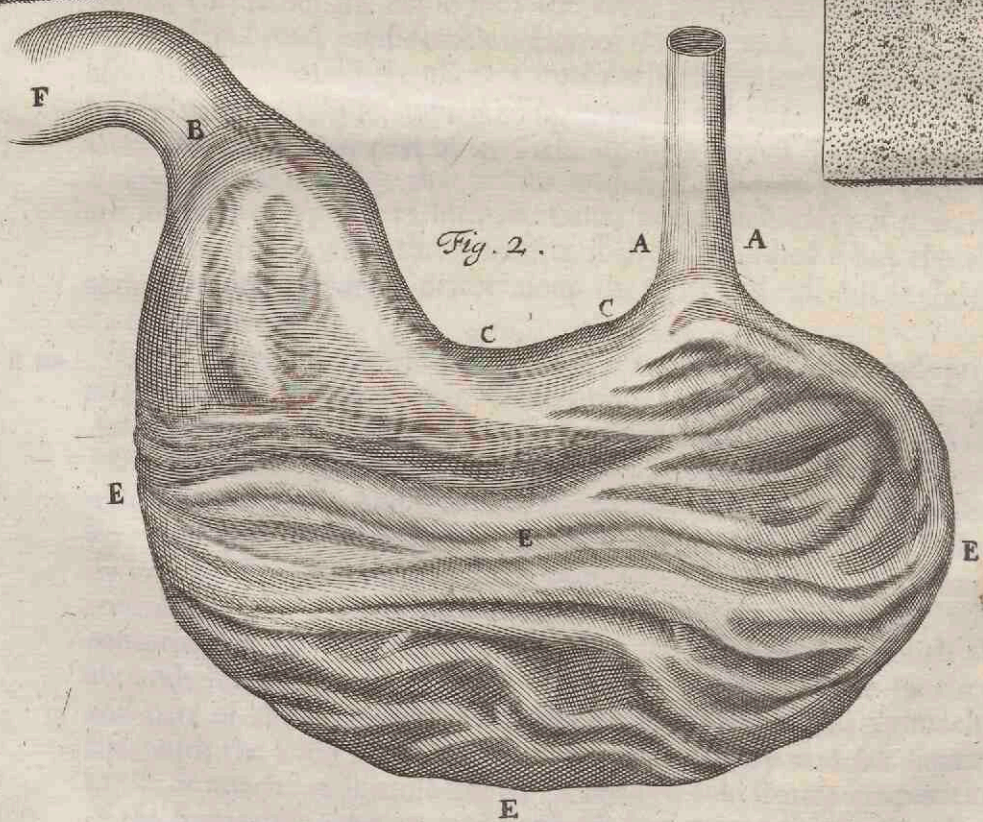
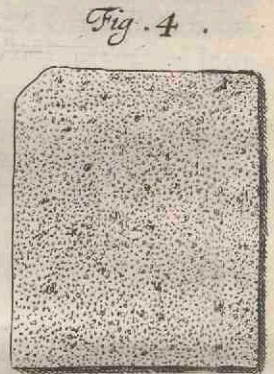
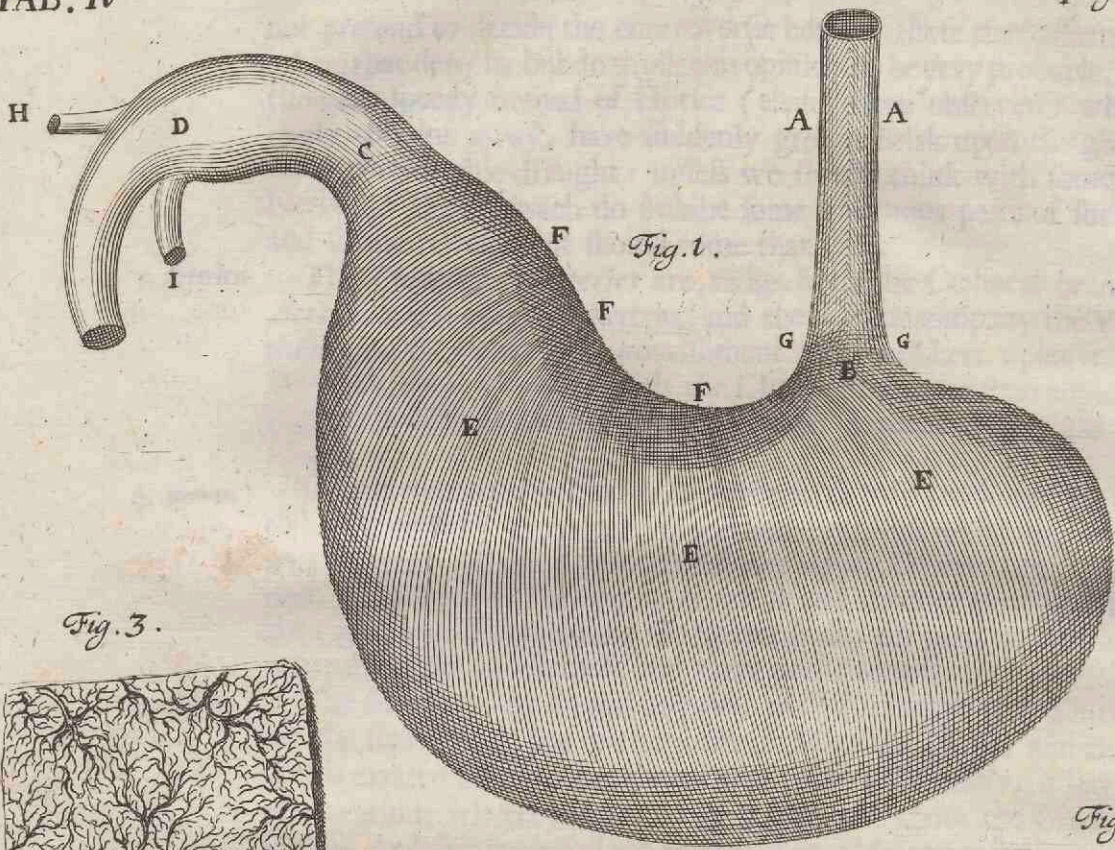
Colour.

As for its *colour*, it varieth as do the humours in the Body; for that humour which most abounds, coloureth it with its proper respective colour; as for example, If blood most abound, then is it most red; if choler do most predominate, then is it yellowish; and so for the other humours.

Use

Its *use* is principally to invest and defend the Body, as I have said before of the Scarf-skin: for as that keeps it from the violent impression of either excessive heat, or cold; so doth this Skin restrain, and, as it were, wall in (as in a Castle) all the spirits and natural heat, which would otherwise in hot weather, or in violent exercise be so fast spent, that they would leave the vital parts destitute, which would occasion the loss of your Beast. But though Nature has made this provision to hinder the dissipation of the spirits, yet has she framed the Skin (as well as the Scarf-skin) full of small Pores, through which upon violent exercise do issue in great plenty hot and moist vapours, which are that we call *sweat*; yea though the Beast be at rest, if the Air be any whit mild or temperate, warm steams are continually a passing through them by insensible transpiration.

It's also as serviceable in cold weather, for then the more fiercely it is besieged by the cold, the narrower do the aforesaid Pores purse up themselves, whereby the internal heat is detained within, and the external cold kept out.



C H A P. IV.

Of the fleshy Pannicle.

NEXT to the true Skin, lieth the fleshy Pannicle, called *membrana Carnosa*, or *panniculus carnosus*, because in most parts of the Body, it comes near to the nature of flesh, and is truly muscular. The names of the fleshy Pannicle.

In Man this Membrane is said to lie under the Fat, though some very curious Anatomists deny that Man has any such Membrane at all, save in the Forehead; and of this opinion is Dr. *Glisson*. I will not intermeddle in that Controversie, as being not proper for me: but in Horses it lies immediately under the Skin, above the Fat, and is more like to a Muscle than a Membrane. In sleying off the Skin, you must be very carefull and curious, or else you will take this Pannicle off along with it, it is so closely knit to it by Fibres and innumerable Vessels that go between. It is of the same extent and figure as the true Skin, investing the whole Body as that does; but in some Parts it is almost wholly fleshy, and in others altogether membranous. Its situation, and extent.

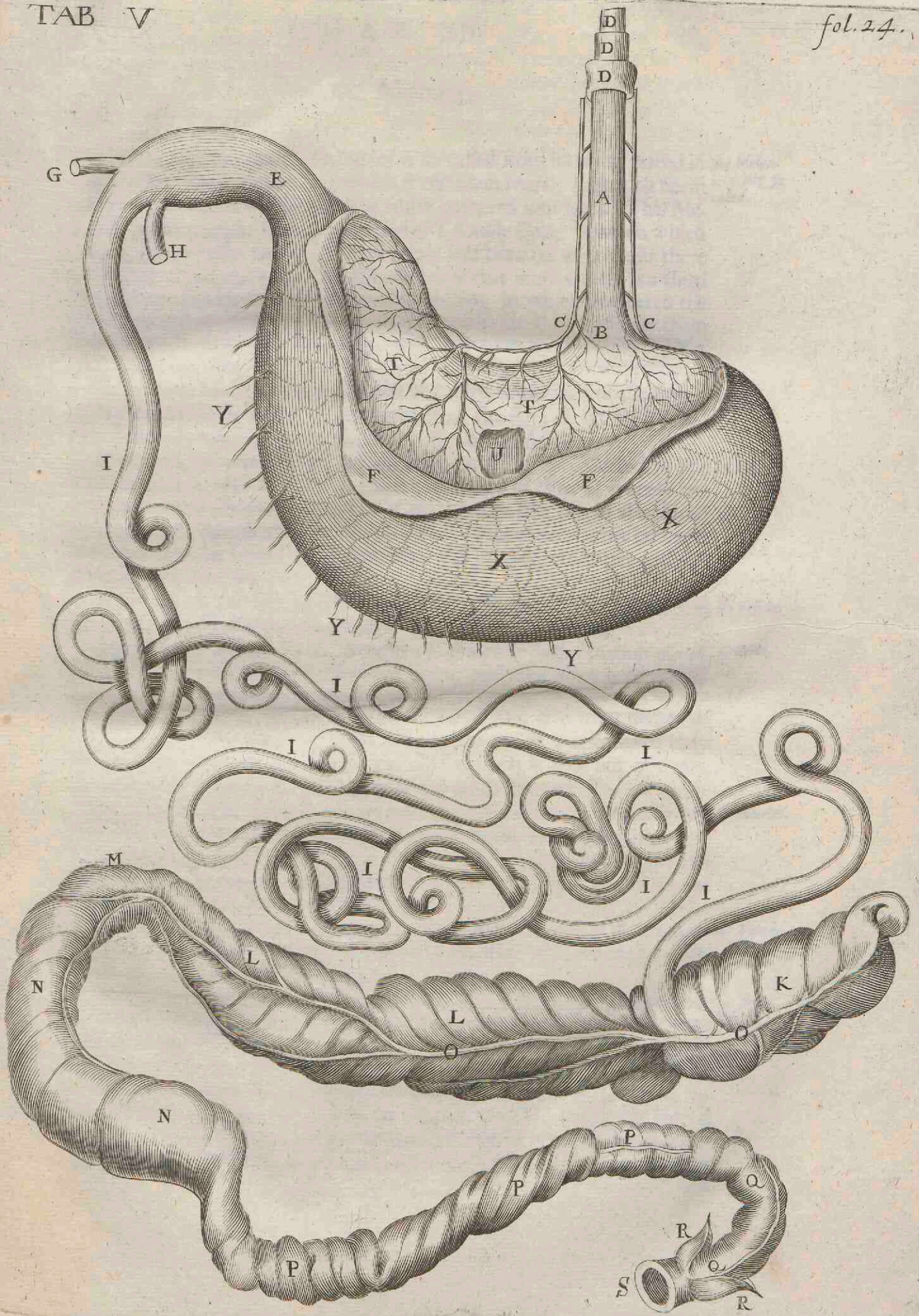
It has *Vessels* of all sorts as the Skin has, for before they can reach the Skin, they must pierce through this Membrane; and as they pass through, they send forth many small twigs into it, both Veins, Arteries and Nerves, but especially Nerves to assist its motion, whence it is by some called the nervous Membrane. Its Vessels.

The use of it is chiefly to serve for a Muscle to move the Skin, where by the Beast shakes off the Flies, or any other thing that offends him. It serves also to defend the neighbouring Parts, and to strengthen in their passage the Vessels which are disseminated into the true Skin. It also hinders the Fat from being melted and spent by the continual motion of the Muscles. And lastly, it helpeth to heal or close up the Skin when it is cut or otherwise hurt; for the Skin being a spermatick Part cannot be bred anew, and therefore this fleshy Membrane helps to glew as it were the sides of it together again, growing into one body with it, and making what we call a Scar. Its Use.

C H A P. V.

Of the Fat, and Common Membrane of the Muscles.

FAT is of two sorts, and is distinguished by two several Names as well in Latin as English. That which we are to speak of in this Chapter is called in Latin *pinguedo*, and in English *Fat*; but that which is within the Belly and makes up the Caul and Mesentery and covers the Kidneys, is named *serum*, Suet or Tallow. The former will not congeal Fat, its difference and matter.



so quickly or so hard as this latter will. Both the one and the other are made of an oily part of the blood; and this we are to treat of here, is congealed between the Carnous Membrane described in the foregoing Chapter, and the Common Membrane of the Muscles.

How generated.

This Fat is the fourth common covering of the whole Body, for there is no Part which has the rest of the common coverings, but has this also, if the Horse be not extreme lean; though the fattest have it not in any great plenty. Now as all Food that is eaten, consists of several parts or principles, which the Chymists can separate one from another, namely Salt, Spirit and Oyl; so the Food, that consists of these several principles, when it is taken into the Body, and concocted in the Stomach (which is natural Chymistry, as I may call it) has them so loosened one from another, that each principle passes into the nourishment and increase of that part that is of the same nature with it. Amongst the rest the oily part, (which is otherwise called the Sulphureous, because it will flame like Brimstone) sweating as it were through the pores of the Vessels and subjacent parts towards the surface of the Body, is stopt by the closeness and compactness of the fleshy Membrane, and there congeals into Fat. Now this Fat is not one continued body as Butter or (what we call) tryed Suet is; but is included in innumerable membranous partitions or cells, almost like Honey-combs, (which it is likely are borrowed from the fleshy Pannicle) which makes the Fat to appear somewhat spongy. It is not easie to give a reason of this oily humour's turning into Fat; for it cannot be by cold, seeing the Beast is always actually warm; much less can it be by heat, which is apter to melt Fat into Oyl, than to harden Oyl into Fat: therefore some make a moderate heat to be the efficient of it. 'Tis true indeed that the Beast is moderately hot, and we see by experience that Fat is generated; but that *that* is the cause of *this*, I dare not affirm. My apprehension of it is this: That when the oily Matter issues out of the Veins and Arteries, &c. there passes along with it much thin watry humour; And when they both come to the fleshy Membrane, this latter being thin, evaporates through it and is evacuated by sweat or insensible transpiration; but the other being thicker and more clammy, is forced to stay behind, and losing by degrees that wheyish humour that before kept it liquid, it curdles into Fat.

The uses of Fat.

The use of the Fat is, like a Garment, to keep the Body warm, and cherish the natural heat, which by its clamminess it hinders from evaporating too much; and on the other side by its thickness it stoppeth the Pores so, that the cold cannot enter in.

It also fills up the empty spaces between the Muscles, and the wrinkles of the Skin, by which the Horse is made plump, smooth and beautifull; and therefore old, lean and decrepit Horses are deformed for want of Fat.

It serves also as a pillow or bulwark against any violence, either from blows, bruises or heavy weights, and the like.

Finally, it relieveth such Creatures as abound with it, in time of scarcity or want of sustenance, by being converted into nourishment; for it serves as aliment, and holdeth the parts of the Body in play, till the Creature attain its proper Food.

The common membrane of the Muscles.

The fifth and last common Covering of the Body, is the *Common Membrane of the Muscles*. This is spread over all the Muscles (immediately under the Fat) and is knit by Fibres to that Membrane which is proper to each Muscle, but somewhat loosely, that it might not hinder their

Figure II

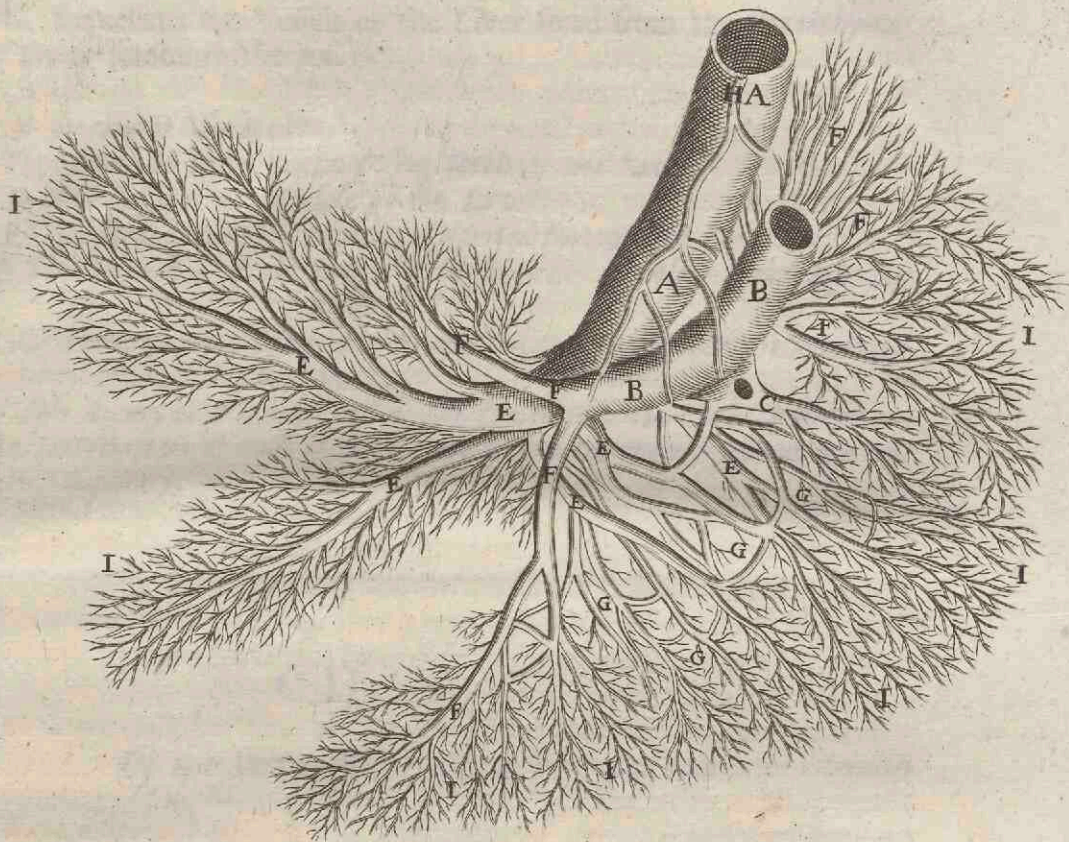
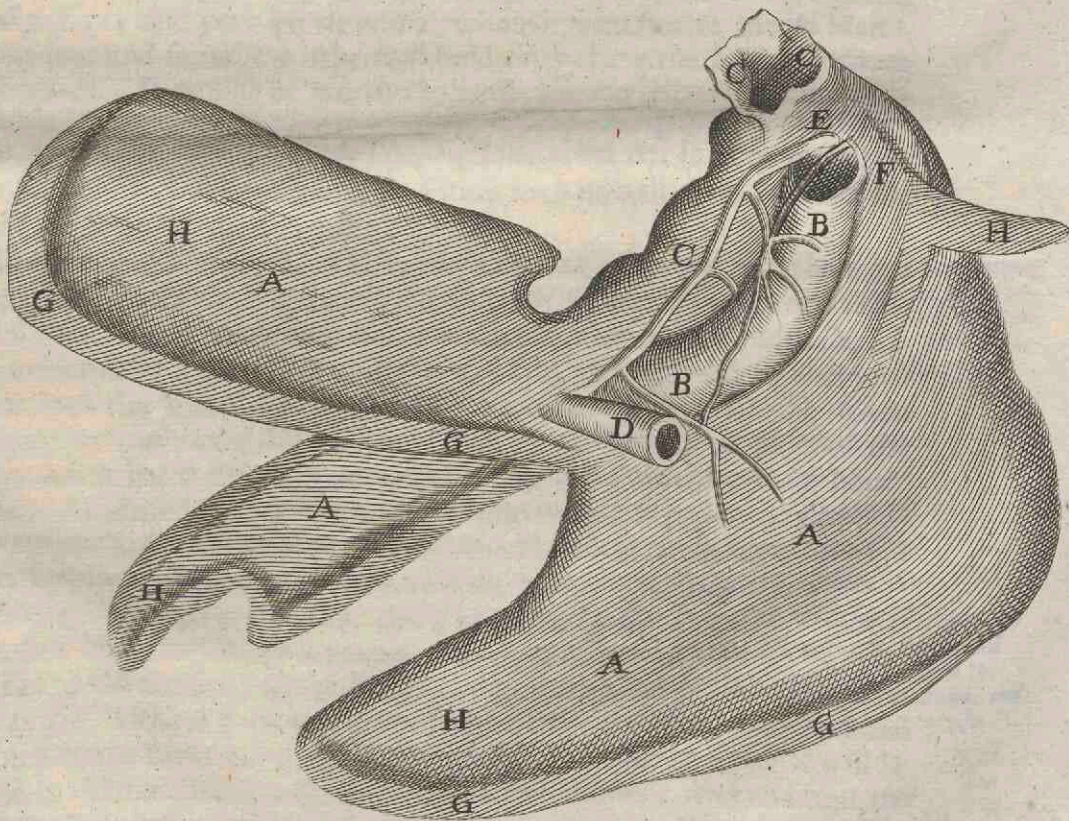


Figure. I.



their motion by investing them too closely. It is said to arise from the Back-bone, because it cleaves most firmly to the Spine thereof, and is stronger there, than in its other Parts. In an Horse it is as thick as Parchment, and very strong. And its use is to confirm and strengthen the Muscles in general in their proper situation, and to be as it were a Case for them to move glibly in, and to defend them from injuries.

C H A P. VI.

Of the Investing Parts proper to the Lower Belly.

HAVING shewed you what are the *common investing* or containing parts of the whole Body, I come now to shew which are those that are *proper* to the Lower Belly in particular, and those are onely two, besides those common ones already spoken of, namely the *Muscles* of the Paunch, and the *Rim of the Belly*.

Now by the *Lower Belly* we understand all that cavity (and onely that) which is below the Midriff, and is encompassed by the short Ribs, the point of the Breast-bone, Loins, Haunch-bones, and Share-bones, and is filled with the Guts and other Entrails.

The *Muscles* are in all Horses of a like number, which is on each side four. The first pair that shew themselves are called the *External oblique* pair; the next are the *Internal oblique* pair; the third are the two *right* or *streight* Muscles; and under these are the two *transverse* Muscles, so called from their going cross the Belly.

The Muscles of the Abdomen or Paunch.

But before I proceed any further in describing these Muscles, I will first shew what a *Muscle* is, and whereof it is compounded, and also the several uses of the Muscles in general.

The Muscles, if you take them in a large signification, are all that which we call *Flesh*; which *Flesh* may be divided into many pieces or parcels without cutting or breaking any of them, if with care undertaken; and each piece so separable, is named a *Muscle*.

What a Muscle is.

Now these pieces have each their several distinct Epithets, appellations or names from several considerations, as from their situation, shape, use, &c. but are all called *Muscles*, their office being to perform the *voluntary motion*: which motion is performed six several ways, namely, upwards, downwards, forwards, backwards, to the right hand and to the left. All which motions are performed in this manner.

Muscles are the instrument of voluntary motion.

You must know that all or most of the Muscles of the Body have each their Opposite or Antagonist, so that the one being contracted or drawn together, (which is its proper motion) the opposite at the same time is relaxed or loosned; and contrarily when that which upon the former motion was relaxed, does it self enter upon motion, it is contracted, whilst that which was before contracted, is now relaxed. As for example, when you stretch out either your Arm, or Leg, that motion is performed by one of these Muscles; and when you draw your Arm, or Leg back again, that is performed by the other.

But

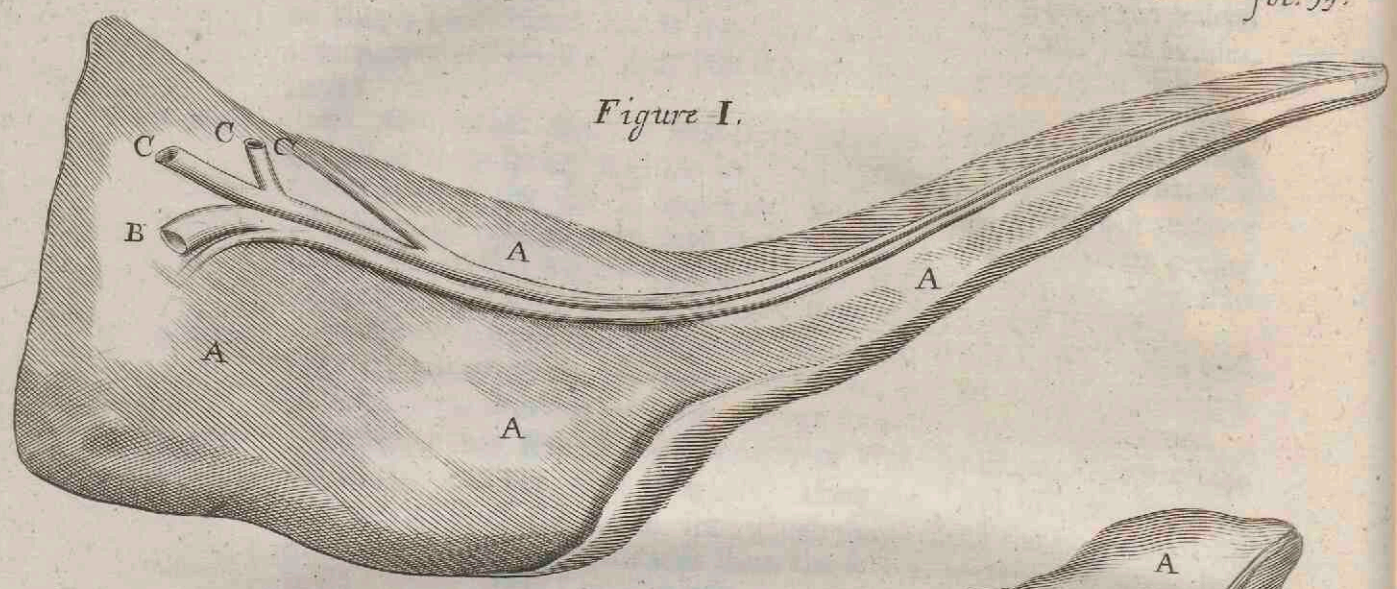


Figure I.

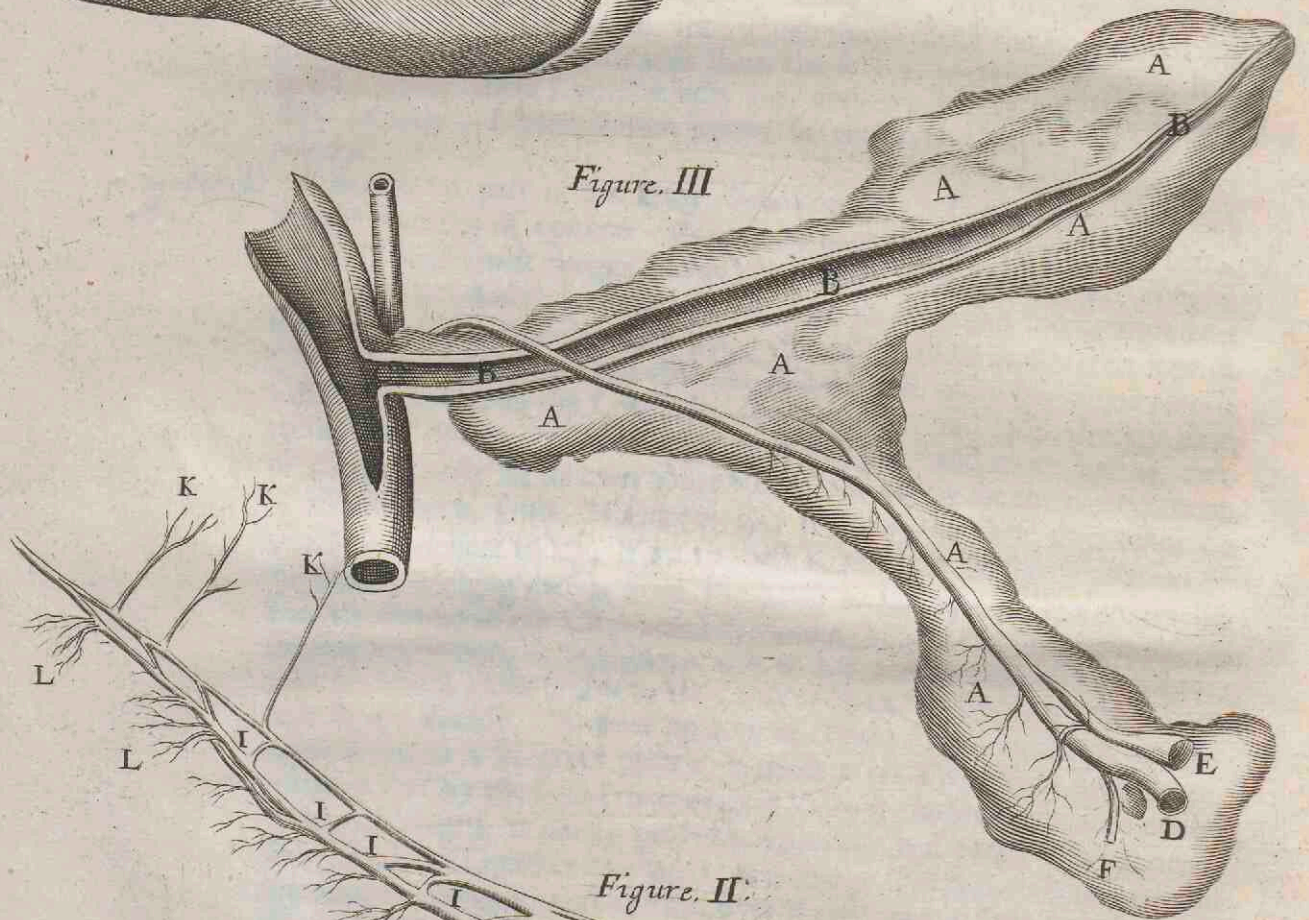


Figure. III

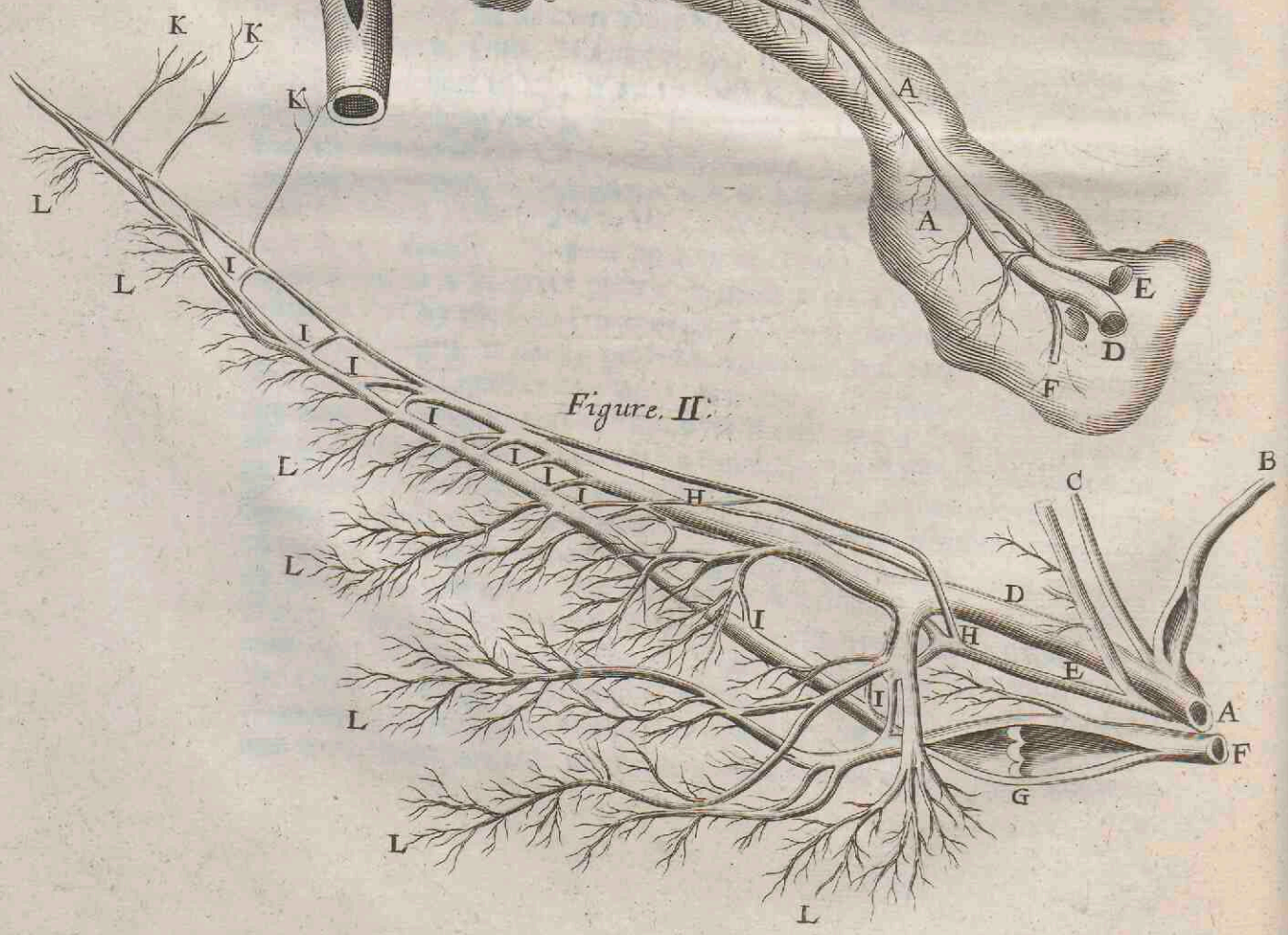


Figure. II.

But here let none so far misunderstand me as to think that either an Arm or Leg can be either stretcht forth or drawn back by the help of *one* Muscle alone; but *as* to either of the before mentioned Limbs there are several parts belonging, *so* do the distinct Muscles of every part perform (at the same time) the offices aforesaid.

Neither can this voluntary motion be performed without the help of a Sinew or Nerve, by which the Spirits are brought from the Brain which give the Muscles their moving faculty.

Involuntary or natural motion is performed without Muscles, properly so called.

Now there are other motions of the Body which are not performed by the Muscles, such as is (according to some) the pulsation of the Heart and Arteries, the peristaltick motion of the Stomach and Guts, of the passage of the Gall, and of the Ureters, and several other Parts which have their continual motions whether the Horse be sleeping or waking, and will perform their several motions as well in Men as Beasts, whether we will or not. Wherefore these are called *not Voluntary, or Natural*.

I shall in the next place shew what parts the Muscles are compounded of, and those are agreed upon by all Authours of Anatomy to be these.

A Muscle is an organical and dissimilar part.

A Muscle being an organical Part is composed of Nerves, Flesh, Fibres, Veins and Arteries, all covered or invested with a proper Coat or Skin. It is called *organical*, because it is the instrument or organ of an action, to wit, motion. And that it is also dissimilar, the several kinds of parts whereof it is made, do evidently prove. The several uses of the parts that make up a Muscle are these: The Fibres and Tendon are the immediate instruments of its action; The Flesh properly so called filleth up the interstices or distances between the Fibres; The Arteries by importing vital spirit and blood do conserve the inbred heat, and help to nourish it; The Veins do convey back to the Heart all that blood that remains from the nourishment of the Muscle; The Nerves convey animal Spirit to the Fibres and Tendon, whereby they are enabled for their action; and the Membrane or Skin which incompasseth the Muscle, doth keep it together, and distinguishes one from another.

Of what simple parts it consists.

Why called a Muscle.

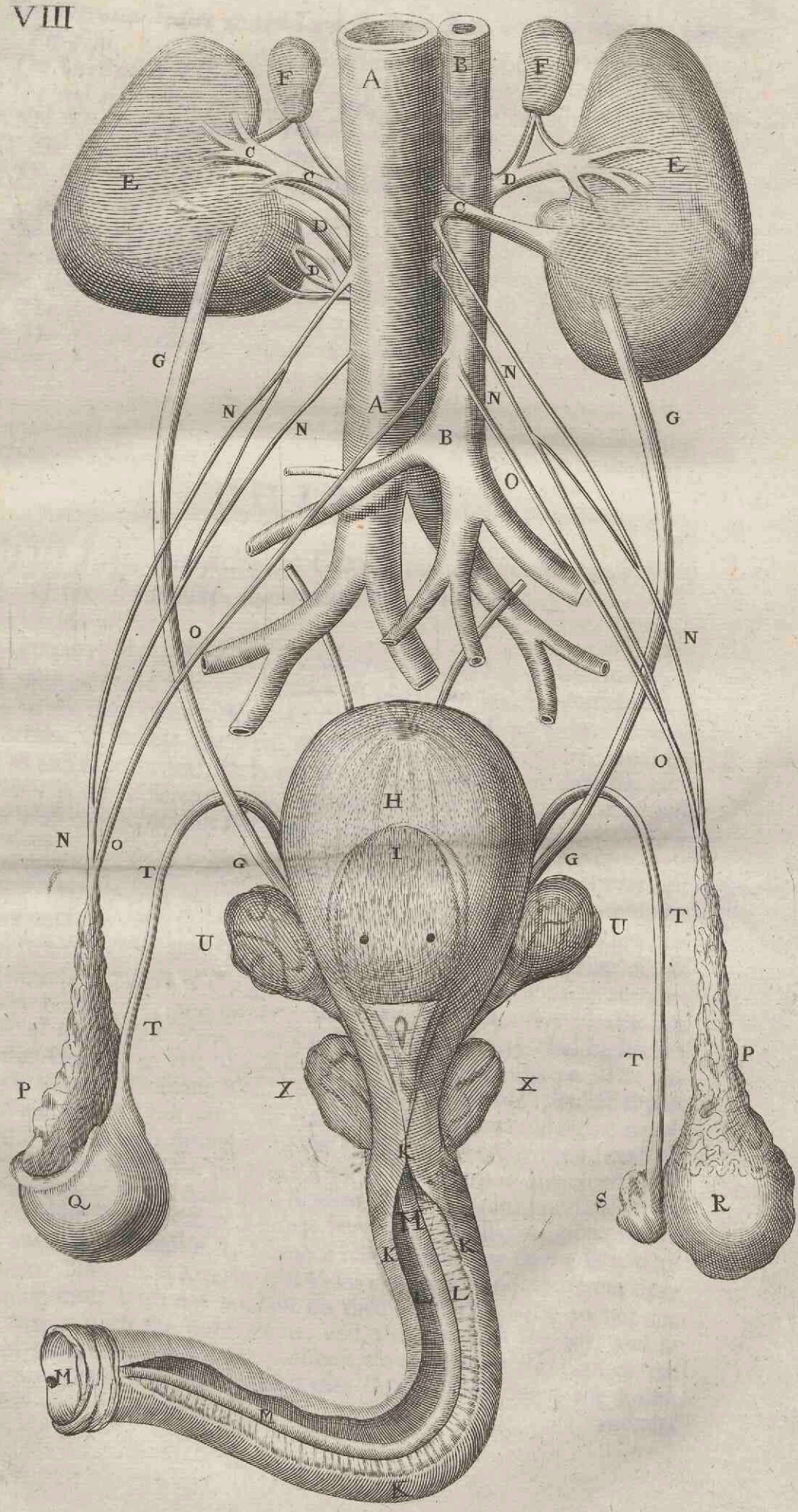
Having shewed what a Muscle is, and the several simple parts whereof it is made, I shall next shew you why it is so called. It is called *mus*, or *musculus*, by the Latins, for that it is like a fley'd Mouse, or a Fish which is called *musculus*; and by some Authours it is called by the name of *lacertus*, from its similitude with a Creature called a Lizard. Yet there can be no one certain figure whereby to resemble it, by reason of its fundry shapes; but that it is like a fley'd Mouse in colour, cannot be denied.

Whence Muscles have distinct names.

Now the Muscles being many in number have accordingly many names, which names they take from either their Figure, their Situation, or their Action, and many times from their Use; also sometimes from their Insertion, and sometimes from their Magnitude.

And although there be such difference in the Muscles, in respect of their Figures, their Magnitude, their Situation, and the like, yet are they so united or conjoynd together through the whole Body, in so close a manner, that in many places they are hard to be separated, except at some times, when either wind, some wheyish humour or some other matter gets between them, and then many times they will gape, and are at some distance the one from the other.

Yet are they not so closely united neither, but that by a carefull and expert Diffector they may be separated, and one divided from another; after



after which, to see the several parts of a Muscle severally, you must divide it also, which is on this manner.

Some divide a Muscle into two parts, which are a fleshy and a tendinous part; Again, they divide it into other three parts, namely, the Head, the Middle and the Tail. By the *Head* is to be understood the beginning or original of a Muscle, which is one while ligamentous and nervous, and otherwhiles fleshy: By the *Middle* is that part meant which is absolutely fleshy; and by the *Tail*, the Tendon, consisting of the numerous Fibres that are extended through the Muscle, and the Membrane that invests it, which grow by little and little into one body, and compose this Tendon, that is the tail of the Muscle. It is sometimes round, sometimes broad; other times long, and otherwhiles short, thicker or slenderer according to the part it appertains to, or according to the use it is put to; it being but necessary that those Parts which are moved most strongly or vehemently, should have thicker and stronger Tendons. Thus much for the Muscles in general.

A Muscle divided into parts.

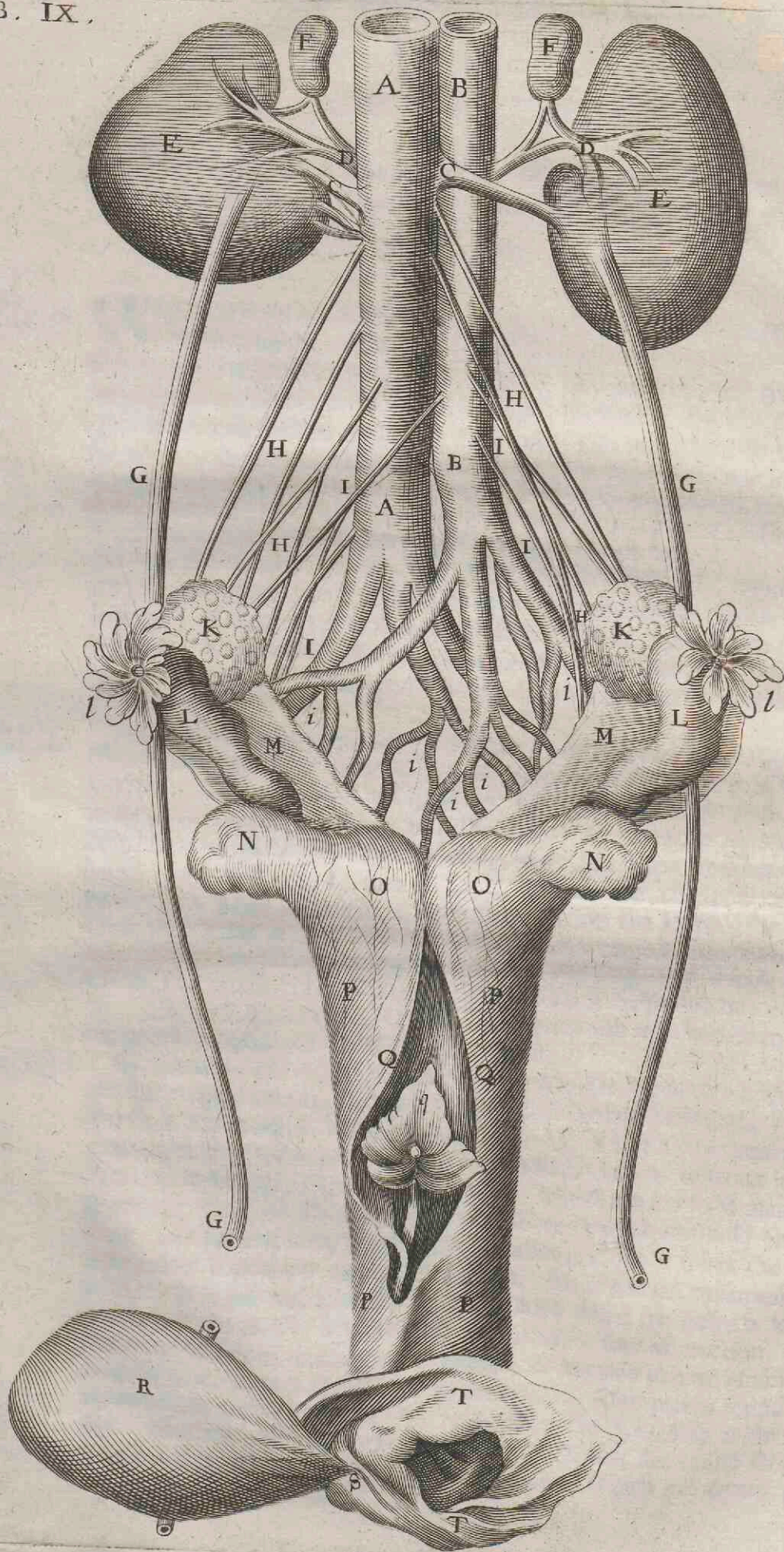
Now I come to the particular Muscles, the first of which are the Muscles of the *Abdomen* or Paunch, of which I have spoken something in the beginning of this Chapter, the which I shall now further prosecute, and let you know how they are situated. The pair that in dissection first offer themselves are called the *Oblique* (or slanting) *Descending External* pair, which pair are the broadest of all the rest, though it is by many Authours said that the oblique internal are equal in figure, magnitude, strength and action. The original or rise of these Muscles is from the side of the Breast-bone, the lower edge of five or six of the lowest Ribs, and from the tips of the cross or transverse processes of the Joints of the Rack-bone in the Loins. Their rise from the Ribs imitates the teeth of a Saw; for springing with a narrow point from the lower side of the Rib, every such point grows broader and broader, till it unite with the two next it on each side, so that there is a space of above an inch between every point, into which empty spaces the greater Saw-like Muscle of the Breast ends with like points. From their rise they run sloping downwards toward the *white line* (so called) in the middle of the Belly; but before they reach half way thither, they lose their fleshy substance, and become tendinous, and their Tendon is so united to the common Membrane of the Muscles, described in the foregoing Chapter, that it seems to become one with it, and running over the streight Muscle is inserted into the foresaid white Line, down even to the very Share bone, into which also it is inserted.

The Oblique descending external pair.

The next to these are the *Oblique Ascending Internal* pair, so called because of the contrary course of their Fibres to those of the External; for as those *descend* obliquely or slant, so do these *ascend* in like manner. Their rise is from the Rib of the Haunch-bone, and from the processes of the *vertebrae* of the Loins and *os sacrum*; and their Tendon is extended to the short Ribs partly, and partly to the white line, above the Navel, adhering to the common Membrane of the Muscles as was said before of the oblique descending, where it is not cover'd by the Tendon of that Muscle. These have a different *action* from the former; for whereas the External pair do draw the lower part of the Belly towards the Breast, where they have their original; these on the contrary draw down the Chest with a kind of slanting motion towards the Hips; it being the action of all Muscles to draw towards their original, and the original of these Muscles is (as was said) at the Rib of the Haunch-bone.

The Oblique ascending internal pair.

Their Action.



The right or streight pair. After these follow the *Right* or *Streight* Pair, so called because their Fibres run streight down the Belly as do the Muscles themselves: for their original is at the sides of the sword-fashioned Gristle at the end of the Breast-bone, and from the gristly ends of the bastard Ribs, whence they go all along the eminentest part of the Belly streight to the Share-bone where they terminate. Now in these Muscles there are several Inscriptions or tendinous Interstices, which are, according to the bigness of the Horse, more or fewer in number, but most commonly there are in each Muscle eight, not so fair indeed as in Humane Bodies, but yet so plain, that they do distinguish the Muscles into nine parts or more, as there are eight of these inscriptions or more; and besides, each part has a distinct Nerve: and yet notwithstanding, because they cannot be easily separated one from another, they do by most Anatomists go for onely one pair. On the inside of these Muscles are to be seen the Epigastrick Arteries and Veins ascending, and the Mammary Arteries and Veins descending, which by an ancient Tradition have been held in Humane Bodies to inosculate one with another, the Arteries with the Arteries, and the Veins with the Veins; but later and more inquisitively curious Anatomists have discovered it to be a mere fancy, invented to support the erroneous Opinion, That whilst the Young was in the Womb, it was nourished with blood carried to it by the Hypogastrick Arteries and Veins; but after the birth, the blood altering its course, regurgitated up from the Womb, by the Epigastrick Vessels, which inosculating with the Mammary, conveyed it to the Breasts, where it was converted into Milk. This I say was the opinion as to Women, which has in several particulars been detected of error: and may receive a further confutation in Mares, from the different situation of their Udders from the Breasts in Women; whereas these Vessels have the same Course in both. The *action* of these Muscles is to shorten the Belly by drawing the Breast and Share-bone towards one another, whereby it is drawn as it were on a heap, to squeez forth the Excrements or Urine, whence Dogs that strain so hard to dung, have these Muscles arising as high up as the Channel-bones.

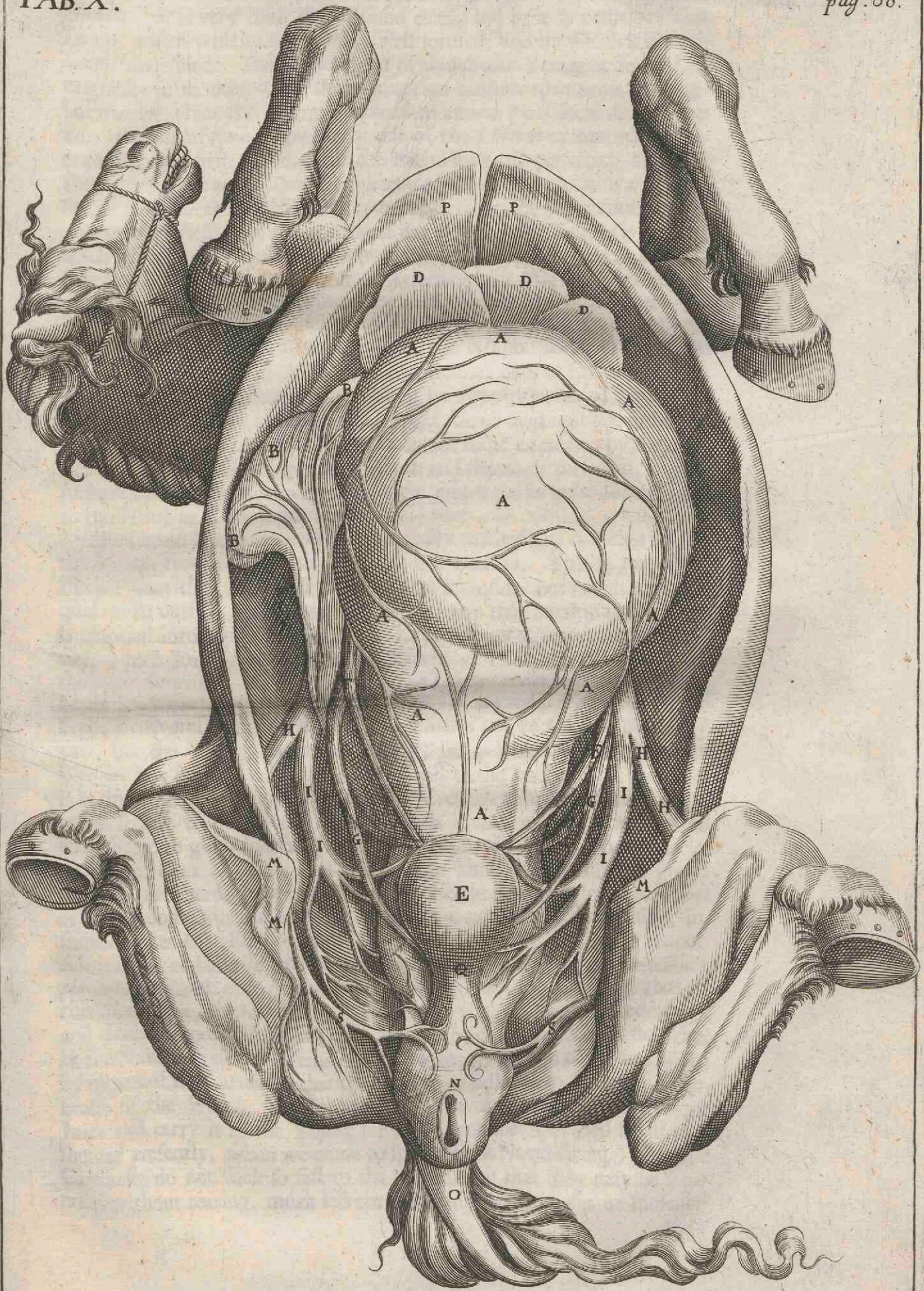
The pyramidal Muscles. There are other two Muscles (sometimes to be found) which do rest upon the Tendons of the Right Muscles at the lower end of them, which I have not yet spoken of, and these are called the *pyramidal* Muscles. They are of a triangular figure, and their use is to assist the streight Muscles in their squeezing forth the Excrements, saith *Fallopious*. I believe these Muscles are so seldom found, that they ought to be accounted *lusus Naturæ*, a sport of Nature; for I do not remember that ever I have observed any other here, but what ought to be accounted the lowest part or portion of the streight Muscles before described.

The transverse or overthwart Muscles. Under all these lie the transverse or overthwart Muscles, so called from their own and their Fibres running cross or overthwart the Belly. They are of a quadrangular or foursquare figure, and do stick so close to the Rim of the Belly (which is under them) that they cannot easily be separated.

Their Original is from the one or two lowest bastard Ribs, the transverse processes of the Joints or *vertebræ* of the Loyns, and the Haunch-bones; and their Tendons reach to the white line, where they terminate.

Their Action. Their *Action* is to press the Guts for the expulsion of Excrements.

Now



Book I. *Of the Lowest Belly or Paunch.*

11

Now as each Muscle has a peculiar action to it self, which is that already ascribed to each, so have all these ten Muscles two Actions general to them all conjoinedly, which are these; The *first* is, that they serve for a defence or bulwark for all the Parts underneath them, and do by their flesh (which pretty much aboundeth in them) cherish their natural heat and assist concoction; The *next* is, that they do all assist together in the compressing of the Guts for the voiding of the excrements, the Midriff assisting thereunto, by whose help the excrements are thrust downwards, which otherwise would be onely squeezed together, and not thrust any more downward than upward.

The action of all these Muscles together.

I think it not amiss in this place to explain what it is I call the *white Line*, for fear the naming of it so often as I have done in this Chapter, without shewing what it is, should puzzle the Reader.

The *white Line* is nothing else, but the extremities or tendinous endings of these Muscles of the Paunch, and is called *white* from its colour, becoming so, because it consists of Tendons and Fibres onely, wherewith no fleshy part or particle is interwoven, whereby to change or alter the colour. It distinguisheth the Belly into two parts, a right and a left, and is placed all along the middle of the Belly both below and above the Navel, running from the sword-pointed Gristle of the Breast as low as to the Share-bone.

The white Line what it is.

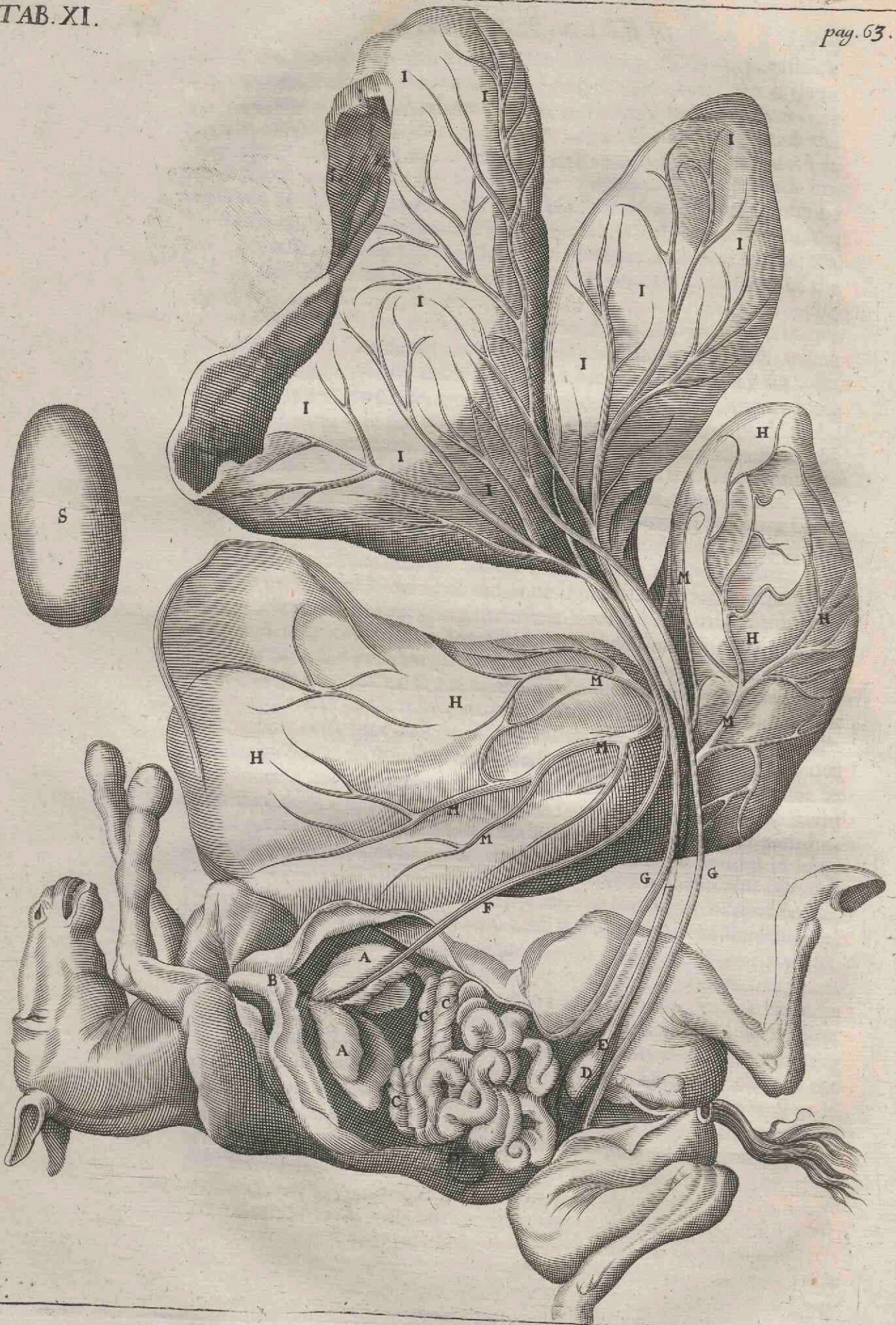
Now the *Udder* being an external part of the Belly in Mares, I might in this place (in order) treat of it; but because its Action, to wit the making of Milk, has so near relation to the Foal, for which it provides nourishment, I shall omit it in this place, and describe it at the latter end of this *first* Book, after I have done with the generative parts of Mares, and the breeding, nourishing, &c. of the Young in the Womb.

The *Second* Table representeth all the Investing parts of the *Abdomen*, as well proper as common.

- AA Shew the Skin and Scarf-skin turn'd back.
- BB The fleshy Membrane likewise turn'd back, with a little sprinkling of Fat on its inside.
- CC The Common Membrane that invests the Muscles, in like manner turn'd back.
- DD The obliquely descending Muscle expressed in situ on the right side.
- dd The Tendon of the same running to the white Line.
- DD Its saw-like origine from the Ribs.
- EE The obliquely ascending Muscle, with its Tendon ee, on the same side, likewise in situ.
- FF The Streight exprest to the full on the left side, but onely in part on the right, because the Tendons of the obliquely descending, and ascending Muscles run over it.
- GG The transverse Muscle exprest to the full on the left side, but hid on the right by the two oblique.
- gg The white Line and outer Skin of the Rim of the Belly cut in sunder, that the Fat contained between the outer and inner Skin of the Rim may appear.
- HH The perforations in the obliquely ascending Muscles, by which the spermatick Vessels do pass out of the Abdomen into the Cod.
- II The Stones. K The Iard. L The Sternum or Breast-bone.

D

CHAP.



C H A P. VII.

Of the Rim of the Belly, called the Peritonæum.

THE Muscles of the Paunch being all removed, as also their Tendons which make the white Line before spoken of, the *Peritonæum* or Rim of the Belly comes next into sight.

What the Peritonæum is.

This *Peritonæum* is of a spermatick substance (as are all other Membranes or Skins) and is of an oval Figure, or like a long-fashioned Egg, for it compasseth all the Lower Belly and ingirts all the Parts therein contained, and also strengthneth them, from whence it hath its name, from its office of *spreading* and *stretching about*. It is thin and soft, that it might not be either heavy or burthenfom; yet is it very strong and compact, that it might be stretched without danger, when the Belly is full of Meat, or the Womb is full of the Burthen. Its inside is smooth, and by reason of the Guts is daubed with moisture; but its outside is rough, which makes it stick so close to the Muscles that lie above it, that they can hardly be separated, as I have before shewed.

Its original.

It takes its *original* from the *vertebræ* or joints of the Loins, where it is very thick, and is therefore believed to proceed from the Membrane that invests the Marrow in the Back-bone, and is propagated from the double Membrane of the Brain. It is in all places double, and betwixt its Membranes I have always observed good store of Fat, which Anatomists do not speak of in other Creatures. The Vessels run along this Fat between the Membranes, that they may be the better secured and defended, and may with more safety disperse their branches all over it; and for that purpose it is *perforated* in several places, so wide as is proportionably necessary to the largeness of the Vessels that are to go through, and no larger, lest in distentions or strains they should tear, as too apt they are to do, as Experience daily testifies in Men and Children, when vehement coughs or long and straining cries do, in some, open the orifice of the Navel, and in others the orifices in the Groin, where the spermatick or seminary Vessels go forth to the Stones, so that the wideness gives liberty for the small Guts to fall out of their places into the outward parts, which causeth Ruptures and broken Bellies. The like I have seen in Horses.

Its perforations.

The outmost Skins of all the parts of the Lower Belly, have their original from this.

From the inner Membrane of this Rim of the Belly, all the outmost Skins or Coats which cover every Part contained in the Lower Belly do proceed, and from it have their original, some thicker and some thinner, according to the necessity or use of the Part respectively. As for Example, the Common Membrane of the Kidneys, the proper one of the Liver and Spleen (each of which have but one) are but very thin, for seeing they are never (naturally) extended, there was no necessity for their being otherwise; but the Common Skin of the Stomach, the Guts, the Bladder and the Womb are somewhat thicker, but much stronger and more compact, because the uses they are put to require it, that they may without danger be stretched, when there is occasion. Now as the Entrails are many and of divers kinds, and also situated in several places different from one another, so does their outward Investing Membrane take

Fig. I.

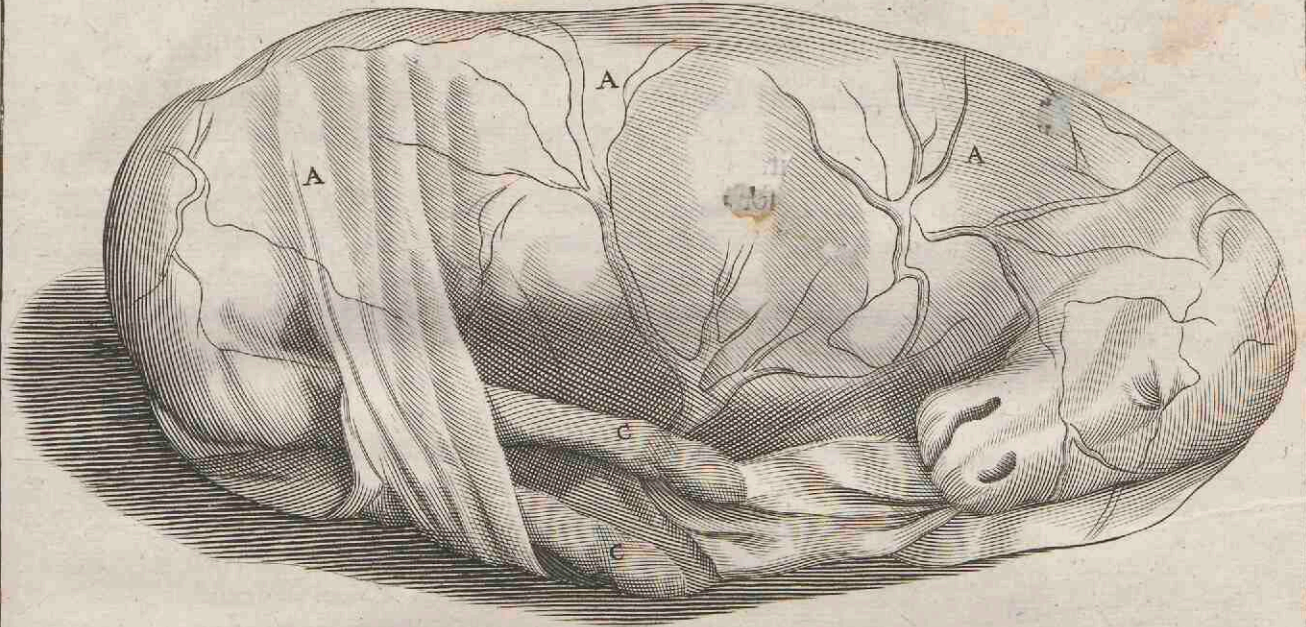


Fig. 2.

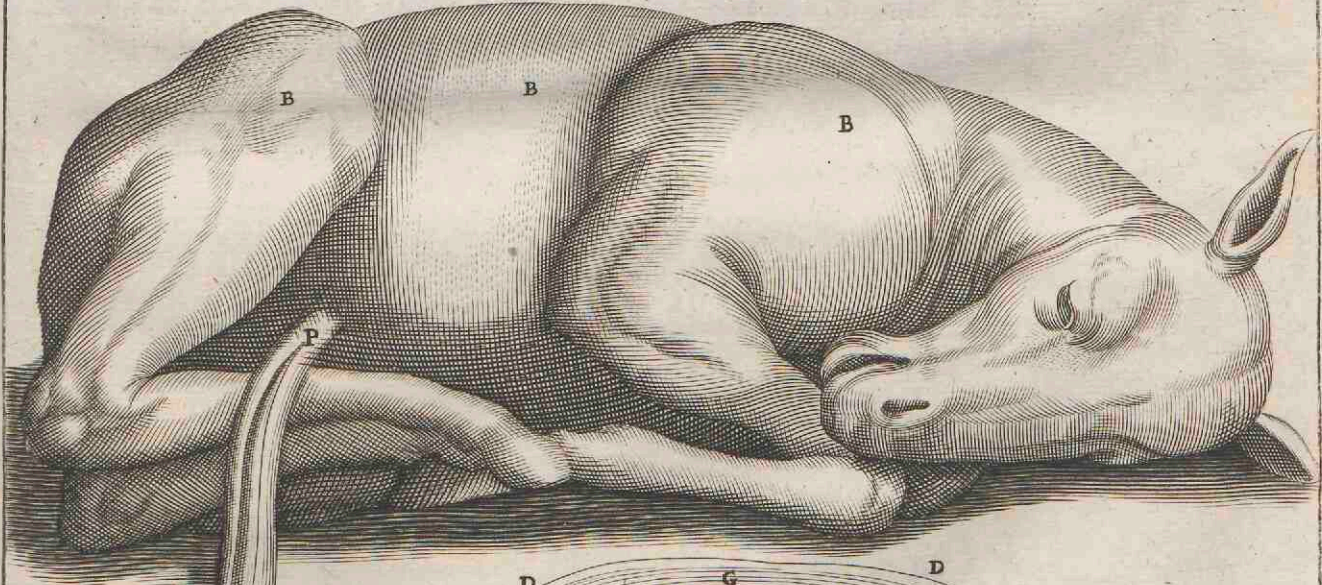
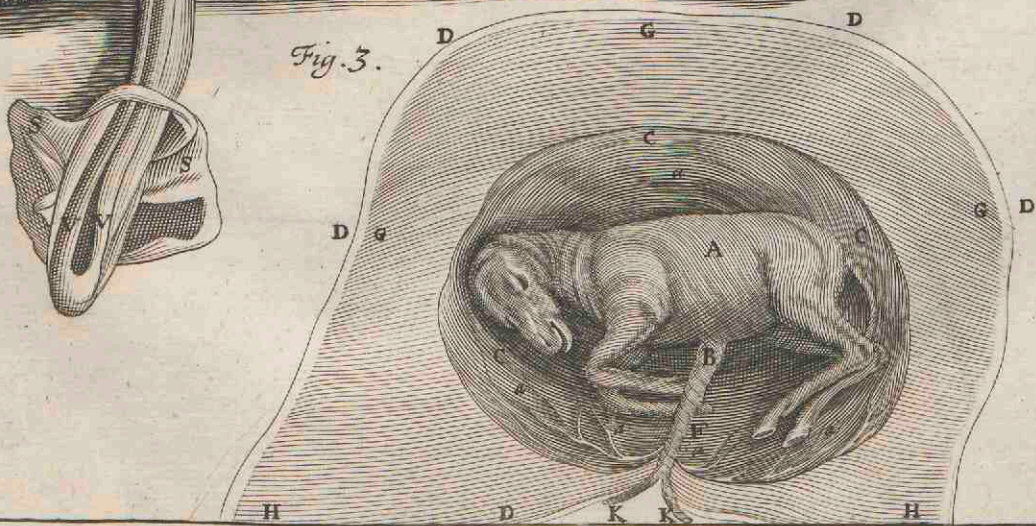


Fig. 3.



take its original from that part of this *Peritonæum* or Rim of the Belly which is next to them; as the upper Entrails, which are the Stomach, the Liver, the Spleen, &c. borrow it from that part of the Rim which makes the under Membrane of the Midriff; so do the lower Entrails (as the Bladder, Womb, &c.) borrow it from that part of the Rim, which cleaveth to the Share-bone, it being the nearest to them.

From this *Peritonæum* or Rim of the Belly do also proceed two double Membranes or Skins, which are those of the Caul and of the Mesentery; as also several Ligaments, of which the most remarkable are those of the Liver and Guts.

This *Peritonæum* is composed of membranous and nervous Fibres Its Composition. which are very small. The Vessels that are dispersed through it are small branches of Veins and Arteries which it hath from the Midriff, and other neighbouring Parts, as the Seminary and Mammary; and for Nerves, it hath them from the branches which are carried to the Muscles of the Lower Belly.

Its *Uses* are several, the first of which is, to cover and contain all the Its Uses. Parts or Entrails of the Lower Belly; secondly, to further the expulsion of the Excrements by pressing the Stomach and Guts before and on the sides, as the Midriff doth above. Again, it binds with its Ligaments all the Guts in their proper places by mediation of the Mesentery, that no violent motion (such as running or leaping) should move them out: By Ligaments proceeding from it, is the Liver also suspended in its place. Its last use is to be a safeguard to the Vessels that run through it, which being but small and having a long course to run, would be in danger of breaking, were they not secured between its two Skins.

C H A P. VIII.

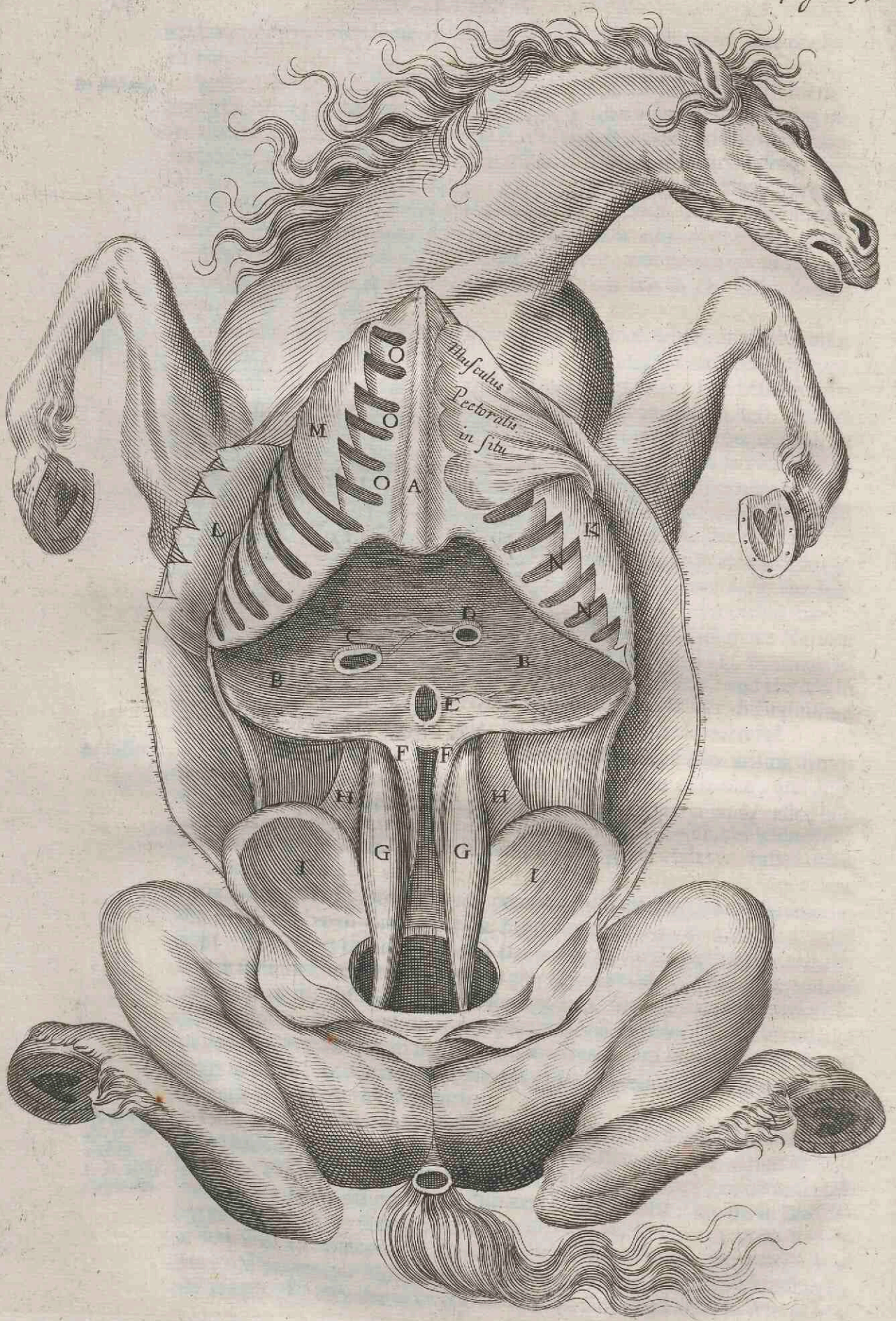
Of the Omentum or Caul.

HAVING according to the order of dissection, removed all the *investing* or *containing* Parts of the Lower Belly, and shewed which, and what they are; it now follows that I shew which are the parts *invested* or *contained*. And because the *Caul* appears first in dissection, I will first treat of it.

This *Caul* is in Latin called *Omentum*, from *Omen*, because the Roman Soothfayers pretended by it to foretell things. It is also called *mappa ventris*, the Map or Dish-clout of the Belly, because it seemeth to lick up the superfluities thereof. It doth cover all or most of the Guts in many Creatures; but in a Horse it is most times removed from all the lower parts of the Belly, and lieth in wrinkles or folds near and about the Stomach. The reason of its being removed, I do suppose, is the hard labour and violent Exercise a Horse undergoeth; for whilst he is young, and before he comes to his labour, it is spread as far over his Entrails as in other Creatures, as hath been observed by the Learned *Marcus Aurelius Severinus*, who did in a She-foal which he dissected at *Naples*, see the

The Caul what it is.

How far it spreads over the Guts.



Caul spread all over the Guts as far as to the bottom of the Womb, to which it was also joined with a strait connection.

It is sometimes the cause of barrenness.

It sometimes happeneth that the Caul falleth between the bottom of the Bladder and the neck of the Womb in Women, and then it so compresseth the mouth of the Womb, that it leaveth very little or no passage for the Man's seed to enter in, which when it so happeneth is a cause of barrenness. But I believe no such thing can happen in Mares.

Its connexion or origine.

It is composed of two Membranes, the uppermost or formost of which ariseth at the bottom of the Stomach to which it is fastned, as also to the hollow side of the Liver and Spleen: The inner or backer Membrane springs from the *Peritonæum*, immediately under the Midriff towards the Back, and is tied to that part of the Gut *Colon* that passeth under the Stomach lengthways, as likewise to the Sweetbread and to the beginning of the small Gut, next to the lower Orifice of the Stomach. These Membranes are larded with plentiful Fat.

Figure.

It is in figure like a Purse net, or Faulkner's Bag, consisting as is said of a double Coat, separate at the top, but knit together at the bottom, where it is round sometimes, and sometimes unequal, but at its upper part or orifice it is orbicular.

Its Vessels.

It has Vessels of all sorts, which do run through the substance thereof. It hath its Veins and Arteries from the Coeliacal and Mesenterical branches, and Nerves from a double branch of the Intercostal pair.

Its Fat.

In Horses it has much Fat, especially in those that are sound and have not wasted it by either sickness or long fasting, for in such it consists of little but the Membranes and Vessels, the Fat serving for a subsidiary nourishment to the natural heat to feed upon when the Beast eats nothing. Now this Fat is not distributed equally to all the parts of the Caul, but runs here and there in streaks accordingly as the larger Blood-vessels do, the spaces between being wholly membranous and seemingly transparent, so that it imitates a Net, whence in some Countries they call it so. Now the Fat adhering to and accompanying the Vessels in this manner, it seems to be bred of an unctuous or oily part of the Blood that sweats through the Vessels, but is detained by the closeness or denseness of the Membrane, by whose respective coldness also it is curdled or congealed into Fat. But very unlikely it is that it should be made of I know not what Vapours steaming out of the Parts contained in the Lower Belly, and condensed by these Membranes; for not to mention the many absurdities of this Opinion, if it were so bred, then would all the Membranes be evenly and equally besmeared with it, which it is obvious to any Eye that they are not.

The use of its Fat.

The use of this plentiful Fat is to cherish and heat the bottom of the Stomach, the upper part of which has no need of its warmth, it being covered with the Liver, whose Lobes hang over it and lie upon it. It serves also to moisten the Guts, which have great need of being kept slippery and glib, that they may the better perform their continual peristaltick motion.

The use of its Membranes or Skins.

The use of the Membranes or Skins besides their congealing and including the Fat, is to prop up and sustain all the branches of the Vessels which lie between and pass through them, to the Stomach, the Spleen, the beginning of the small Gut, and *Colon*, &c.

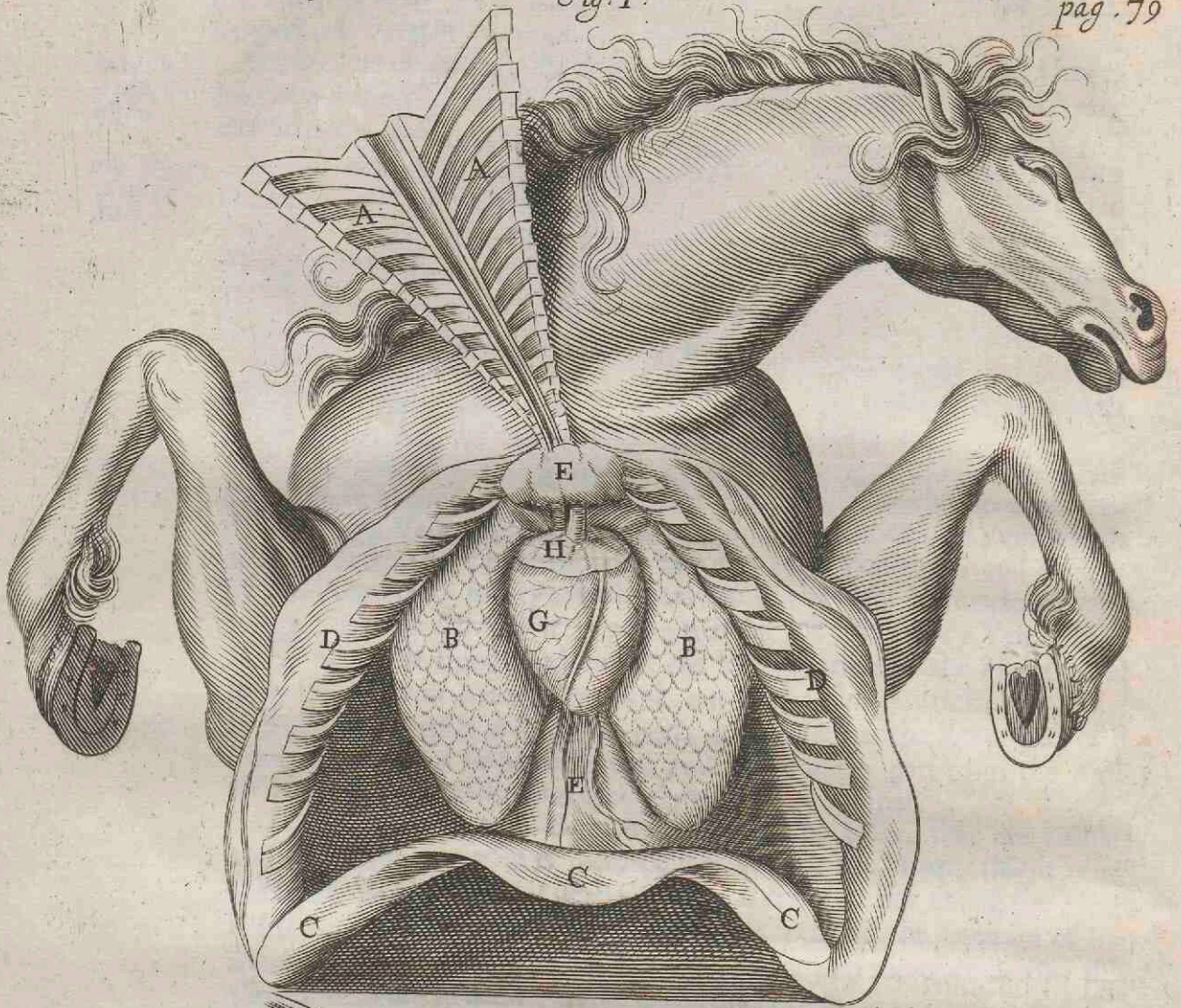
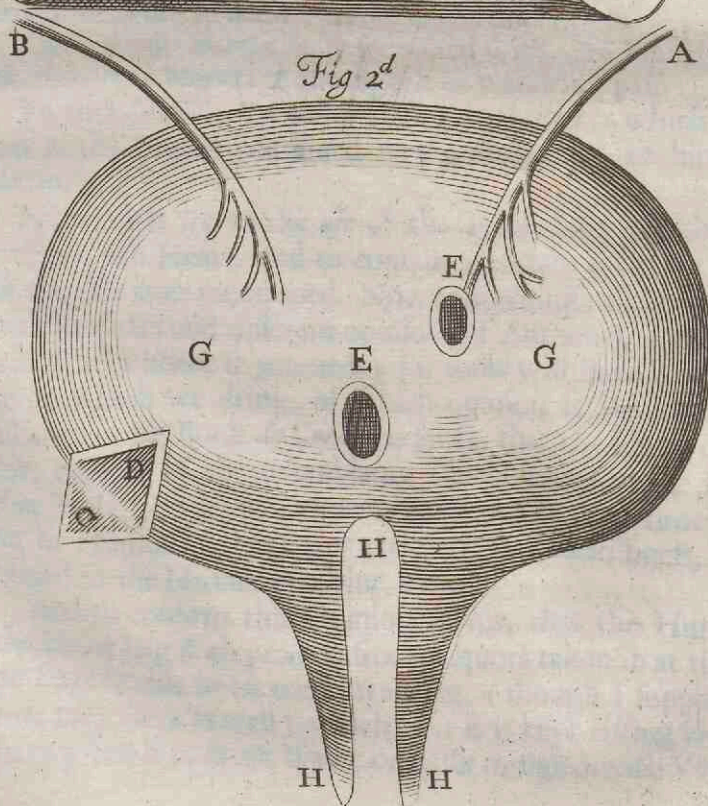


Fig. 2^a



The *Third Table* representeth the Guts *in situ*, as they appear after the Caul is taken away.

AAAA Sheweth the Gut Colon or Colick Gut with its Convolutions or Folds, as also what parts of the lower Belly it takes up.

BB The streight or Arse-gut.

CCC The Gut Cæcum or blind Gut.

DDD The Diaphragm or Midriff.

EE The Horses Tard.

CHAPTER IX.

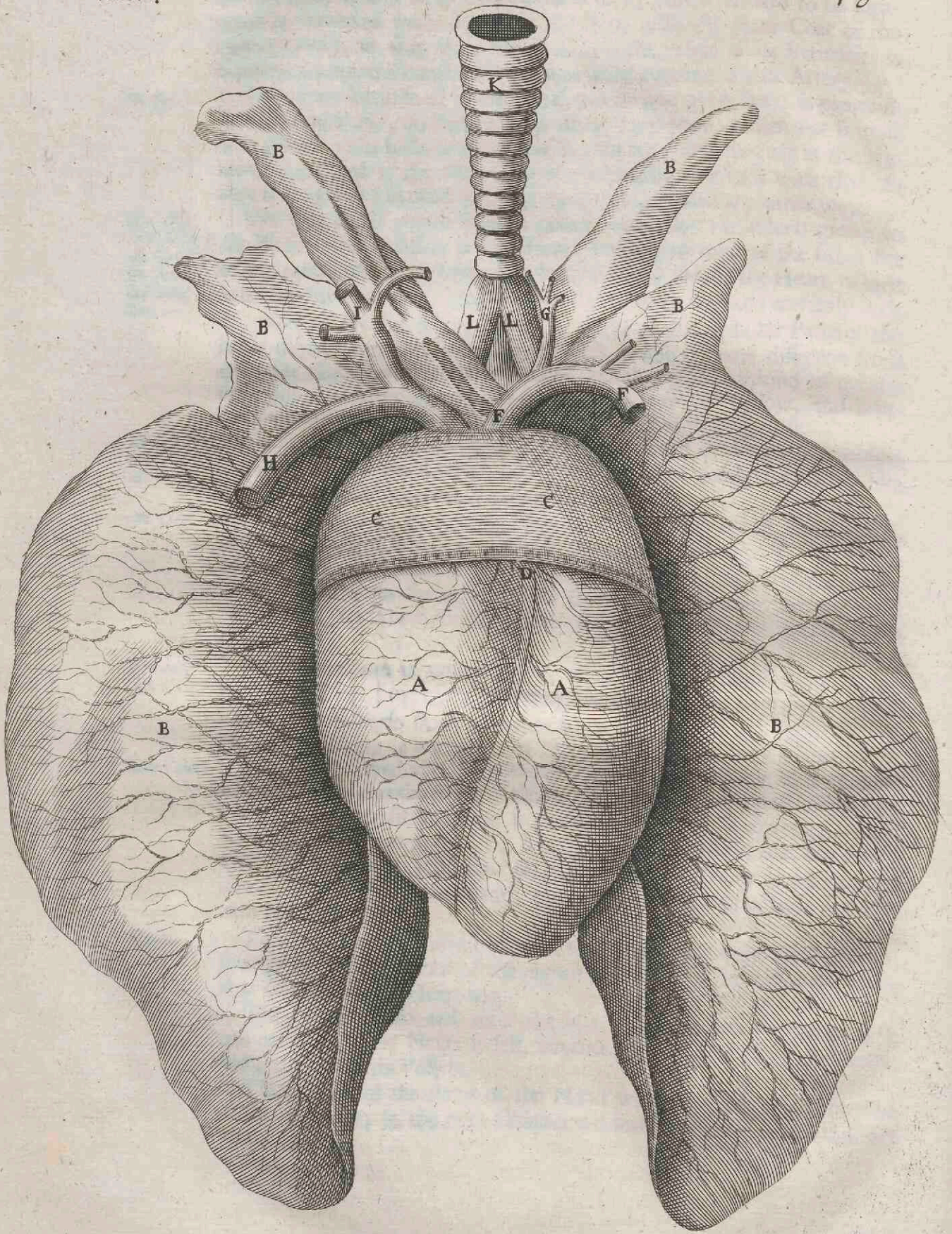
Of the Gullet and Stomach.

AFTER the Caul is removed, the Intestins or Guts do appear in their natural situation, as is shewed in the foregoing Figure; but there is another Part that lies absconded under them, which must first be spoken of according to the order of dissection, and that is the Stomach. It is single in an Horse as it is in Man, though such Creatures as have Horns, as Beeves, Sheep, &c. and such as having no Horns yet chew the Cud, as Camels, Hinds, &c. have four. This is the Kirchin of the Body and receptacle of Meat and Drink; as also the seat of Appetite, by reason of the Nerves that are disperfed chiefly in its upper Orifice, but run in small twigs also through its whole substance. It is called in Latin *ventriculus*, which is as much as to say a little Belly; and is placed or seated just under the Midriff between the Liver and the Spleen, almost in the very middle of the Body, inclining a little towards the left Side that it might ballance the Body against the Liver, which is much bigger and heavier than the Spleen.

But before we enter upon the Stomach it is convenient first to describe the *Gullet* which is an Appendage to it, and serves as a Tunnel to convey the Food out of the Mouth into it, though the greatest part of it be contained in the Neck and Breast.

It is an organical or dissimilar Part, hollow and round, beginning at the root of the Tongue, behind the head of the Windpipe, and passeth down from thence directly between the Windpipe and the Joints of the Neck and of the Chest, about the fifth or sixth Joint of which latter it turneth a little to the right side, to give way to the trunk of the great Artery, but about the ninth Joint it turns toward the left again and climbs upon the great Artery, and passing through the Midriff at an hole proper to it self it is inserted into the Stomach toward its left side, as you may see in the following Figure.

It consists of three Membranes or Skins. The *outermost* is common, its substance which it hath from the *Pleura* or from the ligaments of the Joints of the Neck and Breast on which it resteth: This investeth the two *proper*. The *middle* or first proper one is thick and fleshy, consisting of two ranks of fleshy



fleshy Fibres, obliquely or slopingly ascending and descending, so that they cross one another like an X. The innermost or second proper is membranous, and hath onely streight Fibres.

Its Vessels. It has *Veins* in the Neck from the Jugulars, in the Breast from the *Vein without a fellow*; and where it is joined to the Stomach, from the coronary branch of the *Porta. Arteries* in the Neck it has from the *Carotides*, in the Breast from the Intercostals; and where it joins to the Stomach, from the cœliack coronary branch. It hath *Nerves* from that pair that is commonly called the sixth.

Its Kernels. It has two notable Glands or Kernels at its beginning in the Throat, called Almonds from their shape, which separate a kind of flegmatick humour to keep the inside of the Gullet moist and glib, that the Food may easilier descend down by it.

Its Use. Its *use* is, to convey Meat after it is chewed in the Mouth, as likewise Drink, down into the Stomach, there to be turned into chyle.

The Stomach. Having done with the Gullet, we now return to the *Stomach*.

Its figure, Its *figure* is round and somewhat long, resembling a Bag-pipe; though on the left side and at the bottom it is bunching and more capacious than on the right side; for there it is by little and little narrowed that it might give place to the Liver.

And magnitude. Its *magnitude* is divers according to the largeness of the Horse, or according to the quantity of Meat or Drink (be it little or much) that is in it; for it contracteth or distendeth it self as there is occasion. As for example, if there be a great quantity of Meat and Drink let into it, it doth extend it self to that largeness as to contain it; and as that Meat is by little and little concocted, and then let forth through the lower Orifice into the small Guts to be there sucked up by the milky Veins, the Stomach doth accordingly by little and little contract or draw it self up so close to that which remains, that it embraceth it on all sides, so that there is never any cavity or hollownes to speak of to be found in the Stomach; whence we see in Tripes, that the inside is by such contracting always rugged or in wrinkles, whereas the outside is smooth and plain. Onely this we may note as to its bigness, that in consideration of the bigness of an Horses Body or the largeness of his Guts, it is far less in him than in most Animals.

Its Orifices. The Stomach hath two *Orifices*, a left and upper, which is to receive in Meat; and a right which is the lower, to let it out after concoction. The first being the uppermost I will first speak of, which is much wider and larger than the other, because it admits the Meat, many times not half chewed, into the Stomach (and for that cause is much thicker and also stronger than the other) whereas all is reduced into a fluid substance, before it pass out at the other.

The upper and left Orifice of the Stomach. This Orifice being a continuation of the Gullet is called the *mouth* of the Stomach, and hath an exquisite sense of feeling because of the Nerves which encompass it, and by which it the sooner perceives the emptiness and want of Meat, and therefore stirs up the Horse to seek Food to satisfy his want. It is near the middle of the Stomach, and not so near the left side of it as in Men.

Its Uses. It is furnished with fleshy and circular Fibres, that it may naturally shut up and straiten it self after the Meat is received in, and also may intercept or hinder the Vapours from coming forth, which would by their ascent up to the Brain be very injurious, by breeding diseases and evil distempers

Fig. III.

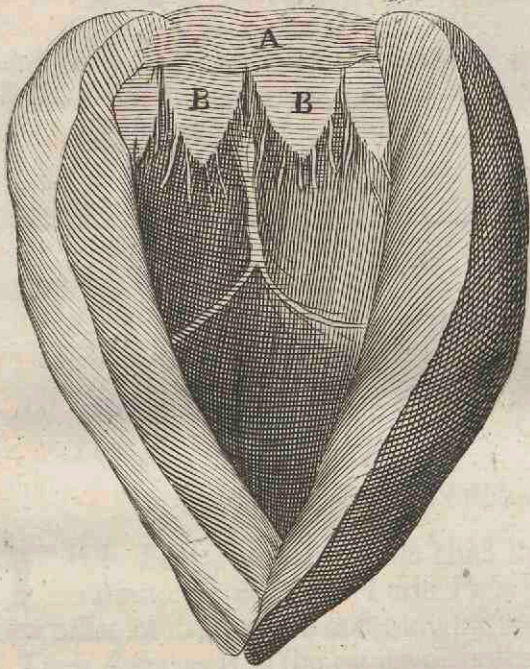


Fig. III.

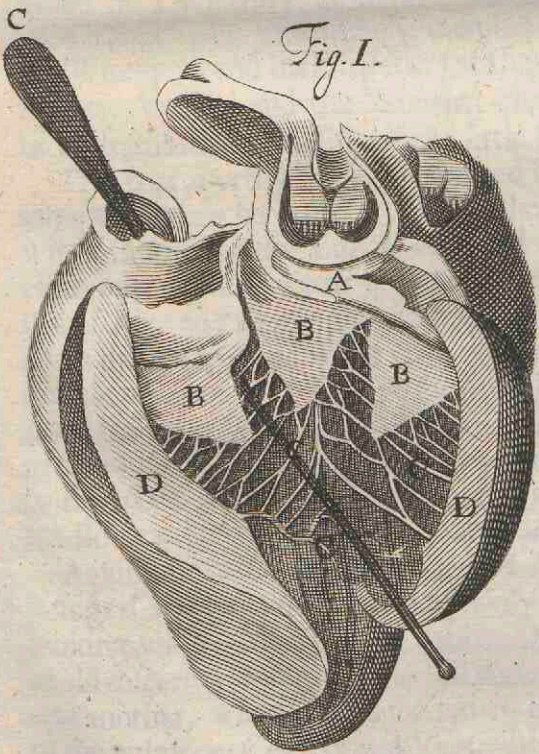
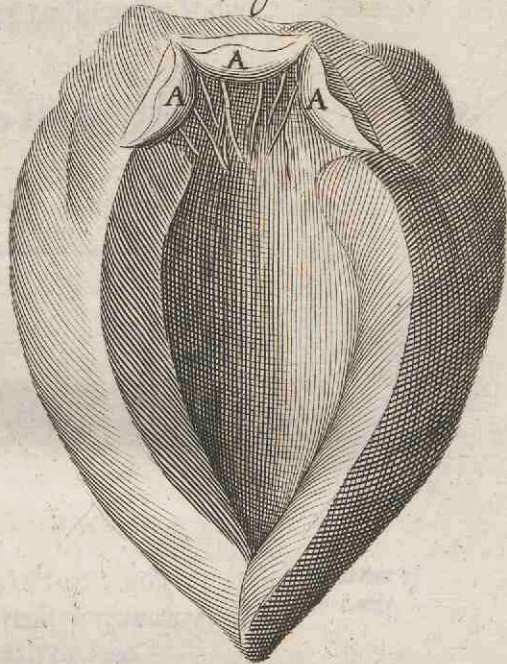


Fig. I.

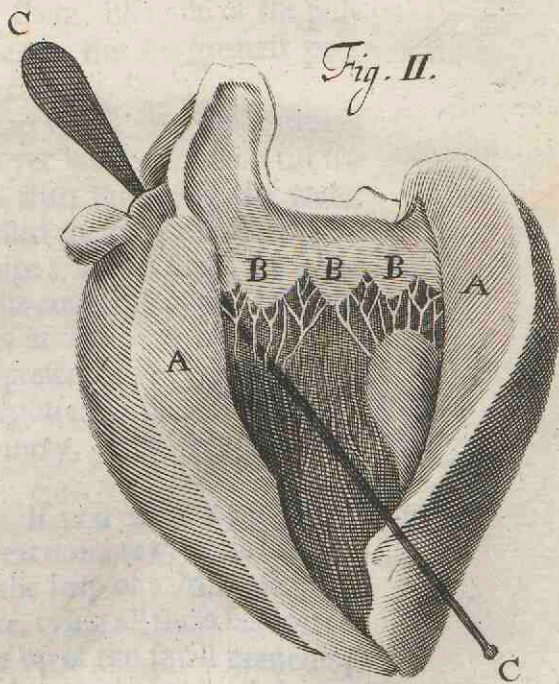


Fig. II.

distemper in the Head; which Vapours would be also wanted in the Stomach to further concoction: for as it is an usual custom when Meat is over the fire for the Pot-lid to be put on to keep the Vapours or Reek from coming forth; so likewise it is requisite in this case that the Vapours of the Stomach should be kept in, that Concoction should be thereby furthered, or the Food be sooner digested, the Vapours assisting thereunto.

The lower and right Orifice is called *pylorus*, which is to say, the Porter, from its office, which is to open and shut as occasion serves; to open, when the chyle is let forth and sent into the Gut *duodenum*, and then to contract or draw it self close up again, that nothing may pass through it which is not fully concocted. Which contraction is performed by transverse or overthwart Fibres, with which it is plentifully furnished for that purpose; as also a thick and compact circle doth encompass it round, which circle is in shape like the sphincter Muscle of the Fundament. By these Fibres and this Circle the action of the Porter, or lower Orifice, is performed, that is to say, it is either opened or shut, widened or strained as there is occasion, as I have said before. And these are the offices of the Orifices of the Stomach.

The lower Orifice, and its office.

Now I proceed to the *composition* of it, which is of three Membranes or Skins, the first or outmost of which it hath from the *Peritonæum*, or Rim of the Belly. The second and middlemost is more fleshy than the former, consisting of fleshy Fibres, which do mightily strengthen the Stomach and by their heat do further concoction. The third and inmost is nervous, into which all the Vessels do terminate or end. This Coat or Skin is continued with the Gullet up to the Mouth, that the Mouth should not admit or receive in any thing that is offensive to the Stomach.

The composition of the Stomach.

The Stomach is furnished with *Vessels* of all sorts. *Veins* it hath first from the Splenick branch, as 1. The *vas breve*, or short Vein, which is inserted into the bottom of the Stomach, whence afterwards it creeps up between the Coats towards the upper Orifice, but is obliterated before it comes quite to it. 2. The two Gastrick Veins (the greater and less) which creep along the bottom of the Stomach, and in their course spread many branches into it; but the largest branch of the greater of these two is that which is called the Crown-vein, that encompasses the upper Orifice of the Stomach. 3. A Vein that is common to the left side of the Stomach and the Caul. *Secondly*, it hath another common to its right side and the Caul, from the Mesenterick branch. And *lastly*, its lower or right Orifice has a small Vein from the trunk of the *Porta* it self, which is called *pylorica* or Porter-vein. Now before the circulation of the blood was found out, it was believed that all these Veins brought blood to the Stomach for its nourishment: but since that was discovered by Dr. *Harvey*, every one knows that they carry nothing to the Stomach, but bring back from it so much of the Arterial blood as is not spent upon its nourishment. But besides the blood some learned Men have entertained an opinion that they suck out of the Stomach a thinner and more spirituous part of the chyle, which passes along with the blood to the Heart by a far shorter passage than if it descended into the Guts and entered into the milky Veins, &c. (as shall afterwards be fullier declared.) And this they think it reasonable to suppose, because of the sudden and quick refreshment that Creatures receive from Cordial Drinks, and the like. I shall not

Its Vessels. 1. Veins.

not

Fig. 1.

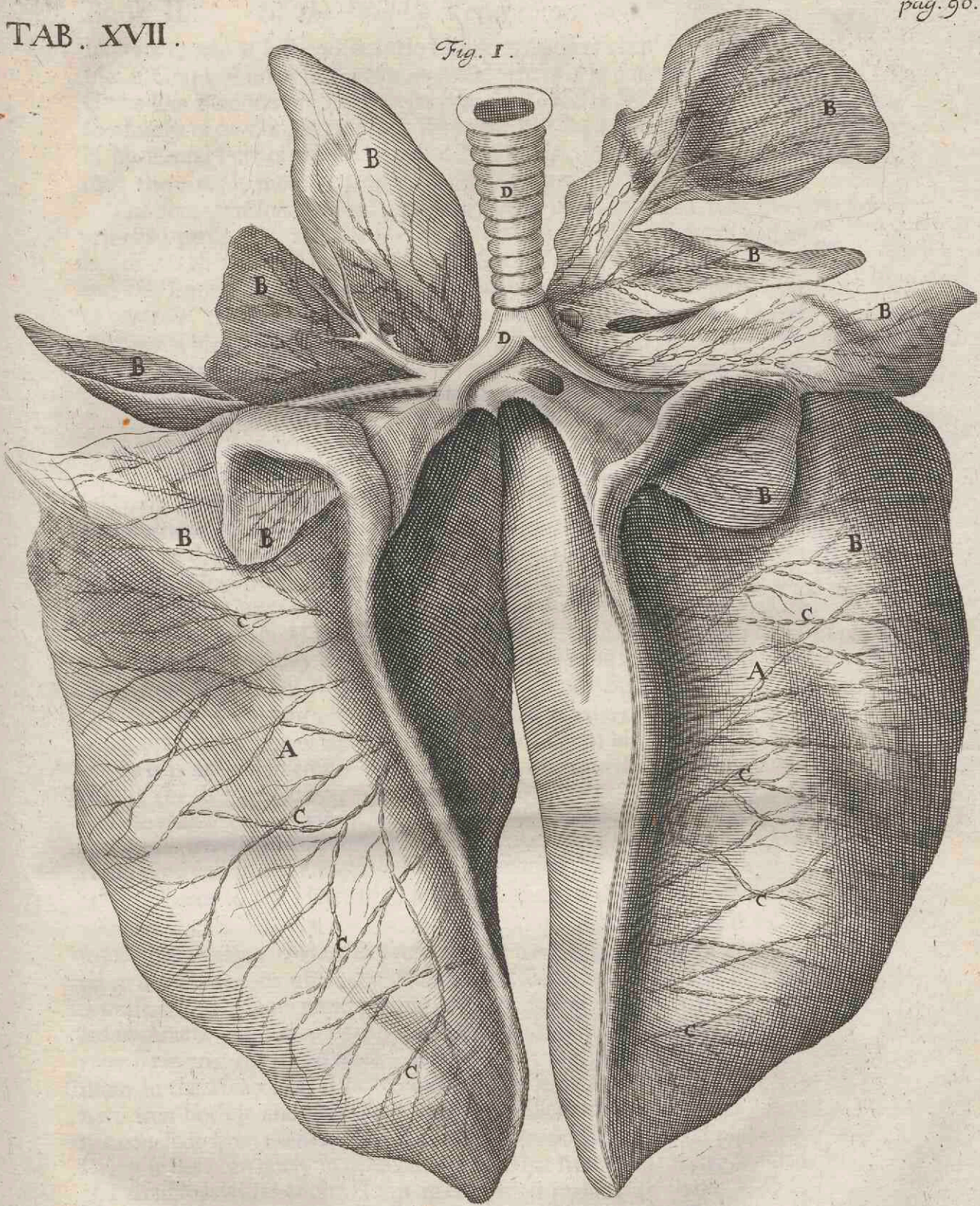
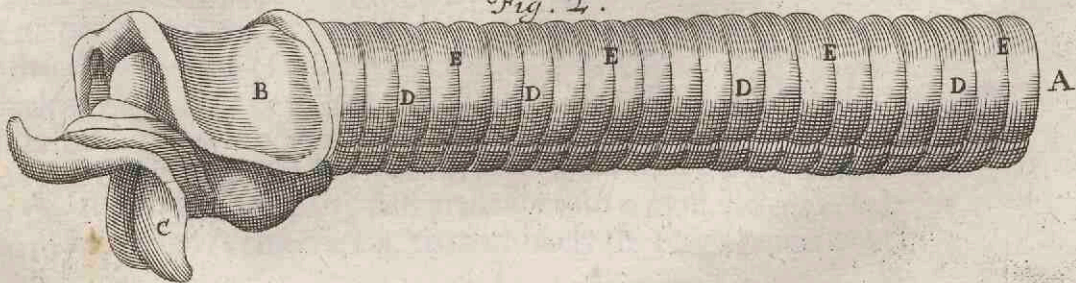


Fig. 2.



not pretend to decide the controversie betwixt those that affirm this, and others that deny it, but do think this opinion to be very probable, because of the very speedy revival of Horses (that I have observed) which being ready to faint away, have suddenly grown brisk upon the giving them some comfortable draught: unless we should think with some, that the Nerves of the Stomach do imbibe some spirituous parts of such potions, and so the refreshment should come that way.

2. Arteries.

The Stomachal Arteries are twigs from the Cœliacal branch of the *Arteria magna* or great Arterie, and these do accompany the Veins in all their course, and bestow nourishment and vital heat upon it. For the Stomach is not nourished with the Chyle, any more than any other part, but with arterial blood which by these Arteries is brought from the Heart.

3. Nerves.

It hath two notable Nerves from the sixth pair (reckoned by Dr. Willis to be the eighth) propagated from those branches which make the recurrent Nerves. These do encompass the upper Orifice, and then are carried, in oblique or slanting lines, cross one another over most part of it; the right branch compassing the foremost and left part, and the left branch compassing the hindmost and right part thereof.

Its Action.

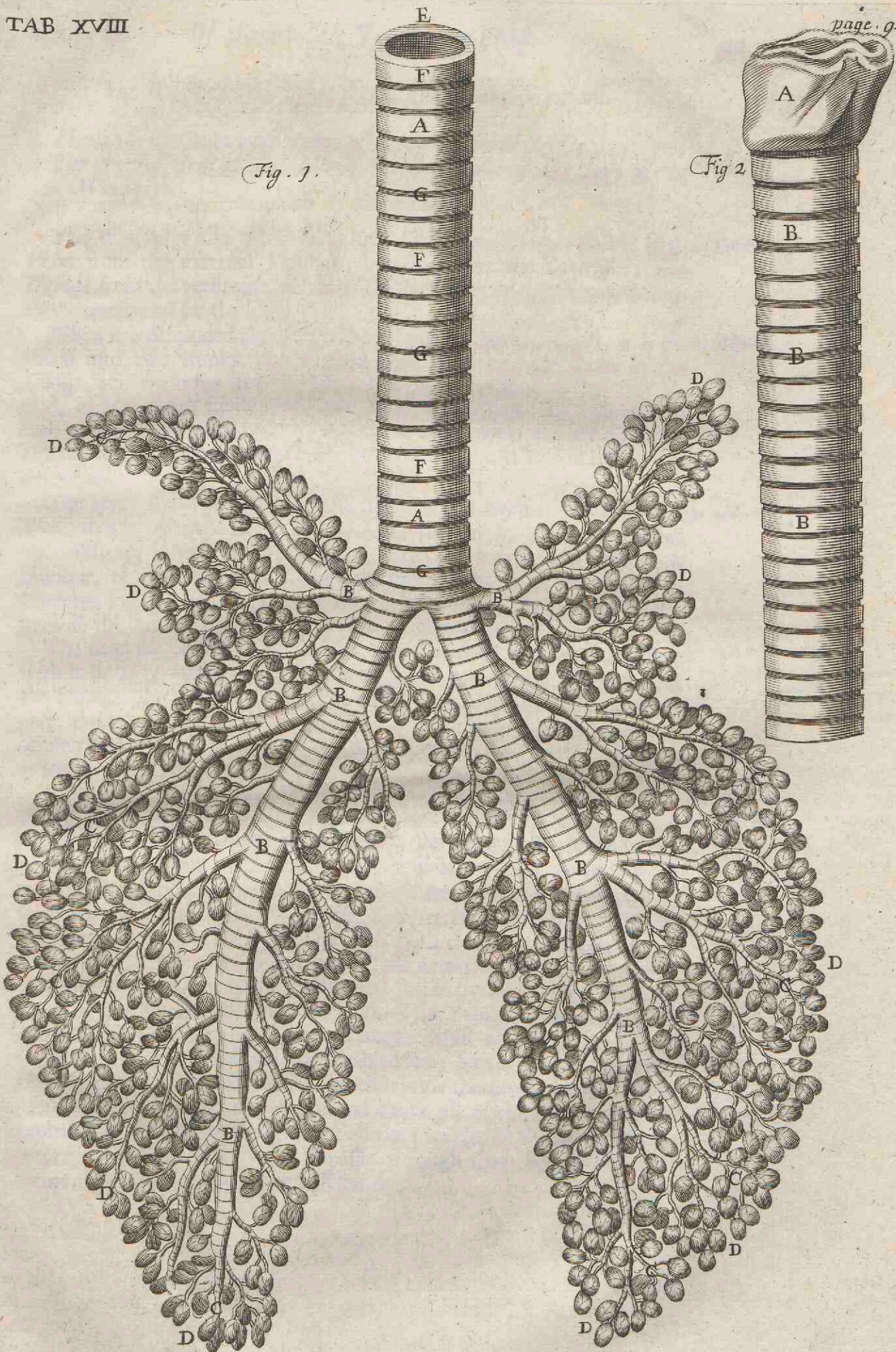
The Stomach has several Actions, as first Hunger and Thirst, which are the sense that it has of the want of Meat and Drink, and an Appetite that is excited in it for the obtaining of them. Secondly, it has an action of retention, whereby it contracts it self close about the Food that is taken in, and detains it so long till it is throughly concocted or turned into a thin juice called Chyle. Thirdly, it has a motion that is called peristaltick, such as the Guts also have, resembling the motion of a Worm, whereby its parts contracting themselves successively from above downwards, thrust out the chyle into the Guts gently and by degrees. But the chief and most considerable action of the Stomach, is, fourthly, Chylification, or turning the aliment into a whitish liquor commonly known by the name of Chyle, which being expelled out of the Stomach into the Guts, is, the thinner part of it, sucked up by a sort of Vessels called *milky Veins*, (so called from that colour which this liquor gives them) that are inserted every where into the Guts, and which carry it towards the Heart, by those ways that hereafter shall be described: but the thicker and more dreggy part is driven along the Guts and cast out at the Fundament as excrement.

How it con-
cocts.

Now there are several things that concur to this last and principal action of the Stomach, viz. Concoction. As first, the very numerous Arteries that are dispersed through it which much foster and encrease its heat, which though it be not the main instrument of concoction, yet much furthers it. And this heat is also encreased by the Liver which covers the upper and fore-part of its right side, as also by the Caul which by its two Membranes invests its bottom. But secondly, that to which concoction is mainly owing is a certain ferment in the Stomach, which is compounded partly of the slaver with which the Horses mouth always abounds for the moistening and softning of his Meat while he chews it, and part of which is continually swallow'd down into his Stomach together with the Food; and partly of an acid or sharp and salt liquor bred in the Stomach, as is most likely, of salt and acid steams evaporating out of the stomachal Arteries, and condensed in it into this juice: And this liquor is that which dissolves and melts as it were the solid Meats that are swallowed

Fig. 1.

Fig 2



swallowed (something like as *Aqua fortis* dissolves Steel) and reduces the whole mass into fluid substance, which then passes down into the Guts, as abovesaid. This acid Juice was formerly thought to come from the Spleen by a Vein called *the short Vessel*; but later Anatomists have discovered from the circulation of the Blood, that that Vein brings nothing from the Spleen to the Stomach, but contrariwise carries the Blood, that is superfluous to the nourishment of the Stomach, from it into the splenic Vein, by which it goes to the Liver, and from thence to the Heart in its circulation. So that no such original or spring of this ferment is to be imagined.

The *Fourth* Table expresseth the second or middle, and the innermost Coats of the Stomach.

Fig. I. Sheweth the Stomach freed from its outmost nervous Coat, that the outer or convex surface of the middle Coat may appear with its fleshy Fibres.

AA *The Gullet.*

B *The Mouth or upper Orifice of the Stomach.*

C *Its lower Orifice called Pylorus.*

D *A portion of the small Gut.*

EEE *The circular Fibres encompassing the Stomach depthways.*

FFF *The top or upper part of the Stomach, where these Fibres arise.*

GG *The circular fleshy Fibres that encompass the upper Orifice or Mouth of the Stomach, which contracting themselves shut or purse it up as occasion serves.*

H *The Gall-passage inserted into the small Gut.*

I *The Pancreatic duct inserted into the small Gut.*

Fig. II. Sheweth the Stomach turned inside out, that its woolly crust with its wrinkles and folds may appear.

AA *The left Orifice or Mouth of the Stomach.*

B *The right or lower Orifice, to which the small Gut is knit.*

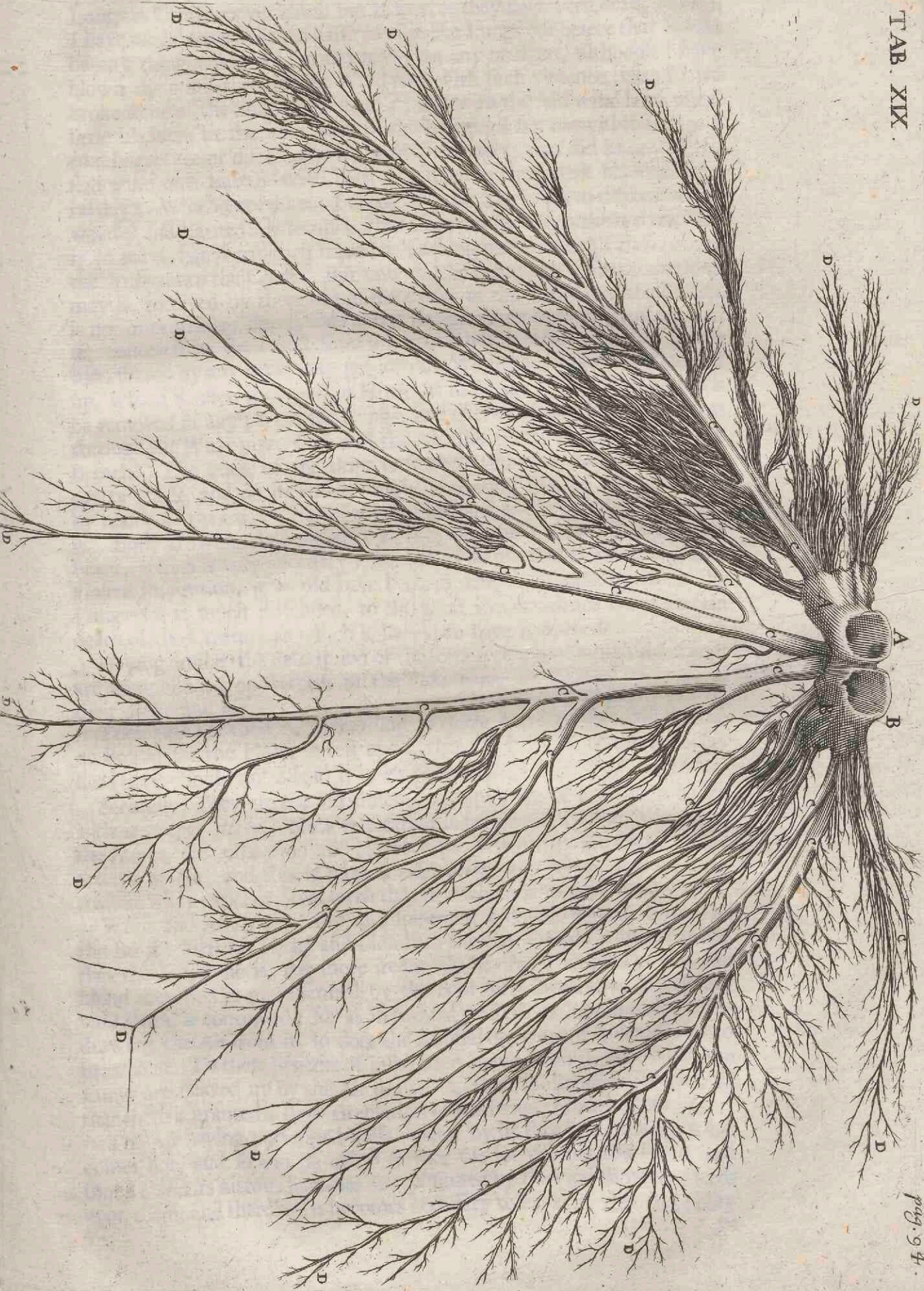
CC *The top or summit of the Stomach between its two Orifices.*

EEEE *The sides, ends and bottom of the inside of the Stomach, with its woolly crust and wrinkles or folds.*

F *A portion of the small Gut.*

Fig. III. Represents a piece of the inmost nervous Coat, wherein the woolly crust being taken off, the inner or concave surface with a very thick ramification of Vessels doth appear.

Fig. IV. Shews a piece of the woolly crust, which looks like a fourth Coat, wherein its outer surface, whereby it sticks to the nervous Coat, appears very full of glands and the mouths of Vessels.



C H A P. X.

Of the Guts in general.

The Guts.
Their Name,
Figure and
Length.

THE Guts are called in Latin *Intestina*, because they are placed in the inmost part of the Body, as you see them placed in the Third Figure, which shews their natural position or situation, they taking up the most part of the cavity or hollowness of the Lower Belly. They are oblong, round, hollow Bodies, in number six, and are bigger or lesser as is the bigness of the Horse. They are the Instruments of distribution of the Chyle and expulsion of the Ordure, being continued with the *Pylorus* or Porter of the Stomach and reaching to the Fundament. They are in length about thirty six yards, a little under or over according to the largeness of the Horse; wherefore they are necessarily girded and wound into manifold convolutions or folds, that the cavity of the Lower Belly might be capable of containing them, which otherwise it could not do.

How knit together.

They are gathered up and entwisted in the folds of the Mesentery, by which coming between they are also knit to the Back: all which is to keep them from falling out of their places or rolling upon one another, which would have often hapned, had not Nature so well provided for the contrary, especially in violent exercise, as hunting, running, leaping and the like; and if it had hapned, the weight of the one lying upon the other would have obstructed the passage of the Excrements, and so caus'd excessive pains, as gripings, strainings to dung, and the like, and upon the continuance of such stoppage, death it self.

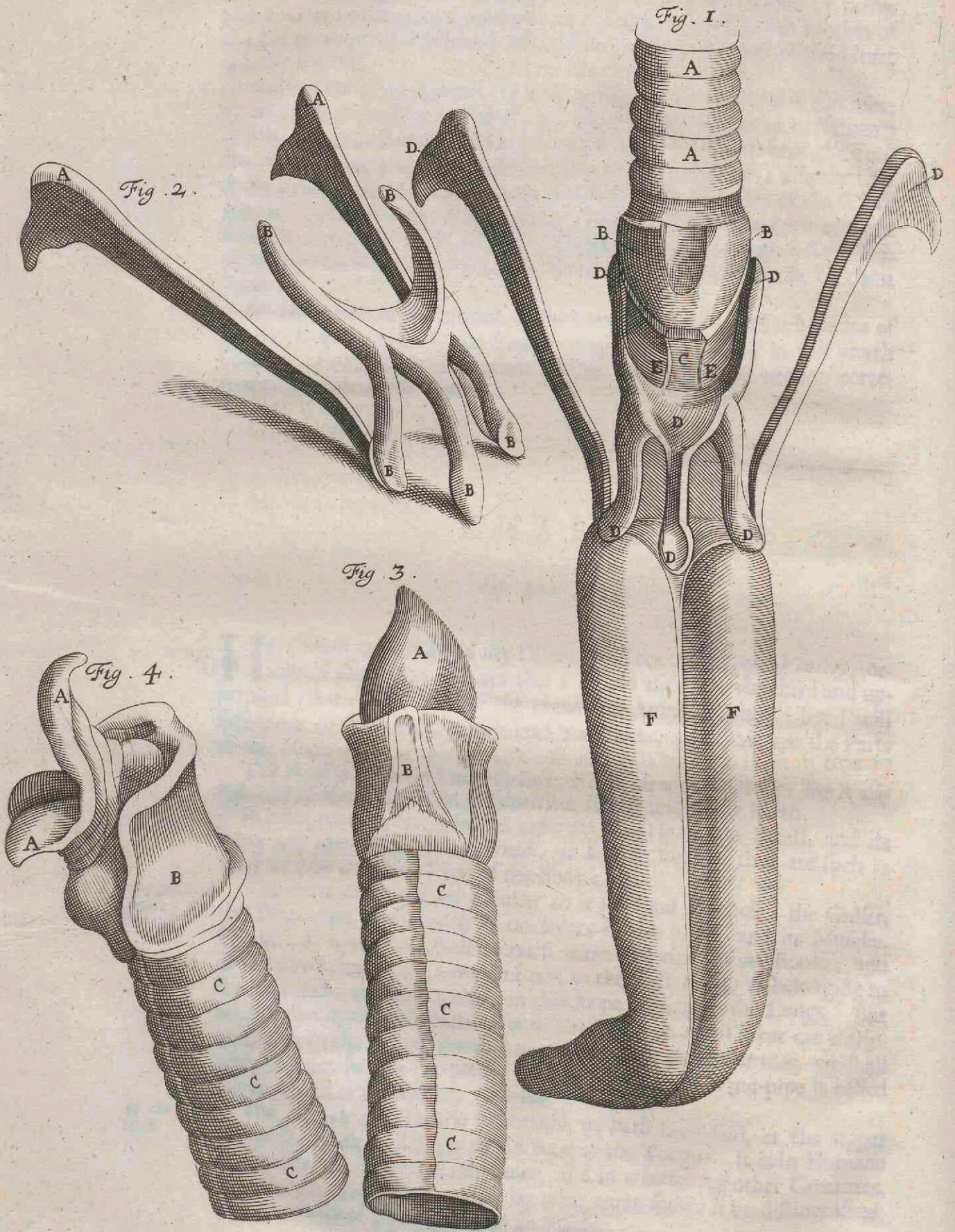
The Guts are on the outside most times fat, but on the inside they are covered with a slimy or snotty substance, for the more free and glib passage of the Dung.

Their Coats.

They have *three Coats*, like as the Stomach hath. The *outermost* or common one is nervous, springing mediately from the Rim of the Belly, but immediately from the Membranes of the Mesentery; saving that of the beginning of the first Gut, and of that part of the *Colon* which runneth under the Stomach, where it immediately proceedeth from the Caul adhering to those Parts. The *middle* is thicker and fleshy, having two ranks of Fibres, the outer of them streight, and the inner transverse or overthwart. The *innermost* is also nervous like the outmost, but on its inside it is crusted over with a kind of spongy substance, that serves as a strainer for the Chyle to pass through out of the Guts into the milky Veins. This Coat has all sorts of Fibres, and is very wrinkled, to prevent the too quick gliding away of the Chyle. The Fibres of this and the middle Coat serve to perform the peristaltick or worm-like motion of the Guts, by which whatsoever is contained in them is gently driven along downwards towards the Fundament.

Vessels.
1. Veins.
Viz. first,
Blood-veins.

The Guts have all sorts of Vessels. As 1. *Veins*. These they have from several branches of the *Porta*, but the most come from that branch of it that is called the Mesenterick. The use of which Veins was by the Ancients thought to be, both to carry Blood to them from the Liver for their nourishment, and to bring back from them the Chyle to the Liver, there



there to be turned into blood. But as to the first, the circulation of the Blood makes it evident, that they carry no blood to the Guts, but all that is contained in them, is received from the Arteries that are inserted into the Intestins, and returns by them to the Liver, through which it passes into the Vein called *Cava*, and by it ascends to the Heart. And as to the latter use assigned to these Veins, namely the bringing of Chyle from the Guts to the Liver, there was another sort of Vessels found out by one *Acellius* about threecore years agoe, that perform this office, called by him (from their colour) *milky Veins*. But ^{Secondly,} neither do these convey the Chyle to the Liver, as the first Inventor of ^{milky Veins.} them thought, but running from the circumference of the Mesentery they unite and discharge themselves into one common receptacle near its centre at the Back-bone, from whence the Chyle passes up along the side of the Back-bone as high as the Collar-bone by a proper pipe, where it is emptied into the subclavian Vein, in which being mixed with the Blood it glides along with it immediately into the Heart. I say then the use of the Blood-veins of the Guts, is onely to receive so much of the Arterial blood as is superfluous from their nourishment.

A *second* sort of Vessel dispersed through the Guts are the *Arteries*, ^{2. Arteries.} which spring partly from the Cœliack branch, and partly from the Mesenterick. These afford both Vital heat and nourishment to the Guts, and besides upon administering a Drench to scour your Horse, they discharge the impurities and bad humours flowing in the mass of blood, into the Guts, to be thrown out in the draught.

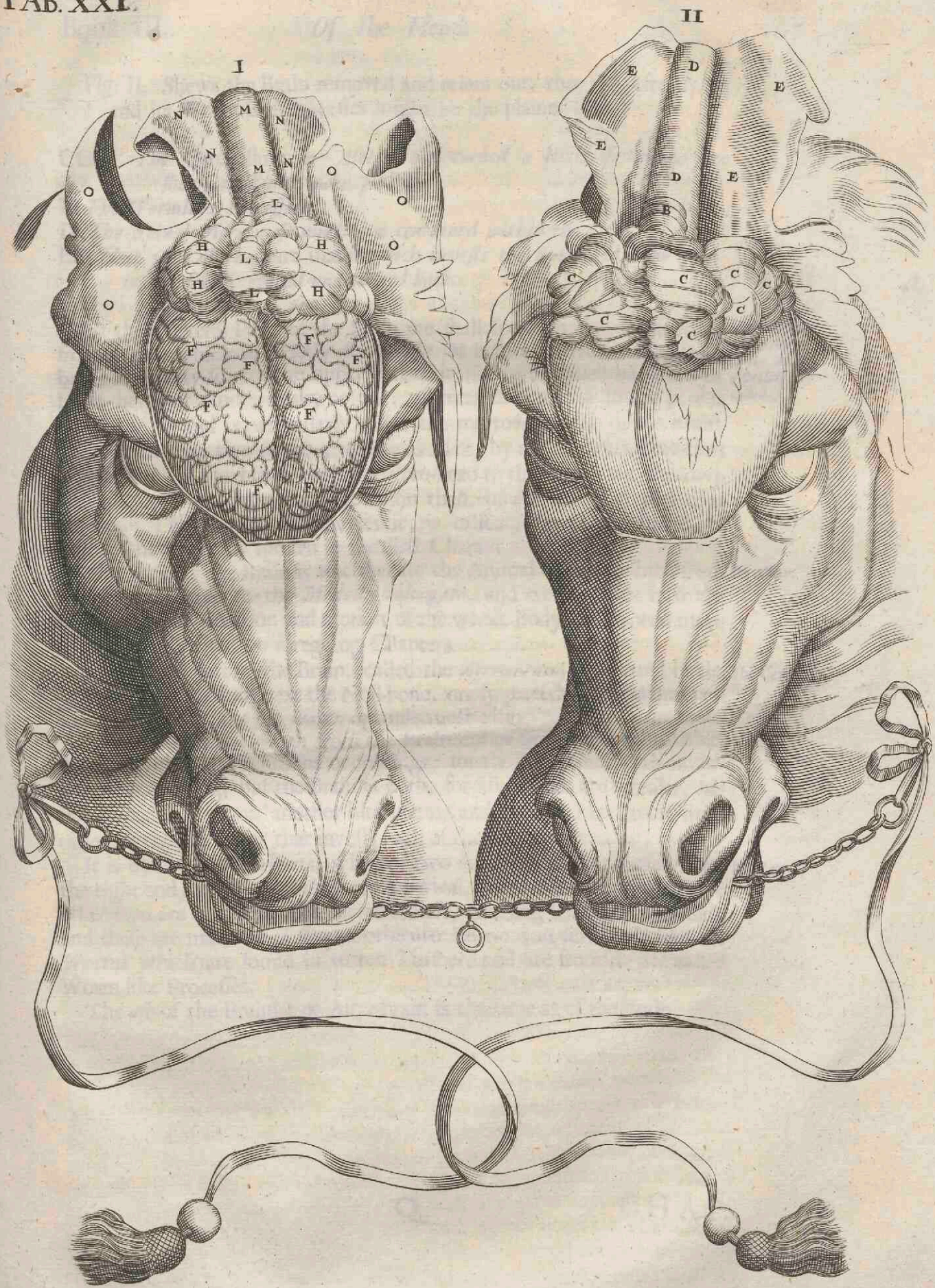
3. Their *Nerves* are from that pair that has commonly been called ^{3. Nerves.} the sixth, but according to Dr. *Willis's* distinction is now generally reputed for the ninth pair, and otherwise called the *Intercostal*, because as it descends down the Chest, it sends out a small twig between every Rib. These contribute to the Guts their sense of feeling, and furnish their Fibres with animal Spirits, whereby they are enabled to perform their worm-like motion.

As for the *milky Veins*, we have mention'd them before, and shall treat further of them in the Chapter of the *Mesentery*.

C H A P. XI.

Of the Guts in particular.

NOW though the Guts be one continued Body from the lower Office of the Stomach to the Fundament, yet they are wont to be distinguished into several; In Men they are divided into six, three small, and three thick: but in a Horse we cannot so well follow this division, there being not any difference in the small Guts so considerable as to ground a distinction upon. However, because the second of the thick Guts seems to have three partitions, we shall make three of it, and so will they answer to the number in Men, and be reckoned *six*.



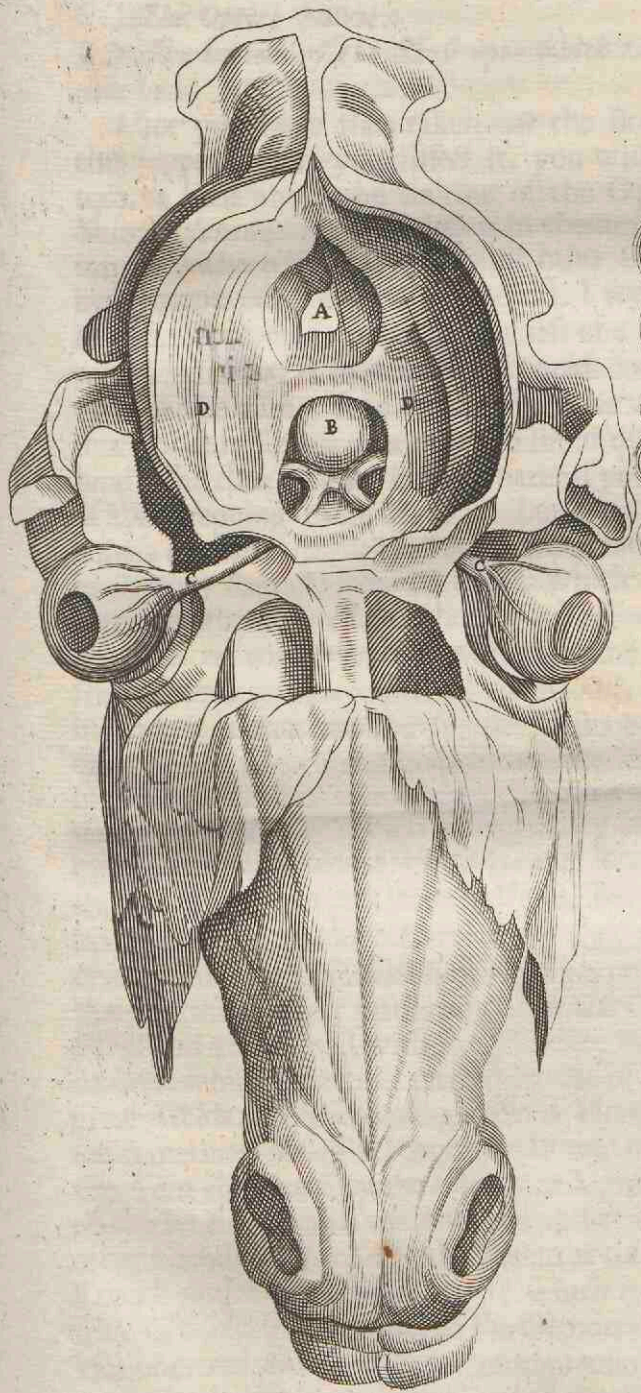
1. The *small Gut.*

The first we shall distinguish onely by the name of the *small Gut*. This is twenty six or twenty seven yards in length, something narrower at a foot and half distance from the Stomach than towards its ending, but through the whole it is wider than in an Oxe, being about two inches or two and an half over. Presently at its beginning it bends under the Stomach towards the Back-bone, streight along which it descends a pretty way, being annexed firmly to it by a strong Membrane (that seems to be borrow'd of the Caul here knit to it) which is all the establishment it has. But by and by it leaves this hold, and beginning to wind about, is received into the folds of the Mesentery, whereby it is admirably kept from twisting and entanglement. Now there are far more of the *milky Veins* inserted into this Gut than into all that follow; and besides those Vessels which are common to it with the thick Guts, namely Veins, Arteries and Nerves, it has two other Vessels inserted into it, one from the Liver and another from the Sweet-bread. By the first is yellow Choler, and by the latter a peculiar Juice from the Sweet-bread (called the *pancreatick Juice*) discharged into it. These two Liquors flowing into it from the aforefaid Bowels about a foot below the Stomach, within an inch or two one of another, make a notable ferment in it, which mixing with the Chyle that is passing down this way, causes it also to ferment, whereby it comes to work it self something clearer, as I may say, even as Ale or Beer in a Barrel does. For by this fermentation the impurer and more earthy or dreggy part of the Chyle, is separated and precipitated as it were from the more pure and spirituous, whereby this latter part is made capable of being received in at the small mouths of the milky Veins that gape in abundance into this Gut, whilst the thicker and excrementitious part is thrust along the Guts by their worm-like motion, and makes the Dung. This Gut for about two hands breadth at its beginning from the *Pylorus* is wider, and for the like space at its end before it is joined to the following, is a little narrower, than in its other parts.

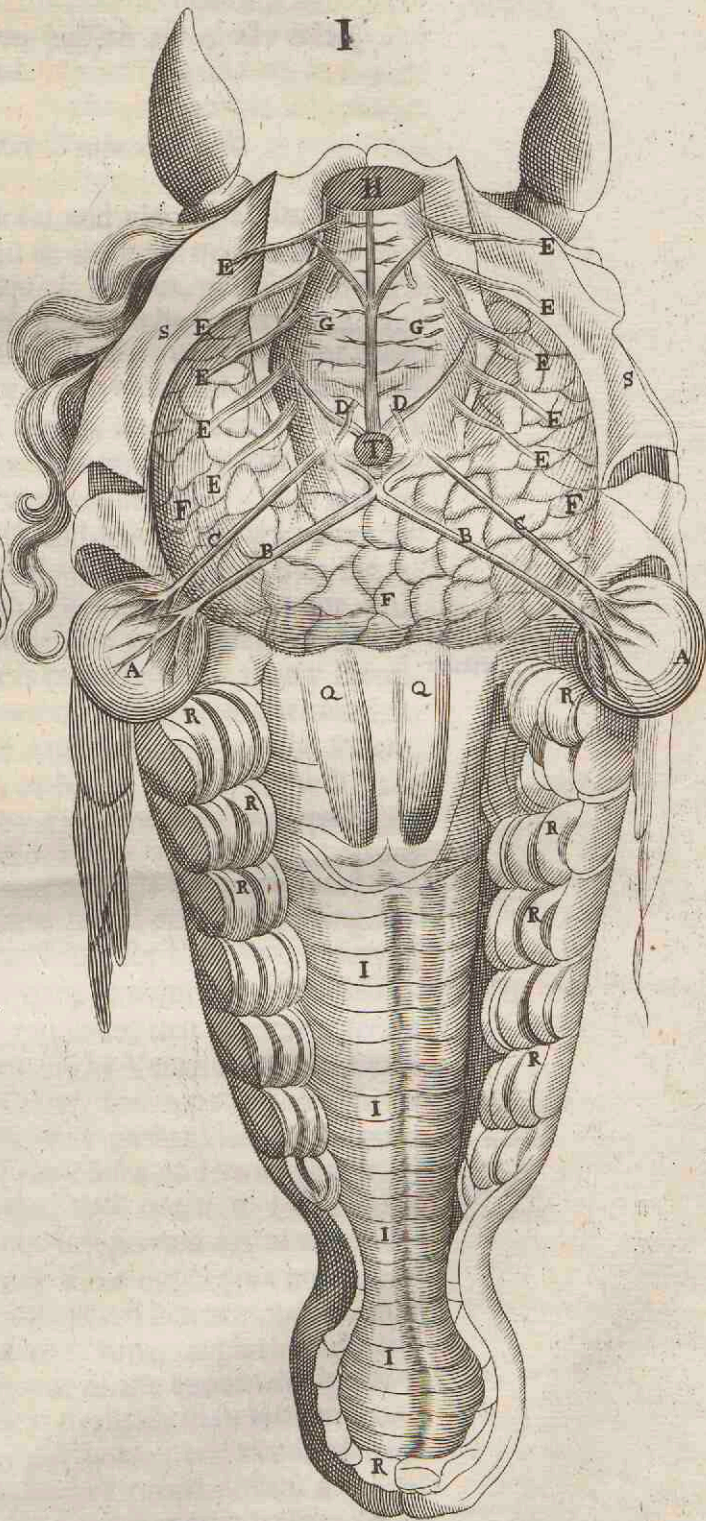
2. The *Cæcum or blind Gut.*

Having done with the *small Gut*, we next come to the *thick ones*, in number five, of which the first is called *Cæcum* or the *blind Gut*, because it has but one passage for the Excrements both into and out of it, which come into it out of the small Gut, and go out of it into the next thick Gut. It is not round in shape like the small Gut, but as it were four-square, which figure it comes to have from four Ligaments that run along it, one on each side, which contain it in that shape; and these Ligaments being shorter than its Coats, make them bag out in many Cells as the *Colon* does in other Creatures. It is almost a yard long, and unequal in breadth: for though at its mouth, where it joyns to the small Gut and the *Colon*, it be near a quarter of a yard over, yet towards its close end it grows so by degrees narrower, that it is not above three inches. This Gut is very inconsiderable for its bigness in most Creatures, particularly in Man, in whom it is not ordinarily above four inches long, and hardly so thick as ones little Finger: onely in a Rabbit it bears much the same proportion with the rest of the Guts, as it does in an Horse. In such Creatures as have it so very small, its use is very obscure; but in an Horse where it is so very large, its use is apparent to be, to stay the too quick passage of the Excrements by receiving them into it self as it were into an Inn, whereas if they kept directly the streight Road of the rest of the Guts without turning in here, they would come too soon to their journeys end, namely the Fundament: I mean the Horse would be continually a-scouring,

II



I



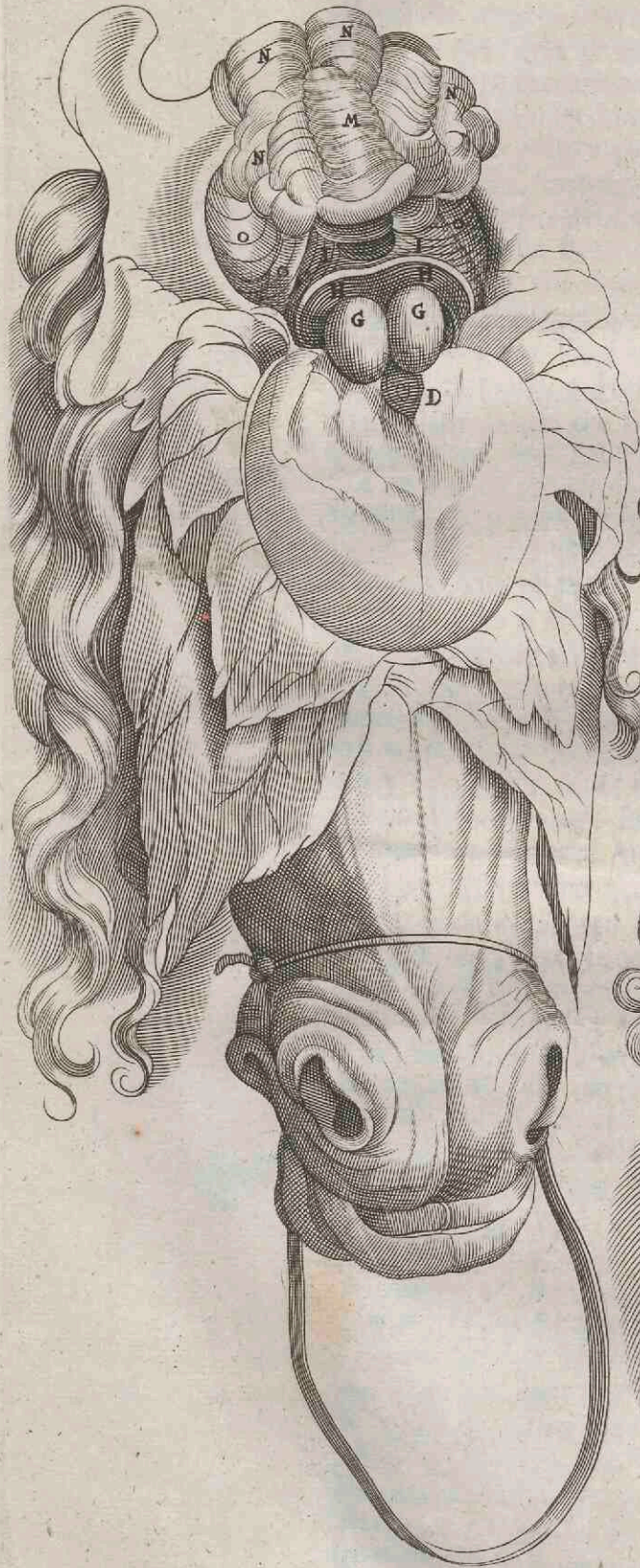
a-scouring, and so fall from his flesh and languish, by reason that the *milky Veins* would not have time to suck up all the Chyle out of the Guts to turn into his nourishment; besides that it would be troublesome to the Horse, and offensive to his Rider to have him always a-dunging. Its connexion to the small Gut and *Colon* you may better conceive of by the following Figure, in which it is well expressed, than by my description of it in words.

That which is the second thick Gut and in Man is called the *Colon*, Three Colons. seems in an Horse to be divided into three, to which I shall not take upon me to assign distinct names, but onely call them three *Colons*. The *first* of them is about a yard and a half in length, and for the most part of it a quarter of a yard over. The *second* is as wide as the first, but onely about a yard in length. These two are divided one from the other by a narrow *neck* about half a yard long, and four inches over. The *first* of these two wide *Colons*, is that which in its upper part joyns with the blind Gut above described, where it has a Valve, consisting of a loose Membrane or Skin that hangs round its mouth, which permits any thing to come into the *Colon* out of the *Cæcum* or out of the small Gut, but when any thing would pass out of that into these, then the edges of this loose Skin flap close one against another and hinder it, whereby Nature has prevented the return of the Excrements back out of the *Colon* into the small Gut. And the lower end of the *latter* of these two wide *Colons* joins to the *third*, which is very narrow in comparison of *them*, but yet is more than twice as long as both of them, namely about six yards. Now all these three *Colons* are contracted into Cells by two Ligaments, one of which runs along the upper part, and the other on the lower side of them: and besides these two which are common to them all, the larger ones have somewhere other two that run along their sides, but especially so has the Neck that divides them whereby it is made foursquare like the blind Gut. The reason why these *Colons* (as well as they are in other Creatures, and the *Cæcum* also in this) are contracted into Cells, is for the slower passage of the Excrements, that what of the Chyle was not drunk in by the milky Veins of the small Gut, might be leisurely sucked up by those that are inserted into these thick ones; for though we call their Contents *Excrements*, yet that is onely because the much greater part is so, for all the Chyle is not clear imbibed from them till they come towards the end of the last *Colon*, though the milky Veins are not a tenth part so numerous in these as in the small Gut.

To the lower end of the small *Colon* is joined the last Gut called *Rectum* 6. The streight Gut. or the *streight* Gut, because it runs streight along without any windings. It is also called the *Arse-gut*, because it reacheth to the Fundament. The Coats of this Gut, especially the middle, are much thicker than any of the other, and the whole seems fleshy and muscular. It is but about half a yard long, and betwixt three and four inches over. This is not gathered in the foldings of the Mesentery, but instead of that, is from its beginning at the lower end of the Loins, to its ending at the Arse-hole, fast tied by a Membrane to the Back and Rump-bones, which keep it from falling out upon straining to dung. At its lower end at the Arse-hole it has a round Muscle that encompasses it, called the *sphincter* Muscle, whereby it is purged up so, that nothing can pass out, except when the Beast loosens it of his own accord when he goes to dung, and then at the same time he squeezes the Guts by help of the Muscles that environ his Paunch,

II

I

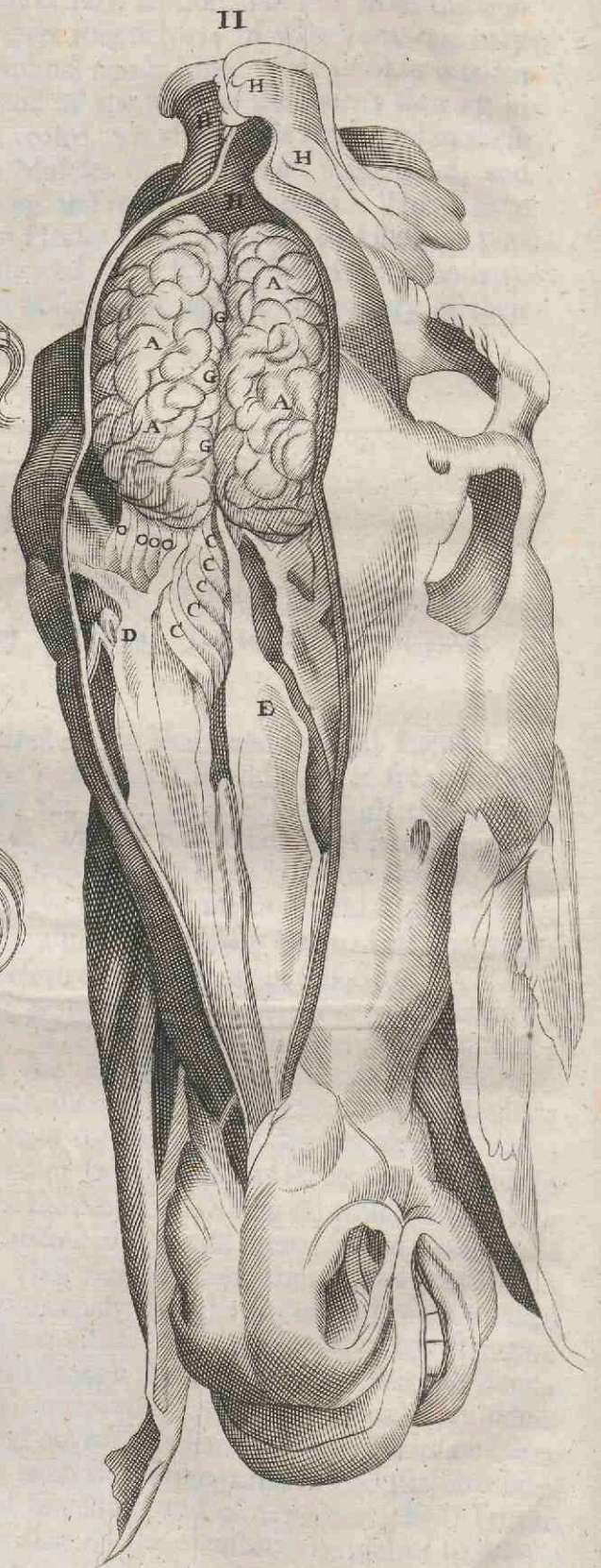


Paunch, which we described above in *chap. 6.* and so forces the Dung to issue out at the Fundament.

And thus we have finished the History of the Guts, not needing to add any thing of the use of them, because their use is all along interwoven in their description, and therefore we shall pass on to the other parts.

The *Fifth* Table representeth the Gullet, Stomach and Guts taken out of the Body.

- A *The Gullet.*
 B *The upper Orifice of the Stomach.*
 CC *The two external Nerves of the sixth pair (otherwise reckon'd for the eighth) dispersed through the upper part of the Stomach.*
 DDD *The three different Coats of the Gullet, a little turned down, to shew them the plainer.*
 E *The lower Orifice of the Stomach called the Pylorus.*
 F *The outermost Coat of the Stomach turned back.*
 G *The entrance of the porus bilarius or Choler-passage into the beginning of the small Gut.*
 H *The entrance of the pancreatic duct or passage of the Sweet-bread into the same Gut.*
 IIIIIII *The small Gut.*
 K *The Intestinum cæcum or blind Gut.*
 LL *The first Colon.*
 M *The small neck that divides the first Colon from the second.*
 NN *The second or middle Colon.*
 OO *One of the Ligaments that contracts the blind Gut and Colons into Cells.*
 PP *The third and last Colon, far smaller than the two former, but longer.*
 QQ *The Intestinum rectum or Arse-gut.*
 R *The two Muscles called levatores Ani, or openers of the Fundament.*
 S *The sphincter Muscle that contracts or purses up the Arse-hole.*
 T *The middle Coat of the Stomach through which the two branches of Nerves are dispersed.*
 U *The third or inmost Coat of the Stomach.*
 XX *The branchings of the Bloud-vessels, as they appear on the outside of the Stomach.*
 YY *The several Gastrick Vessels inserted into the bottom of the Stomach.*



C H A P. XII.

Of the Mesentery.

THE *Mesenterium* or *Mesentery* is so called from its being placed in the middle of the Guts, which it embraces round, gathering them together in form of a Globe, but is it self gathered into folds. This Mesentery is of a circular figure, composed of a double Coat, between which do run many Vessels and those of all sorts, and betwixt which also there is a collection of much fat. Dr. *Wharton* says that in *Man* there is a third Membrane betwixt the two commonly known, in which are seated the Glands or Kernels, and through which the Vessels run. If so, 'tis likely there is the same in an *Horses* Mesentery, which abounds with Glands. 'Tis a little above a quarter of a yard broad from its centre to its circumference.

The Mesentery why so called.

Now its *centre* or *rise* is at the first and third Rack-bone of the Loins, where membranous Fibres are produced from the Rim of the Belly, and spread into the two investing Coats or Skins of the Mesentery.

Its rise.

The fat with which these Membranes are stufed, is collected in the same manner as that of the Caul above-described in *chap. 8.* namely the oily part of the Bloud sweating out of the Arteries that run in abundance between these Membranes, is stoped by them, (they being more compact and close than the Coats of the Arteries) and by their respective coldness is congealed into fat.

Its Fat.

There are almost innumerable Vessels running through it, but such as are rather sustained and conducted by it, than for its own use.

Its Vessels.

The first sort are the *Veins*, to which it gives the denomination of *Mesaraick*. These are all branches of the *Porta*, and their office is to receive so much of the Arterial blood as is not spent on the nourishment of the Guts and Mesentery, and to convey it to the Liver, and from thence to the Heart. Before the *milky Veins* were found out, it was believed they brought the Chyle to the Liver; but that opinion is now out of doors, as we have more fully shewn before in the tenth Chapter.

1. Veins.

Its *Arteries* also from its name are called *Mesaraick* or *Mesenterick*; these run in great numbers through it to the Guts, to which what office they perform was likewise declar'd above, *chap. 10.* And besides the uses there ascribed to them, they continually supply new oily Vapours for the maintenance of the fat of the Mesentery.

2. Arteries.

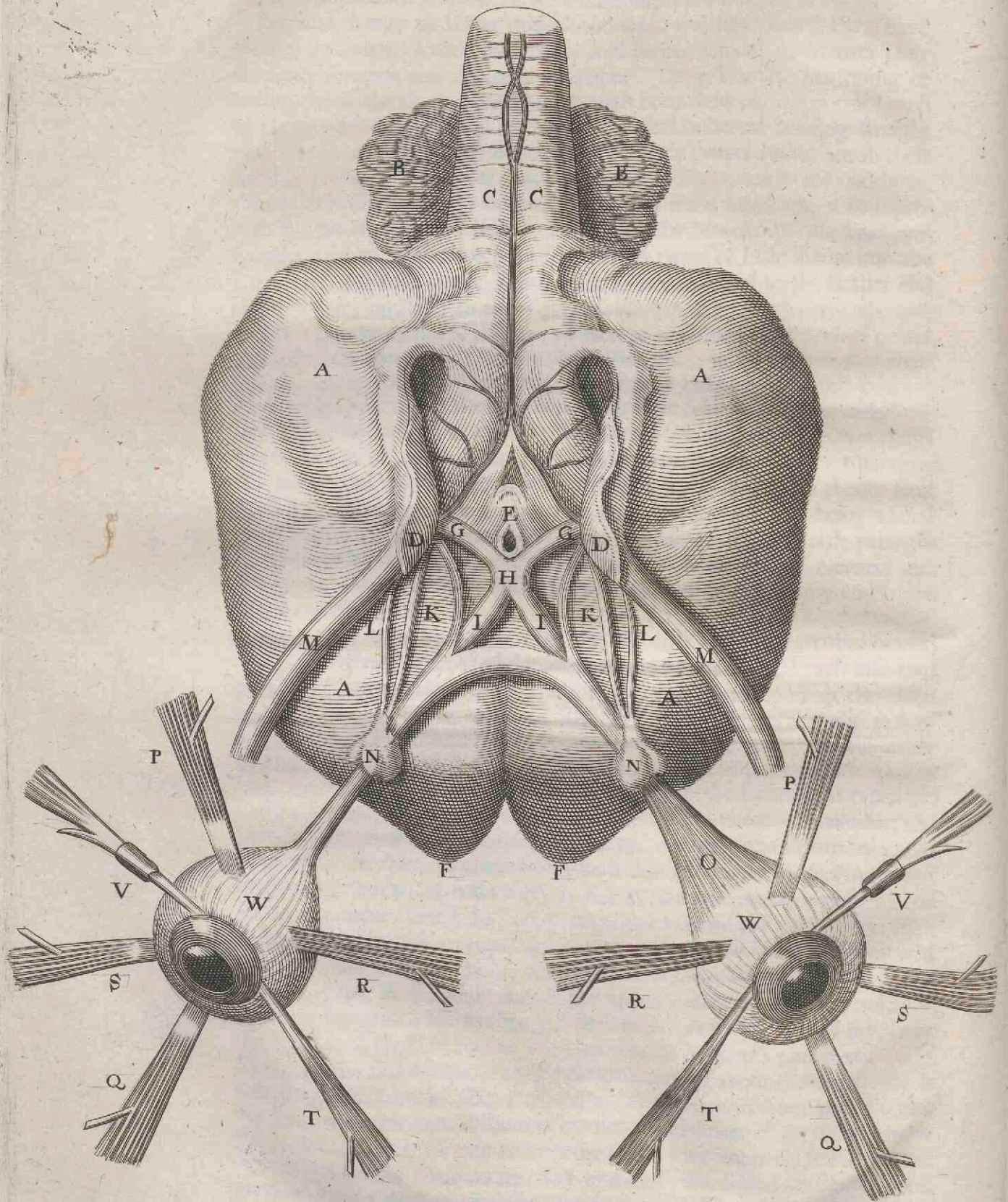
Its *Nerves* are very numerous, and spring from that pair which is now (from Dr. *Willis*) commonly called the *Intercostal*, and reckoned for the ninth pair, but was formerly reputed the sixth.

3. Nerves.

All the *venæ lacteæ* or *milky Veins* run through it from the Guts towards its centre. These are very slender and almost transparent Vessels, having but one single Coat, and gaping with their mouths in the inmost Coat of the Guts do there suck up the Chyle, and take the nearest course thence to those Glands or Kernels of the Mesentery that are next to them, several smaller in their passage growing into one greater. From the several smaller Glands they proceed to the greatest that is placed at the Back at the centre of the Mesentery, and from thence to the common receptacle that

4. Milky Veins.

that



that is seated betwixt the Kidneys. What course it takes from thence the Reader may see in the already twice mentioned tenth Chapter.

3. *Lympheducts.*

Besides all these sorts of Vessels there was a fifth sort found out by *Thomas Bartholin* (a Dane) some thirty years ago, which indeed are to be found in most parts of the Body, but most abound in the Mesentery, and are called *Lympheducts*, as much as to say, Water-passages. Their Coat is single as that of the milky Veins, but more transparent; and the *lymph* or water that is contained in them, is very clear. This Liquor differs from the *serum* or wheyish watery part of the Blood, which one may discover by this Experiment; If you take a little of this Liquor into a Spoon, it will soon thicken into a gelly of its own accord, which the *serum* of the Blood will not do unless you heat it over the fire. It is supposed to be made of thin moist Vapours of the Blood, which being condensed into water, are imbibed by these Vessels. All those that run through the Mesentery discharge their water into the common receptacle of the Chyle above-mentioned, so that it passes together with the Chyle up the passage that ascends by the Back towards the Shoulders, and there mixes with the Blood in the subclavian Vein.

Its Glands.

In the middle Membrane of the Mesentery (first found out by Doctor *Wharton* as above-said) there are a great many *Glands* or *Kernels*, into which the milky Veins as they pass through the Mesentery are inserted, and then rise out of them again, continuing their course to the one great Gland at its centre, in which they all meet together, and from it hold on their way to the common receptacle as was above-declared. By these Glands the said Veins are supported and strengthened in their passage.

Its Use.

Now the *use* of the Mesentery is to be as it were a tie or band to the Guts to bind or gather them together, and to fasten them to the Back, that their great weight do not cause them in violent motion either to break or twist or roll confusedly one over the other, whereby their gentle worm-like motion would be hindred, if not perverted or abolished. And besides by its Membranes and Glands it does guard and sustain the several Vessels whose way lies through it.

C H A P. XIII.

Of the Pancreas or Sweet-bread.

The Pancreas why so called.

THE *Sweet-bread* is an unshapely body, of a glandulous yet flesh-like substance, from whence it hath its name *Pancreas* which signifies *all flesh*.

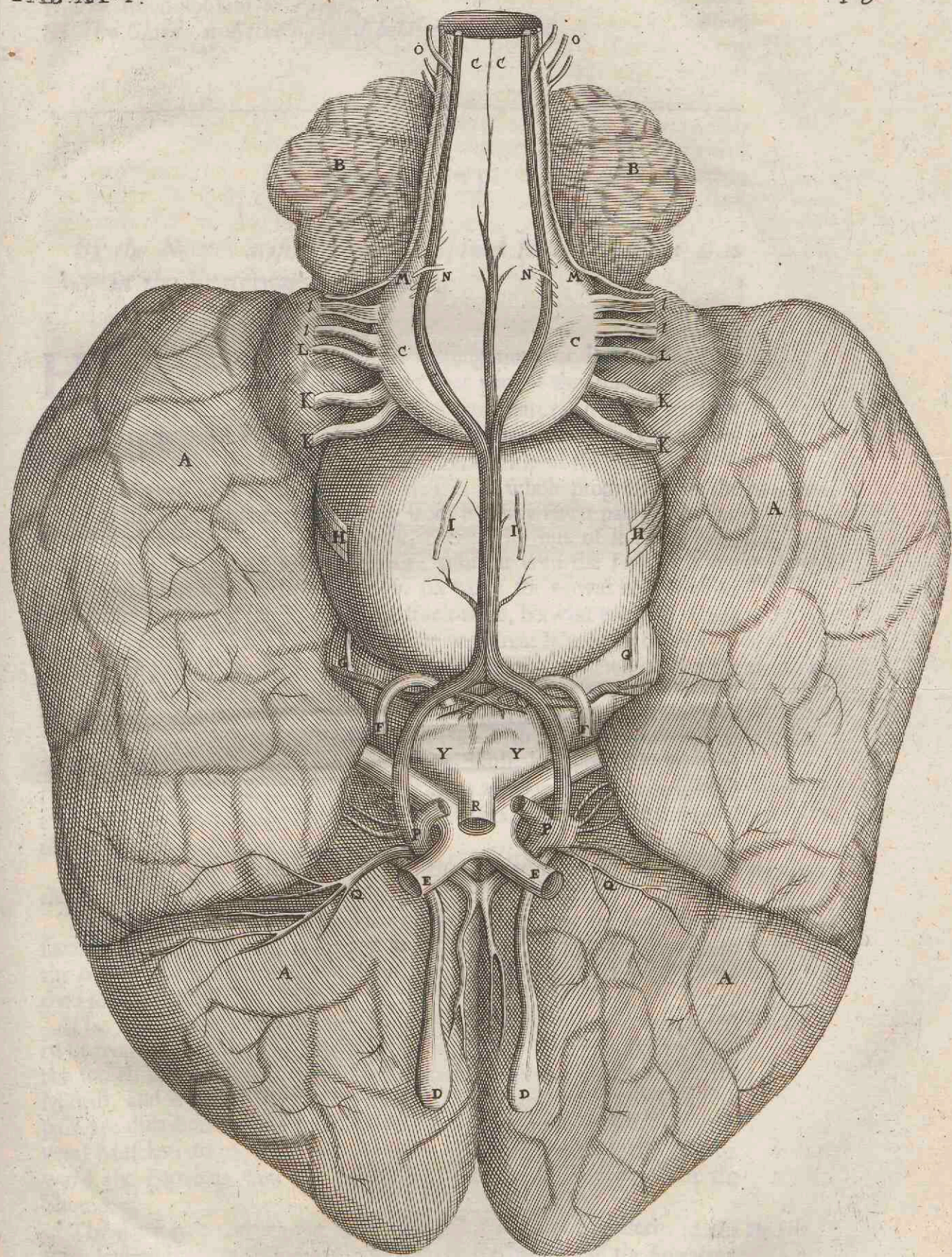
Its situation.

In dissection it is at the end of the Liver and bottom of the Stomach; but while the Horse is living, it is situated on the backside of the bottom of the Stomach, and lies cross the Belly lengthways as that does.

Its substance.

Its proper flesh is white and soft, but the little Kernels with which it is plentifully stored, are of a more reddish colour. It is covered with a single Membrane which it has from the Rim of the Belly, as all the Bowels of the Lower Belly have, of which it is almost the least.

It

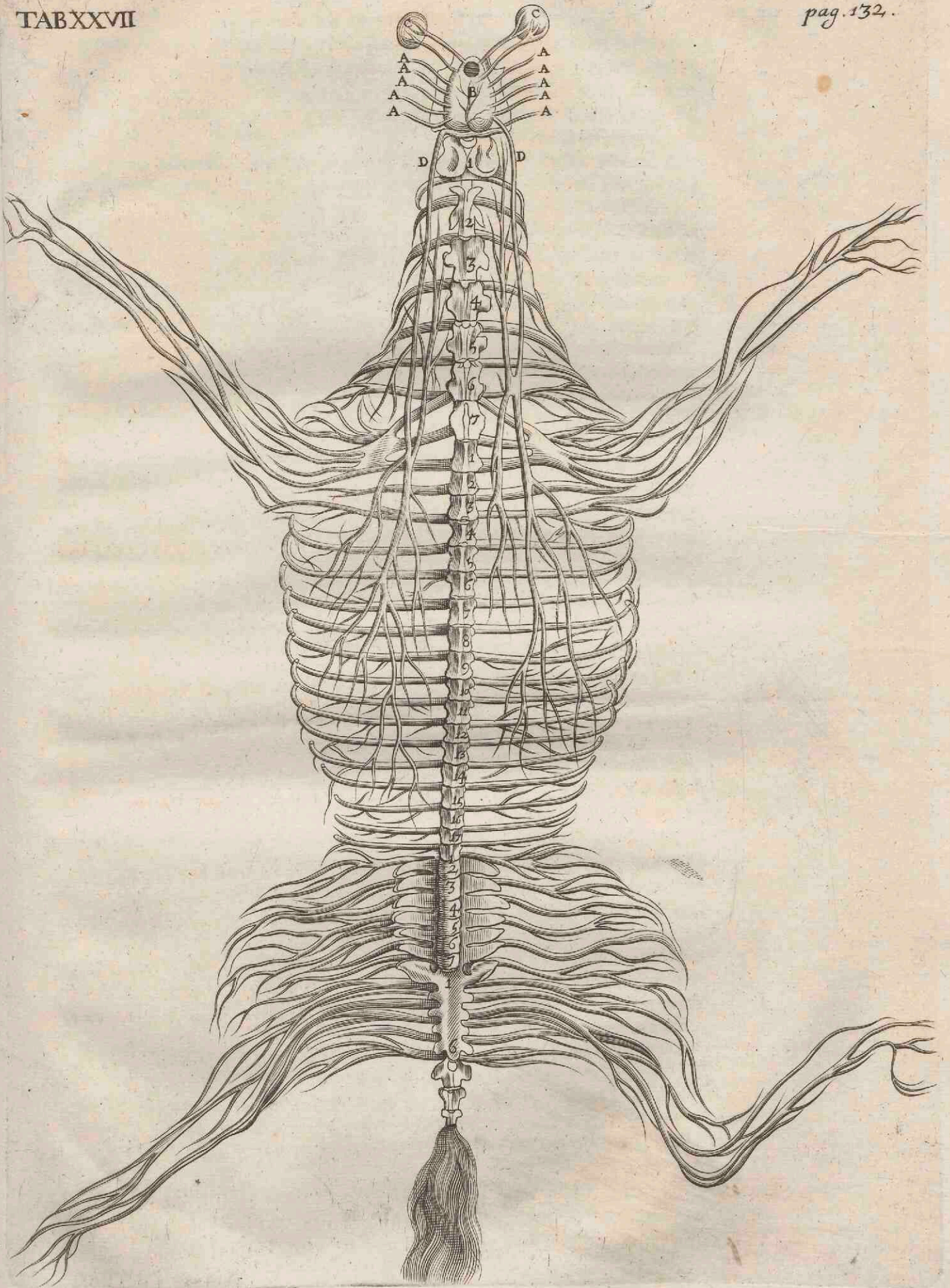


It has *Veins* from that branch of the *Porta* that runs to the Spleen, ^{its Vessels.} and is called the Splenick. Its *Arteries* spring from the *Cœliacal*; and its *Nerves* from the *Intercostal* or ninth pair. This Bowel for its bigness has very many of those *Lympheducts* that we described in the foregoing Chapter running through the *Mesentery*.

Besides these *Vessels* which are common to it with other parts, it has a ^{its proper} pipe or passage peculiar to it self, which was first found out at *Padua* in ^{passage.} an humane Body about forty years ago. This passage is membranous, and though it be but one in its going out, yet within the Sweet-bread it is divided first into two, and those two into innumerable small branches which are dispersed all over its Body, but their extremities terminate in the abovesaid reddish *Kernels* with which the Sweet-bread abounds.

Before this passage was found out, some thought the *use* of the Sweet- ^{its Use.} bread to be only to serve as a *Cushion* (being very soft) for the *Stomach* to bolster upon, and to sustain the *Vessels* that run through it; and others, that it sent a ferment to the *Stomach* to assist concoction. As to this latter use it must needs be onely imaginary, seeing there is no passage from it to the *Stomach*. And as to the former, though it doe those offices mentioned, yet from its proper passage (which opens into the beginning of the small *Gut* very near the same place where the *Gall*-passage enters) it gives suspicion that it has a further use. Now some have been so curious as to open *Dogs* alive, and cutting off this passage where it is inserted into the *Gut*, to receive its end into a narrow-mouth'd *Vessel*, (you may see the manner of it in *Barthol. Anat. l. i. c. 13.*) into which *Vessel* in a few hours time there has a Spoonfull of Juice distilled out of it. And this Juice, to distinguish it from all other *Liquors* in the *Body*, they call the *Pancreatick juice*, from the name *Pancreas* whereby ^{The Pancreatick Juice.} the Sweet-bread is otherwise called. So that it seems there is a peculiar *Liquor* separated from the *Arteries* into this passage in the little *Kernels* or *Glands* above-spoken of, which those that have tasted it, say, is of a saltish and somewhat sowerish taste. Now this Juice passing by its *Pipe* into the beginning of the small *Gut*, meets there with the *Gall*, with which it ferments, and causes some fermentation in the *Chyle* as it descends that way, whereby its purer parts are separated from the more impure and earthy, as was discoursed more fully in the eleventh Chapter, when we were describing the small *Gut*, (to which the Reader may please to turn back.)

As for the *figure* of the Sweet-bread, you have it express in the next Table but one, namely in that wherein the *Spleen* is also described.



C H A P. XIV.

Of the Liver.

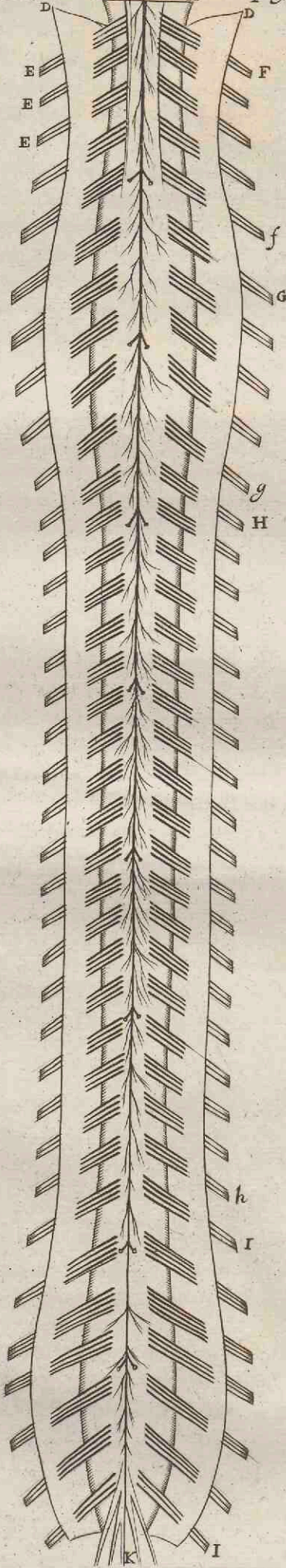
HAVING now done with the Parts that minister to the first concoction, namely *Chylification*, we proceed to those other that in some measure, some more some less, assist *Sanguification*, of which the *Liver* was esteemed by the Ancients the principal, nay almost the onely instrument. Which error of theirs was founded on this mistake in Anatomy, That having not then found out the milky Veins which we have before described, they thought that the Chyle was received out of the Guts by the Mesaraick Veins, which being branches of the *Porta*, all run to the Liver; And the *Cava* or large hollow Vein that arises out of the Liver, and is the trunk whence all the branches of Veins in the whole Body spring, containing nothing in it but blood, it necessarily follow'd that if the Chyle came to the Liver, it must by it be turned into blood before it departed from it again. Yea so deep was this Opinion of the Liver's making blood fixed in Mens Brains, that for some while after the milky Veins were found out, they would needs have *them* to convey the Chyle to the Liver, though they were forced to a thousand shifts to apologize for their non-appearance between the great Gland of the Mesentery, (whither they might be easily traced) and the Liver. But this prejudice was soon overcome when about thirty years ago the common Receptacle (described before in the tenth and twelfth Chapters) was found out, and a new office was invented for the Liver, which yet may in some sort be said to assist Sanguification: and what this office is, shall be shewn by and by in this and the next Chapters.

Its substance,
situation and
figure.

The *substance* of it is like concrete or congealed Blood, for which cause it is called *Parenchyma*, which is to say an affusion or shedding forth of blood. It is one in number, and situated in the Lower Belly in the upper part thereof on the right side under the short Ribs, near to the *Diaphragma* or Midriff, in its upper side, and its lower lies upon the right and fore side of the Stomach. It is divided into several Lobes or Flaps, in Horses, otherwise than in Men, in whom it is one continued body. These Lobes do cover the Stomach, grasping of it (as it were) as one should grasp any thing with their hand by spreading their fingers about it. This covering the Stomach stands in great need of, for thereby is the heat thereof much cherished for the furthering concoction. As for its *shape*, you cannot so well conceive it by any description, as by the figure of it annexed at the end of this Chapter, which you may please to take a view of.

Its Liga-
ments and
investing
Membrane.

It is tied in its place by three Ligaments: the strongest of which is that which is called its *suspensory* Ligament. This springs from the *Peritonæum* where it is spread over the under side of the Midriff. It is very strong and membranous, and arising from the Midriff somewhat towards its right side, it is inserted into the upper or bunching side of the Liver, into which it enters a little way; but in its entrance it loses one of its Membranes, which dilating or spreading it self makes the skin that enwraps



wraps the whole Liver; for the Liver is onely covered with one thin skin which it has from this Ligament. There is a *second* Ligament which seems to spring from this skin of the Liver, and is inserted into the sharp-pointed Gristle at the bottom of the Breast-bone. By these two is the Liver kept from falling lower down into the Belly, or from slipping out of its place sideways. The *third* Ligament is not one originally, but when the Foal is in the Womb it supplies the place of a Vein, running from the Navel to the lower or hollow side of the Liver, and by it is nourishment brought from the Dam to the Foal. But as soon as it is foaled, and it begins to take its nourishment by the mouth onely, and not any longer at all this way, this Vein dries and closes up, and so degenerates into a Ligament, whereby the Liver is kept from ascending or bearing up against the Midriff, as it might have done in an Horses leaping or the like. This is just opposite to the *Suspensory* one, entering in at the lower side over against where that does on the upper.

It hath two sorts of *Veins*. The *first* are the roots of the *Vena cava* or *Veins*. large hollow Vein, which spreading themselves through all its parts, do receive into them the blood that is brought into the Liver by the *Porta*; which having done, the smaller roots two or three of them grow into one, and this one uniting with two or three of the like kind into another larger root, they do at last all of them meet in one trunk and make the hollow Vein, which issuing out of the upper part of the Liver presently enters the Midriff, and so ascends up to the Heart. The *second* sort of Vein is the *Porta*, all whose branches coming from the Guts, Spleen, Stomach, &c. and uniting into one trunk enter the Liver on its lower or hollow side, into which it is no sooner entred, but presently it disperses it self into innumerable branches through all the Lobes of the Liver, affording nourishment unto it, in that regard supplying the place of an Artery, which it resembles the more, because within the Liver it has two Coats, the outer whereof it receives from that skin that cloaths the Liver, in its entrance into it. Now so much of the blood that is imported by the *Porta*, as is not spent on the nourishment of the Liver, is drunk in by the roots of the *hollow Vein* before-mentioned, and returned to the Heart. This Vein is called *Porta* or *Vena portæ*, the Gate-vein, from two bunchings out, of the Liver, (called *gates* by *Hippocrates*) between which it enters it.

Yet is not the Liver, at least all the parts of it, onely nourished by *Arteries*. the blood that is brought in by the *Porta*; for there is a branch which comes from the *Cœliack* Artery that ascends to its hollow side just by the *Porta*, which sends forth twigs all over its Coat, as likewise through the Coats of the *Porta* and the *Choler-Vessels*: but whether any of them enter into its parenchyma or substance, is not discovered. These twigs of *Arteries* bring vital heat and nourishment to those parts through which they run.

Its *Nerves* spring from the Intercostal pair, *viz.* partly from the stomachick and partly from the mesenterick branch thereof. These onely are communicated to those parts to which the *Arteries* are dispersed, so that the substance of the Liver has very little sense. *Nerves.*

We shew'd before how that for some while after the milky Veins were found out, they were believ'd to convey the Chyle to the Liver: and all the colour for this Opinion was a few small clear, limpid and almost transparent Vessels, that run between the Mesentery and it. But as on *Lympheducts.*

Fig. 2.

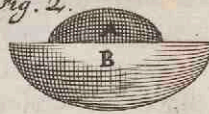


Fig. 1.

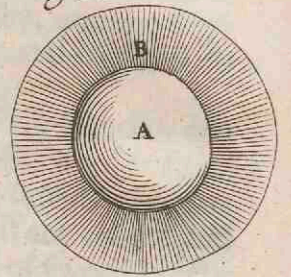


Fig. 3.

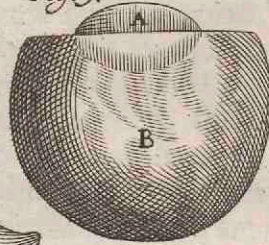


Fig. 4.

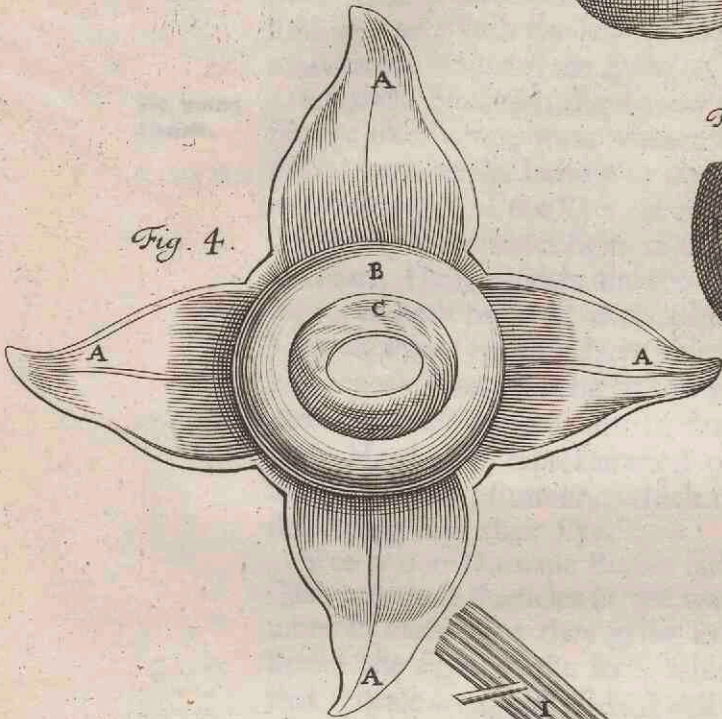


Fig. 5.

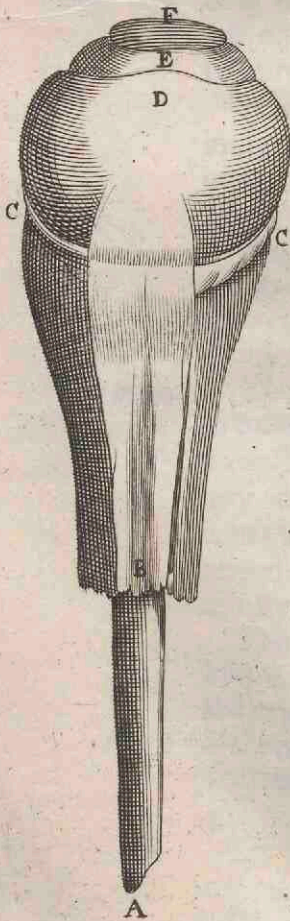


Fig. 6.

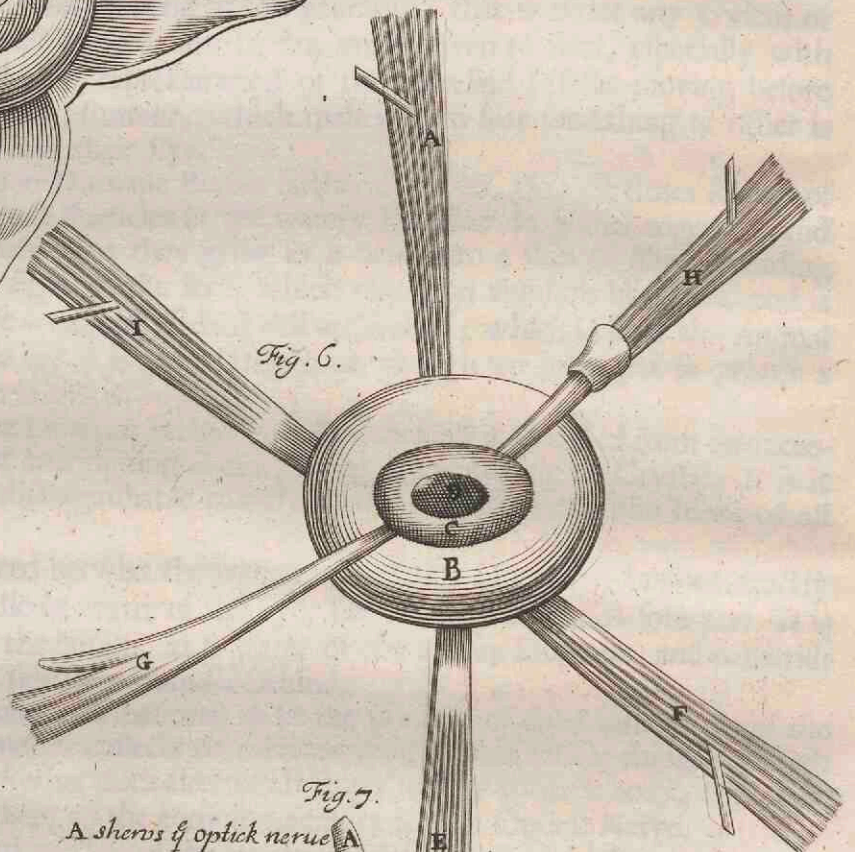
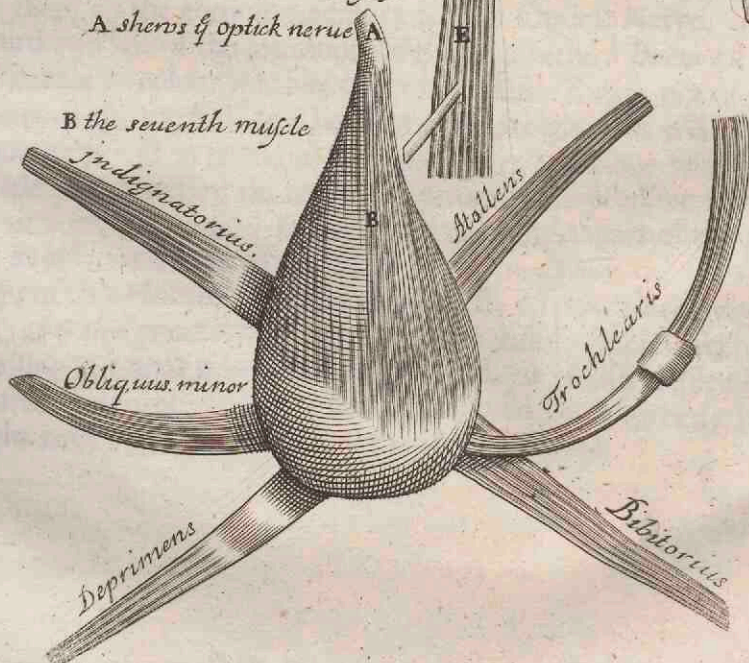


Fig. 7.



the one hand they are too few in number for that office (especially being so slender) being scarce one for ten of the milky Veins in the Mesentery: so on the other, they are neither of the same colour (as being much clearer) nor does the Liquor they contain come from the Mesentery to the Liver, but runs from this to that, as has been observed in Live-dissections, in which having been tied they have swelled on that side of the Ligature toward the Liver, and grown empty toward the Mesentery. They are indeed then truly *Lympheducts*, which carry that water that is separated from the blood in the Liver, towards the Mesentery, and from it to the common receptacle of the Chyle with which it mixes.

Besides these Vessels there are the numerous branches of the Gall-passage, of which we shall treat more fully in the next Chapter. And shall say no more here, but onely how one may distinguish betwixt the branches of the *Cava*, *Porta* and these of the Gall-passage, so as to know which are which. Those of the *Cava* are clad but with one Coat, are white, thin and of a large cavity. Those of the *Porta* have a double Coat, and so are thicker and stronger, and yet not so wide as those of the *Cava*. Lastly, the branches of the Gall-passage are of a duskyish yellow, have a thicker Coat than either the *Cava* or *Porta*, and yet have the narrowest channel. These are included in a common case with those of the *Porta*, which makes their outer Coat.

Its Use.

Having in the beginning of this Chapter detected the error of the Ancients in ascribing Sanguification to the Liver in so eminent and large a sense; we must however confess that it does something towards the purifying of the Blood, and that is, by separating the Choler from it, as shall be fullier shewn in the next Chapter. In it also is a pretty quantity of ferous or wheyish humour filtrated or strained from the Blood, which is sent by the Lympheducts to the common receptacle of the Chyle as aforesaid. In the third and last place it furthers the concoction of the Stomach by its kind and cherishing heat.

The *Sixth* Table sheweth the Liver intire, and also its Vessels freed from the *Parenchyma*.

Fig. I. Expresses the Liver taken out of the Body, and placed with its hollow side uppermost.

- AAAA The hollow side of the Liver cloathed with its Coat.
- B The Vena portæ or Gate-vein, and its egress out of the hollow side of the Liver.
- C The Trunk of Vena cava or hollow Vein also coming out of the Liver.
- D The Gall or Choler-passage cut off close to the Liver.
- E An Artery which is branched to the Liver from the ramus Cœliacus.
- F A Nerve of the sixth pair (as commonly reckoned) also branching to the Liver.
- GG The Edges of the Liver turned down and hanging over the hollow side of it.
- HHHH The four Lobes or Scollops of the Liver.

Fig. II.

Fig. 7

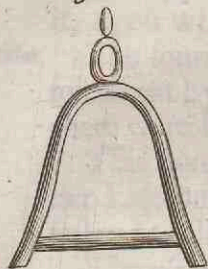


Fig 4

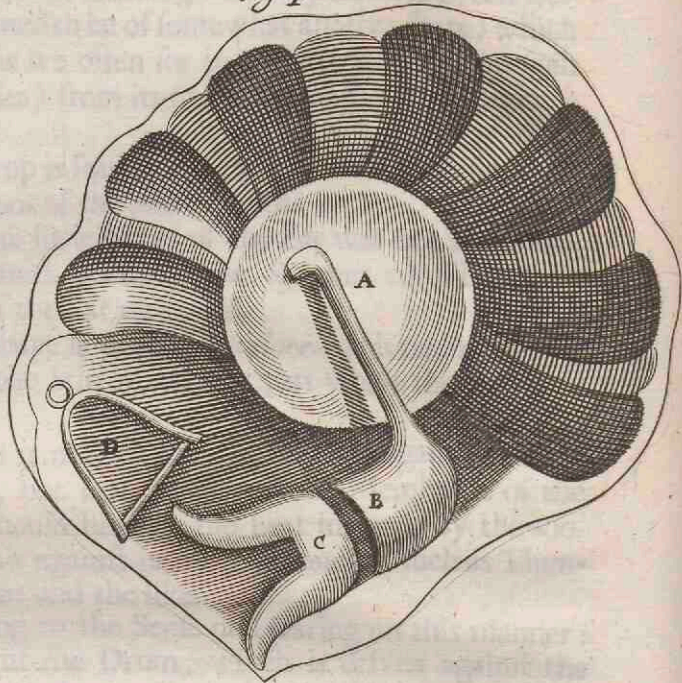


Fig. 6.

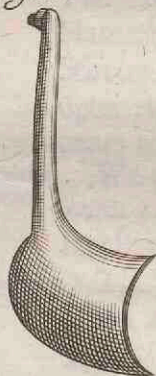


Fig. 5.

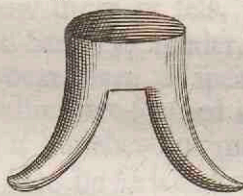


Fig 2

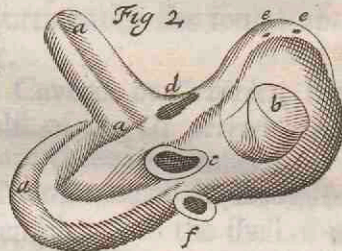


Fig. 3.

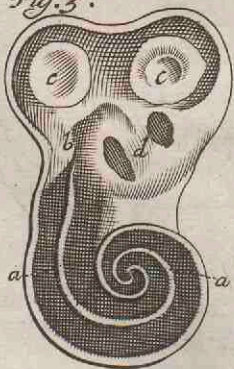


Fig 1

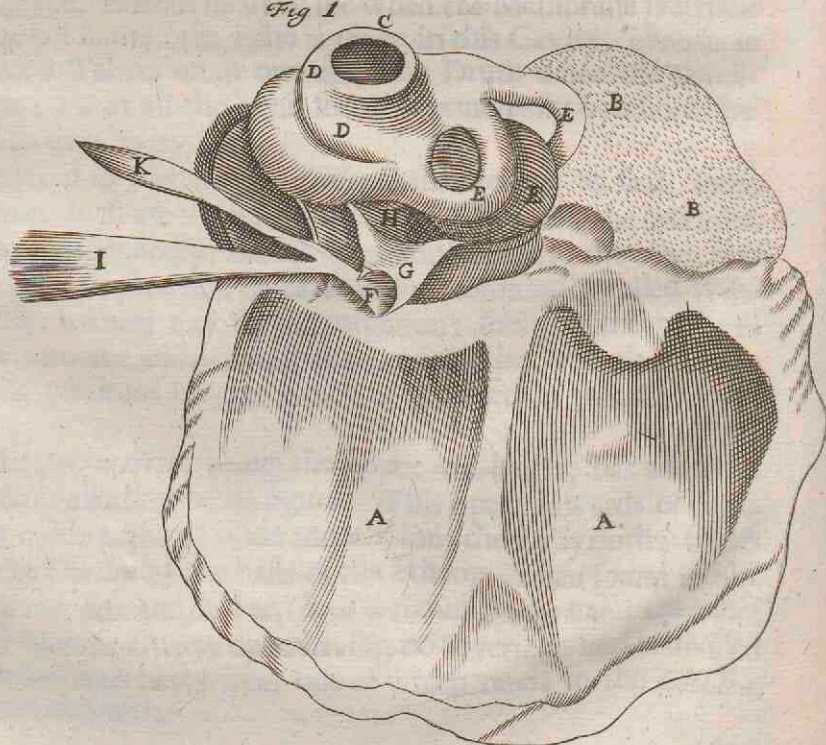


Fig. II. Represents the Vessels of the Liver freed from the *Parenchyma*, or fleshy substance thereof.

- AA *A portion of Vena cava.*
- BB *The Trunk of Vena portæ passing forth of the Liver.*
- C *The Gall-passage cut off close by the Liver.*
- EEEE *The Branches of Vena portæ dispersed through the Liver.*
- FFFF *The Branches of the hollow Vein likewise distributed through the Liver.*
- GGGG *The most remarkable Anastomoses or joinings together of the mouths of the Cava and Porta.*
- HH *The Artery that is branched to the Liver from the Cœliack Artery.*
- I *The Extremities or ends of the Veins, which for their smallness are called Capillary, or hair-like.*

C H A P. XV.

Of the Porus Bilarius, or Gall-passage.

IT is difficult to give a satisfactory account why most Creatures should have both a *Gall bladder*, for the collection of the *Choler*, and besides, a *Gall passage*; and yet a *Horse* and all whole-hoofed *Beasts*, as also *Harts*, *Fallow-deer* and some few others, should onely have the *passage* without the *Bladder*. It would be worth the while for our *Virtuosi* to invent a probable reason of it, but for my own part I dare not pretend to be so sagacious. But much have those been mistaken that not finding any *Bladder* of *Gall*, have affirmed that an *Horse* hath no *gall* at all. And this, *Dr. Brown* reckons up amongst *vulgar Errors*.

Now the trunk of this *Gall-passage* enters the *Liver* very near the same place with the *Porta*, together with which it is enwrapped in one common *Cover*, which they both borrow from that skin wherewith the *Liver* is clothed. I mean they begin to be so invested just at their entrance into the *Liver*, for before they have but each one single *Coat*. Its branches run along with those of the *Porta* through all parts of the *Liver*, and it has the same *Artery* and *Nerve* running through its *Membrane*. All these branches uniting into one trunk, it passes the directest way to the small *Gut*, into which it is inserted about a foot from the lower *Orifice* of the *Stomach*, where it discharges it self of the *Choler*.

Having described the *Vessel*, there remain two things to be enquired into, *first* how the *Choler* is separated in the *Liver*, and *secondly* of what use it is. As to the first, we must consider that there can be no such separation as this, without some sort of ferment to cause it. There comes indeed nothing to the *Liver* but under the form of *blood*, but however it will be of use to examine from what parts that *blood* comes: And amongst the rest we find that a considerable quantity comes from the *Spleen* by the *splenick branch*. Now every one that will taste it may discern that the

Its branching in the Liver, and its tendency without it.

Choler how separated from the Blood, and its use.

blood

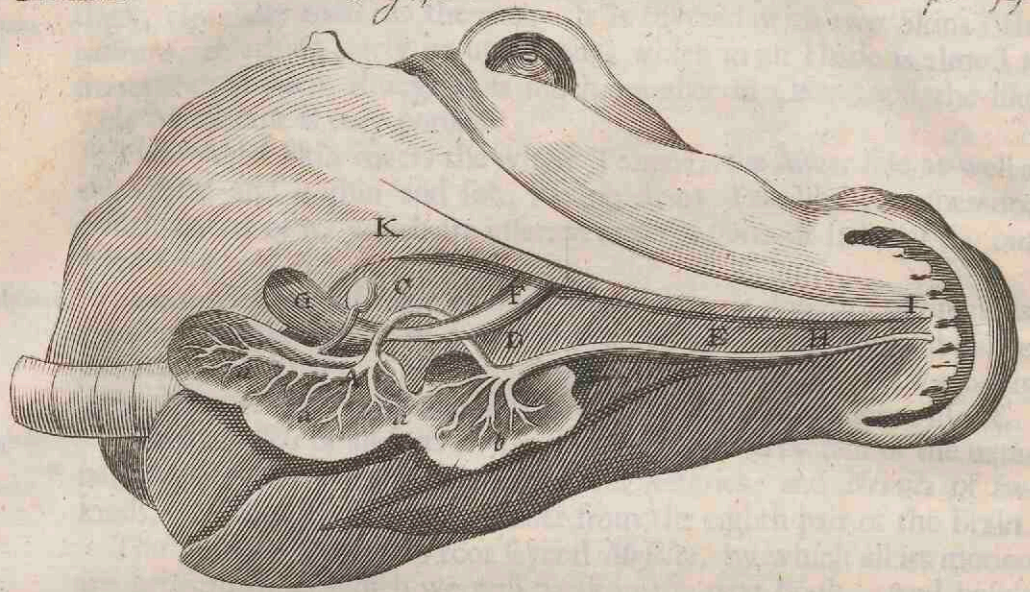


Fig. III.

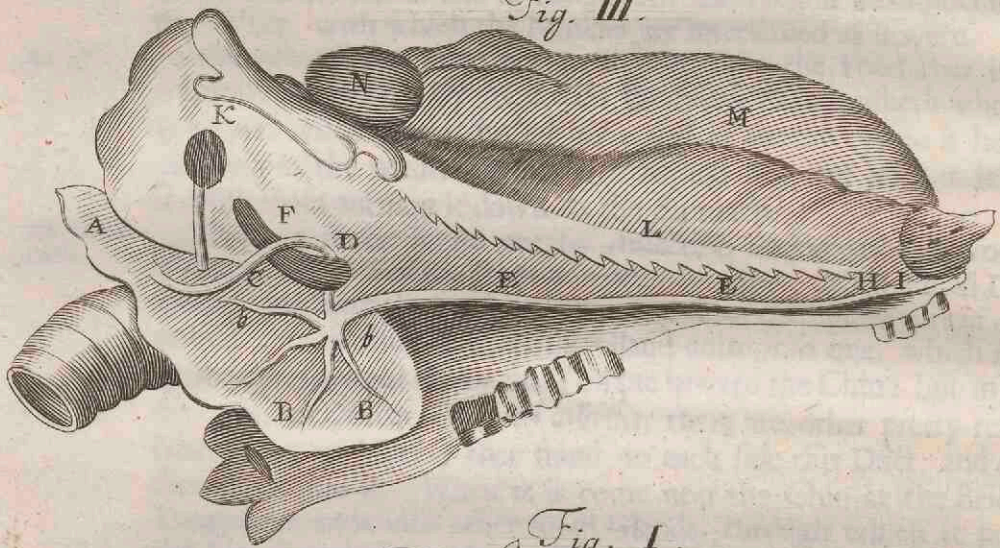
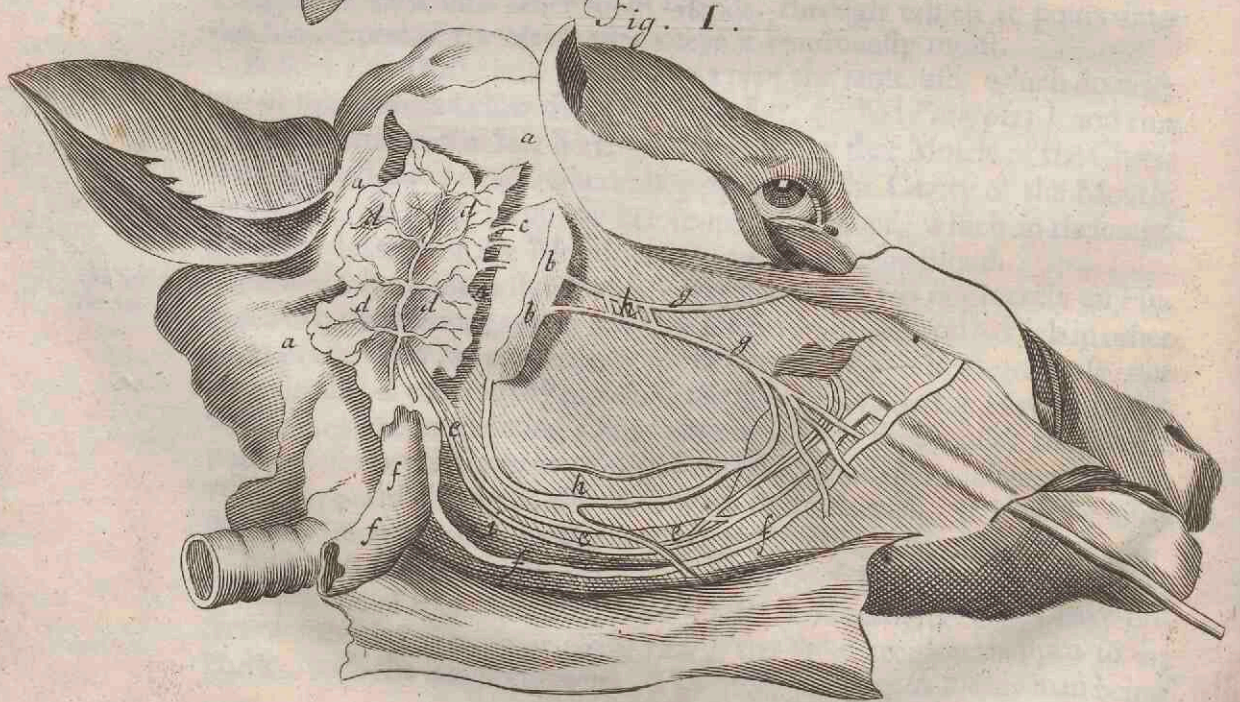


Fig. I.



bloud that comes out of the Spleen by this branch has a kind of a fowrish harsh taste to what the rest of the mass of bloud has. This then mixing with the rest of the bloud and passing with it through the narrow Vessels in the Liver, causes it there to ferment (as a small piece of fowr Dough will I know not how much that is not leavened) and in that fermentation this yellow Choler is separated from the Bloud, much in the same manner as Yest from Beer in a Barrel, (which it partly resembles in colour.) And this fermentation is assisted by the proper nature and faculty of the Liver given by Nature to it; who hath also framed this liquor of Particles so differing from those of the Bloud, that though the Bloud pass out of the *Porta* into the *Cava*, yet the Choler stays behind and is received by the small mouths of the Choler passage. Some affirm this separation is performed by the help of some Glands or little Kernels into which the ends of the severall Vessels are inserted, but I have not been able to discern them. The use of the Gall is, Together with the Juice that is sent from the Sweetbread, to make a ferment in the first Gut for the uses that are fully enough delivered in the eleventh Chapter: to which we shall onely add, that it serves by its acrimony to exstimulate the Guts to expell the Excrements contained in them. And seeing there is no bag or repository to store it up in, it passes continually to the Guts, whereby Horses come to dung oftener than most other Creatures: which as *Dr. Brown* notes, "was prudently contrived by Providence in this Animal, considering his plentiful feeding, the largeness of his Guts, and their various circumvolution. For, says he, Choler is the natural Glyster, or one excretion whereby Nature excludes another, &c."

C H A P. XVI.

Of the Spleen or Milt.

The substance
of the Spleen.

THE Spleen or Milt is of a soft, spongius substance, like thick, black and congealed Bloud, from which it is said to be generated; though some that of late have examined it more curiously with Magnifying Glasses, declare the greatest part of its substance, besides the Bloud-vessels, to consist of abundance of little Kernels inclosed in skinny Cells like Honey-combs, which in their own nature are of a white colour, and will appear such when the Bloud is washt from them. For my own part, I question whether there be any such Kernels in it, or if there be, they must be far different from those of any other part, and be of a much looser substance, seeing I have onely in River-water (after I had taken off the investing skin) washt off the parenchyma so clearly from the Vessels, that there has seem'd to be nothing else remaining. A figure of which Vessels so cleared of the parenchyma by washing, you have in the following Table.

Its situation
and connexion.

Its *situation* is under the short Ribs on the left side over against the Liver, between the Stomach and the short or bastard Ribs. It *cleaveth* oft-times to the Midriff by a skin or coat, which it hath from the Rim of the Belly. It is also fastned by a skin to the Stomach.

It is



It is of a triangular *shape*, yet long, and something sharp-pointed, as *Its Figure.* you may see in the Figure.

Its Colour is (in a sound Horse) reddish, inclining somewhat to black; *Its Colour.* but in an unsound Horse it is more inclining to black, or of a leaden or ashey colour: yet most times in an unsound Horse it is of the colour of the Humour which offends.

There are several Creatures that naturally have no Spleen, as all Insects; and therefore that Proverb is not literally true, *That even a Fly has a Spleen*; Such also as have no Piss-bladder, want the Milt, as the *Chameleon*, and many such like: But now it is a great question, whether such Creatures as by Nature have Spleens, can have them taken out, and yet live. It is true indeed that other Parts that seem to be as considerable, have been taken even out of *Humane* Bodies, and yet the Parties have lived: So I have read of some Women that upon incurable distempers in the Part, have had their Womb cut out, and yet have liv'd in tolerable health afterwards (*Barthol. Epist.*) And it is a common thing to geld any sort of Creature, though there be considerably large Vessels that run to the Stones. But it is to be confess'd that these parts instanc'd in, seem to be wholly framed for the propagation of the several *kinds* of living Creatures, and not for the necessary service of the *Individual* that has them. And therefore when they are taken away, though the end for which they were created, to wit *generation*, be frustrated by the loss of them; yet may the Creature it self that loses them, live well enough without them. But now as for the Spleen, it does not at all serve for procreation, but is of use onely to that Body that has it. (What its *use* is, we shall shew towards the latter end of this Chapter.) Yet several have boasted that they have taken it out of Dogs and Cats, and that they have lived in pretty good plight a considerable while after. The operation must needs be somewhat difficult, seeing the Spleen is seated on the inside of the short Ribs, nearer the Back than the Breast: nor can I believe that a Horse could live any while if it were taken out of him; but least of all could Man, in whom it is larger than in any other Creature, as *Bartholin* affirms. For the Vessels that are inserted into it are so many and large, that it would seem impossible to stanch the Blood; besides the necessary use that it seems to be of to the Body, of which by and by.

The *skin* that it is covered with, is *thicker* than that of the Liver, both because of the loose and soft substance of the Spleen that required a stronger covering to defend it; and also that it might the better sustain the strong beatings of its Arteries that are pretty large and many. This skin it has from the *Peritonæum* or Rim of the Belly, to which it is commonly knit, as also to the left Kidney and the Midriff, and on its inside to the Caul. Some late Anatomists have affirmed it to be clad with two Coats, the outer that which we have mentioned, and the inner arising from the Vessels that enter the Spleen.

All the *Veins* that it has, are from that branch of the *Porta* that is called the Splenick branch. For the *Porta* as soon as it comes out of the lower or hollow side of the Liver, sends one notable Branch to the Spleen, which passing cross the Body from the right to the left side under the Liver and Stomach, enters the Spleen and disperses it self into innumerable Twigs all over it. A Twig of the splenick Artery opens into this Vein a little before it enters the Spleen: And from the lower end of the Spleen there

*Whether an
Horse can
live without
it.*

*Its Mem-
brane.*

*Vessels.
1. Veins.*



there go two or three Vessels to the Stomach, which are called *Vasa brevia* or short Vessels. The use of the splenick Vein is to bring from the Spleen all that arterial blood that is not spent on its nourishment; and besides, that proper and peculiar juice that is made in the Spleen, of which presently.

2. *Arteries.* Its *Arteries* are three or four times more in number than the Veins, and all of them spring from the left Cœliack branch that has the name of *Splenick*, from the Spleen, into which it is inserted. Hereby it receives vital heat and nourishment, and matter out of which to make its proper juice. Before this Artery enter the Spleen, it sends forth one twig that unites with and opens into the splenick Vein, as was noted before.

3. *Nerves.* Its *Nerves* are but small yet pretty numerous. They spring from a mesenterick branch of the left Intercoastal Nerve, and are disperied principally through the skin that covers it, though some few enter its substance.

4. *Lympheducts.* Lastly, it has several *Lympheducts*, or Water-passages, which creeping all over its Coat, take their way along the Caul towards the common receptacle of the Chyle, into which they empty the liquor contained in them, as all those that arise from the several parts of the lower Belly do. What these Lympheducts are, and what that liquor is which they contain, I have shown above in the 12th Chapter, of the *Mesentery*.

Its action and use.

There is no part of the Body concerning whose use there has been greater diversity of opinion. Some have made it the receptacle of black Cholera (or of thick dreggy Blood) separated in the Liver and brought hither by the splenick branch. Others that thought this too ignoble and base an use for so considerable a part, esteem'd it to be as it were a second Liver: For as they believed that the thinner and more spirituous part of the Chyle passed to the Liver; so, that a thicker and more dreggy part went to the Spleen, of which was made a blacker and more earthy sort of Blood, partly for its own nourishment, and partly for the nourishment of the Stomach, Guts, Mesentery, &c. In answer to these two opinions it will be sufficient to say, That the first is contrary to the circulation of the Blood, nothing passing from the Liver to the Spleen, but contrarily from the Spleen to the Liver: and the latter, besides that it is contrary to the said circulation, is repugnant also to the true motion of the Chyle, none of which either passes to the Liver or Spleen, as we have more than once shown already. A third opinion is, That of the blood that the Arteries bring to it in great plenty, is made a certain acid or fowr Juice, which is sent by the *vasa brevia* or short Veins to the Stomach, into which being discharged, it partly provokes appetite, and partly helps concoction: And this Opinion has had a great many Abettors, whereas its falsity may be demonstrated by this, that if one open a Dog (or the like) alive, and tie these short Veins with a thred, they will fill and swell betwixt the Stomach and Ligature, but will grow empty on that side toward the Spleen; which is a plain evidence that the Blood or whatever other Humour that runs in these short Veins, flows from the Stomach and not to it. However we will grant that the Spleen does indeed make such a fowr Juice, of part of the Arterial blood that is imported into it by the splenick Artery; but then it passes not from thence to the Stomach, but to the Liver by the splenick branch of the *Porta*: for if one tie the said branch, as was said above of the *short veins*, it will fill towards the Spleen and grow empty towards the Liver. And the use of this Juice seems to be



be this, *viz.* That mixing in the trunk of the *Porta* with all the Blood that is received by the branches thereof out of the several parts of the Lower Belly, especially from the Guts, it enters with it into the Liver, where it causes the Blood to ferment, whereby the Choler is separated from it, for the uses mentioned in the foregoing Chapter, where we have treated more at large of this separation.

Another *use* of the Spleen is, by its warmth to cherish the left side of the Stomach, as the Liver does the right, to further the concoction thereof. And this it may be conceived to doe in a very considerable degree; for seeing it has so very many Arteries, it must needs be very warm.

There are many more Opinions concerning the use of the Spleen than these I have mentioned: but as it would be *tedious* to recite them, so it would be but *needless* to refute them, the new Doctrines of the circulation of the Blood and the motion of the Chyle being improveable to a general confutation of them.

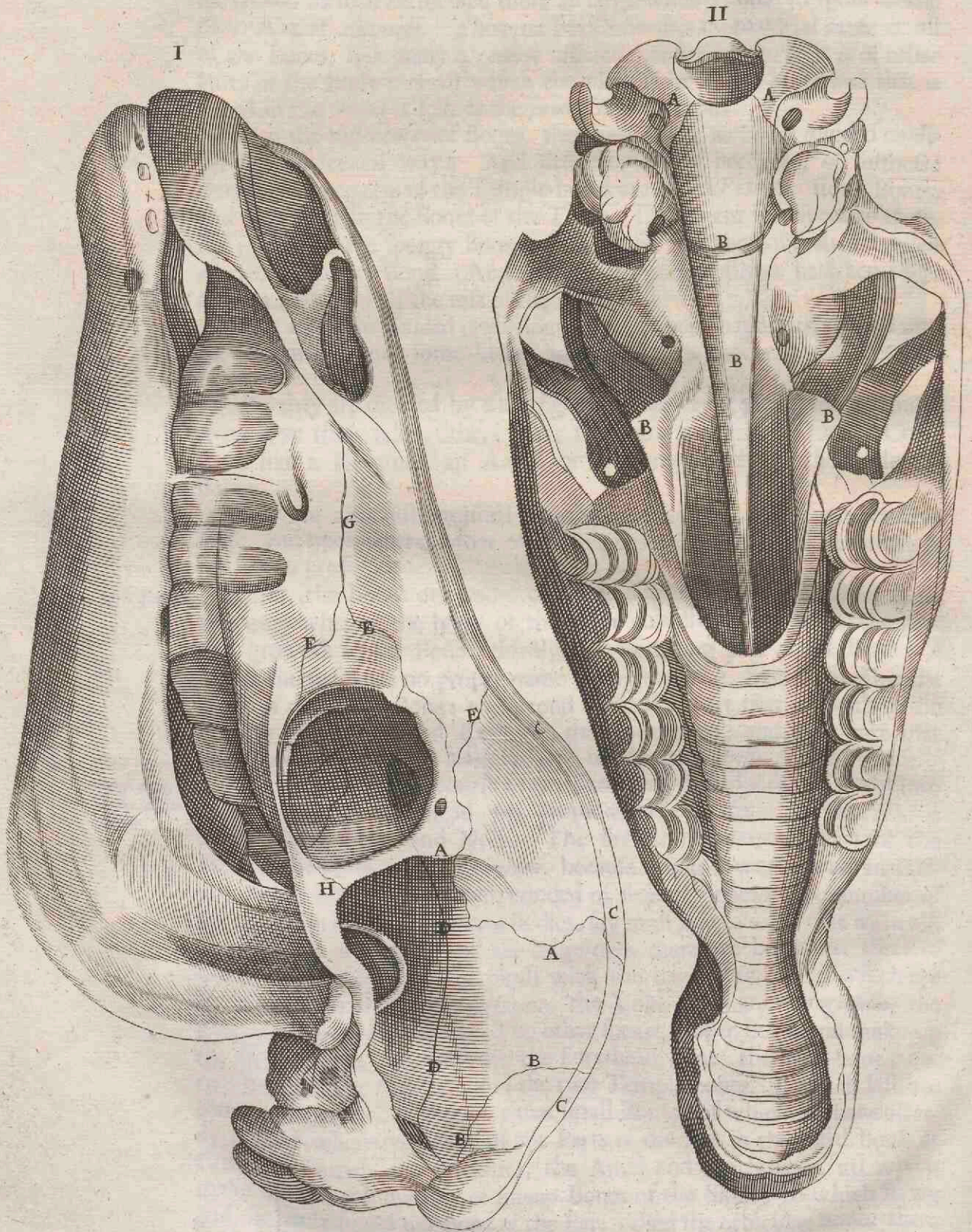
Table VII. Expresseth the Spleen intire with the Vessels going in and out, and the same Vessels alone freed from their *parenchyma*; as also the Sweet-bread intire with its Vessels.

Fig. I Representeth the Spleen intire, with the Vessels going in and out.

- A Shews the body of the Spleen on the concave or hollow side which receives the Vessels.
- B The splenick Vein.
- C The splenick Artery.
- D Its Nerves proceeding from a Mesenterick branch of the left Intercostal Nerve.

Fig. II. Representeth the Vessels of the Spleen devested of their *parenchyma*.

- A Shews the Arteria Coeliaca, cut close off at the great Artery.
- B Its ramus dexter superior, or right-hand upper branch, producing the gastrica dextra, or right-hand Stomach-artery: it makes also the cysticæ gemellæ that go to the Liver and Gall-passage.
- C Its ramus dexter inferior, or right-hand lower branch, which goes to the Mesentery and Guts.
- D Its ramus sinister, or left-hand branch, called Arteria Splenica or splenick Artery, which brings the blood to the Spleen.
- E The Nerves of the Spleen coming from a mesenterick branch of the left Intercostal Nerve.
- F The splenick branch of Vena portæ cut off close by its trunk.
- G The splenick Vein cut open to shew its Valves, which permit the Blood to pass from the Spleen to the Liver, but hinder any Blood from returning from the Liver to the Spleen.
- HH The Distribution of the Nerves through the substance of the Spleen, accompanying the Veins and Arteries.
- II &c. Several (seeming) Anastomoses or inosculationes of the Veins and Arteries.
- KKK Vessels going from the lower end of the Spleen to the Stomach, called Vasa brevia, or short Vessels.



LL &c. The capillary branches of Veins, Arteries and Nerves dispersed through the whole substance of the Spleen.

Fig. III. Representeth the *Pancreas* or Sweet-bread freed from its Membrane and part of its substance, the better to shew the course of the Vessels in it, which come to it from the splenick Vein and Artery. It representeth also the new *Wirtfungian* passage, so called from the late Inventer of it.

- A Shews the body of the *Pancreas* dissected.
- B The new passage called ductus *Wirtfungianus* or *pancreaticus*.
- C The Orifice of the said passage where it opens into the beginning of the small Gut.
- D The Artery of the Sweet-bread dispersed through its substance.
- E The Vein of the Sweet-bread dispersed likewise through its substance.
- F Its Nerves, being a branch of the *Intercostal* pair.

C H A P. XVII.

Of the Kidneys, and Deputy-kidneys.

Their name.

THE *Kidneys* are otherwise called *Reins* from their Latine name *Renes*, which is derived from a Greek word which signifieth to flow, because the watery or wheyish part of the Blood doth continually flow through them, and maketh the Urine.

Number, situation and connexion.

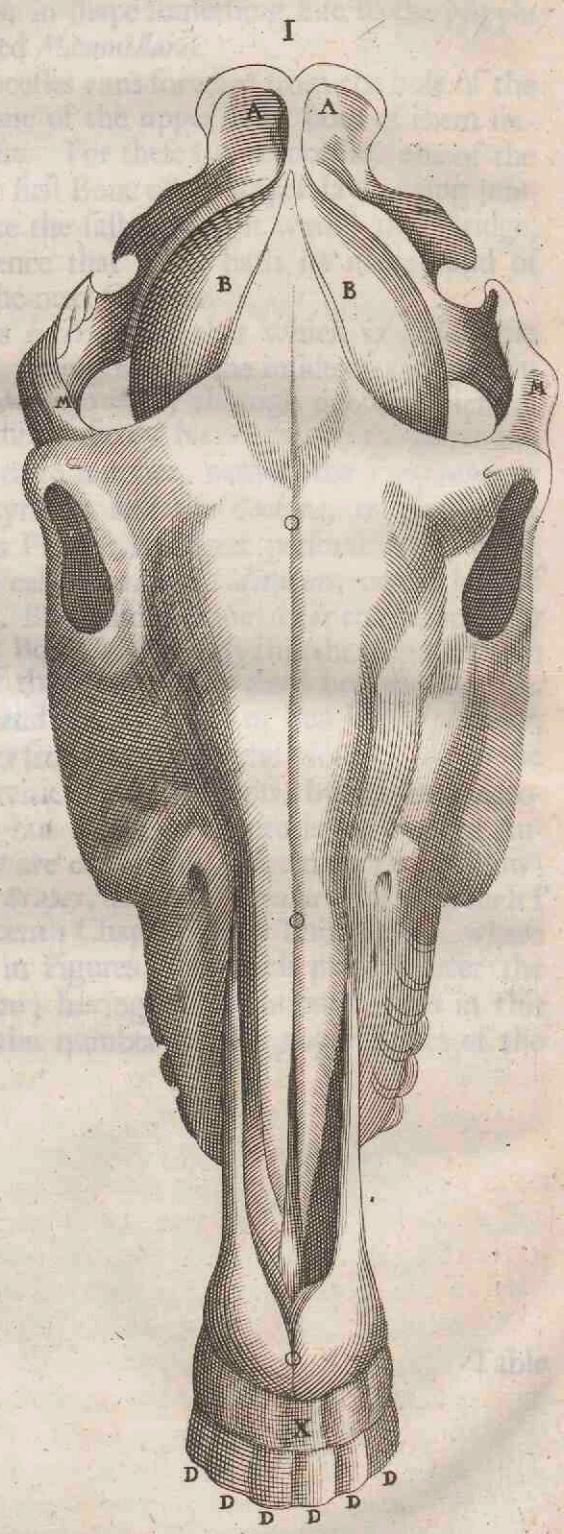
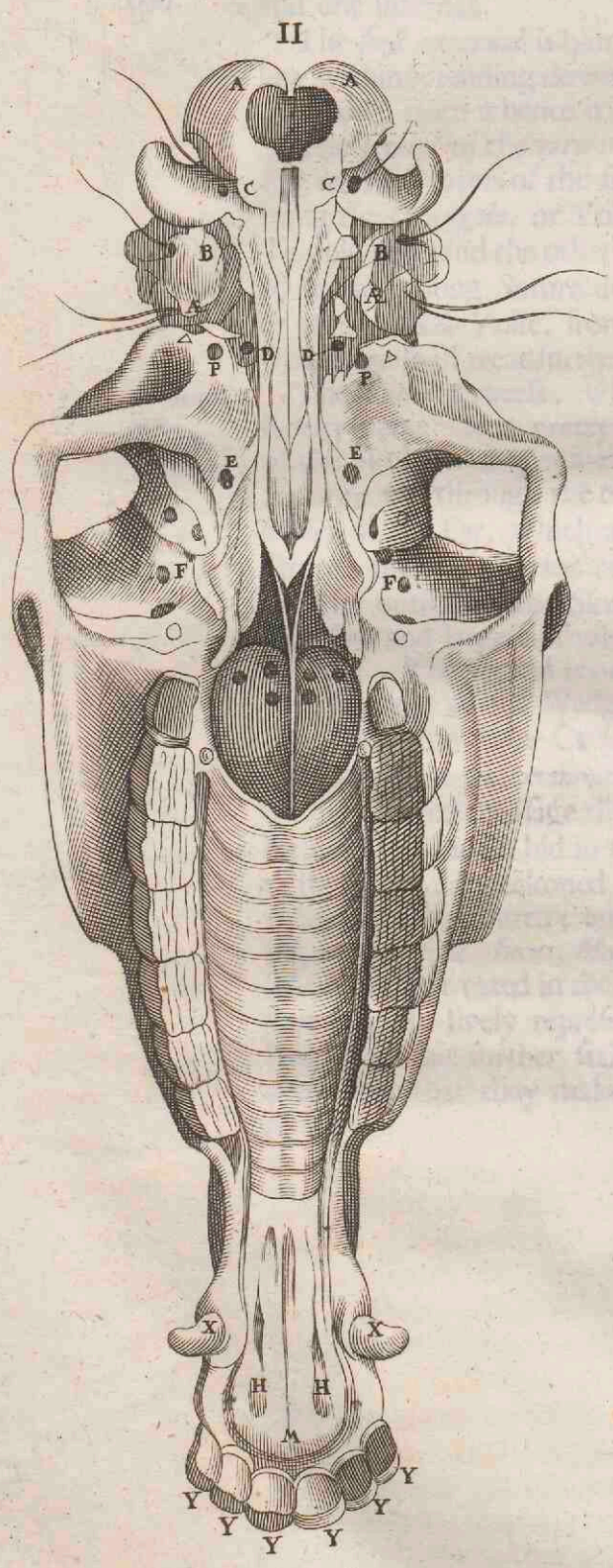
They are in number two, that when one is stop't with a stone or gravel, or hurt by any accident, the Urine might be separated in the other, or otherwise the Beast would die. They are seated in the Loins behind the Stomach and Guts, the right under the Liver and the left under the Spleen, on each side of the hollow Vein and great Artery, opposite to one another. They rest upon the Muscles of the Loins, and are included betwixt the Membranes of the *Peritonæum* which keeps them firm in their place. They are knit to the hollow Vein and great Artery by the Emulgent Vessels, and to the Bladder by the Ureters which we shall describe in the next Chapter.

Figure.

They are seldom like to one another in shape; for the Right is in figure like a Heart, but something flatter; whereas the left is like that of a Man, viz. of the shape of a Kidney-bean, as you may see them represented in the following Figure.

Membranes.

They are covered with two Membranes, an inner which is proper, and an outer which is common. The inner Skin seems to spring from the outer Coat of those Vessels that enter into them: this cleaves so close to them, that it can hardly be separated, being very thin, and having small threds of Nerves running along it from a twig of the *Intercostal* Nerve. The outer which is common, is borrowed from the Rim of the Belly, and is wrapped somewhat loosely about the Kidney. This Skin is bedaubed with fat, and is therefore called the *fatty Coat*; and into it are inserted an Artery



tery and Vein, which have also the title of *fatty*, and spring from the great Artery and hollow Vein.

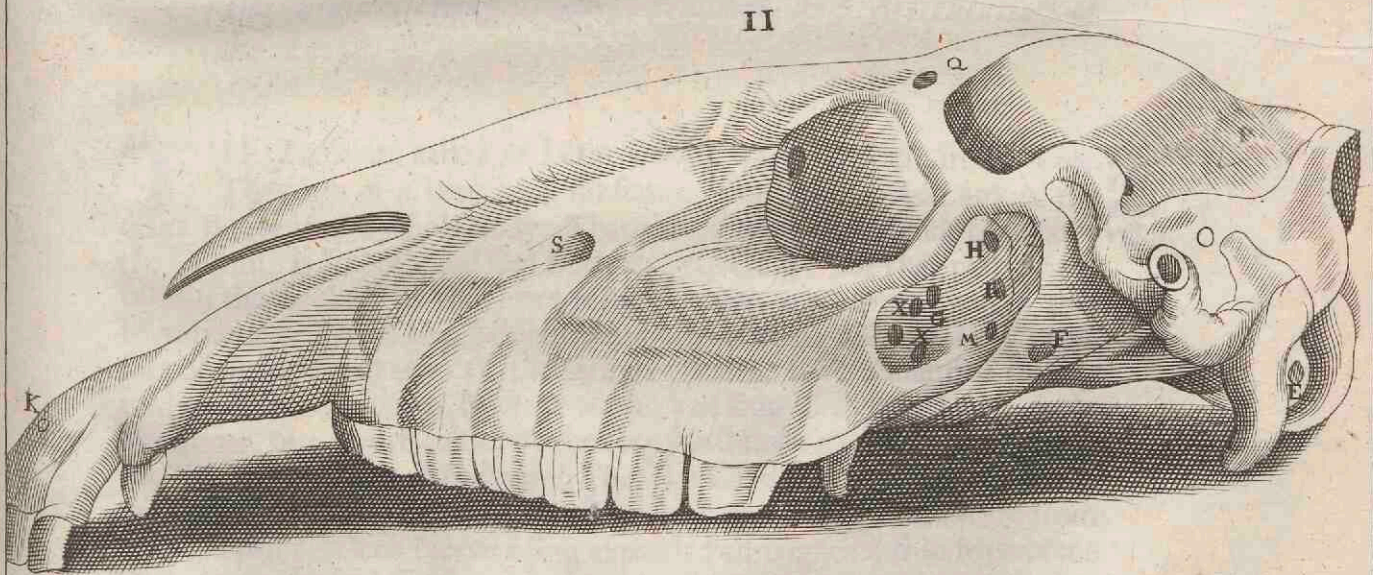
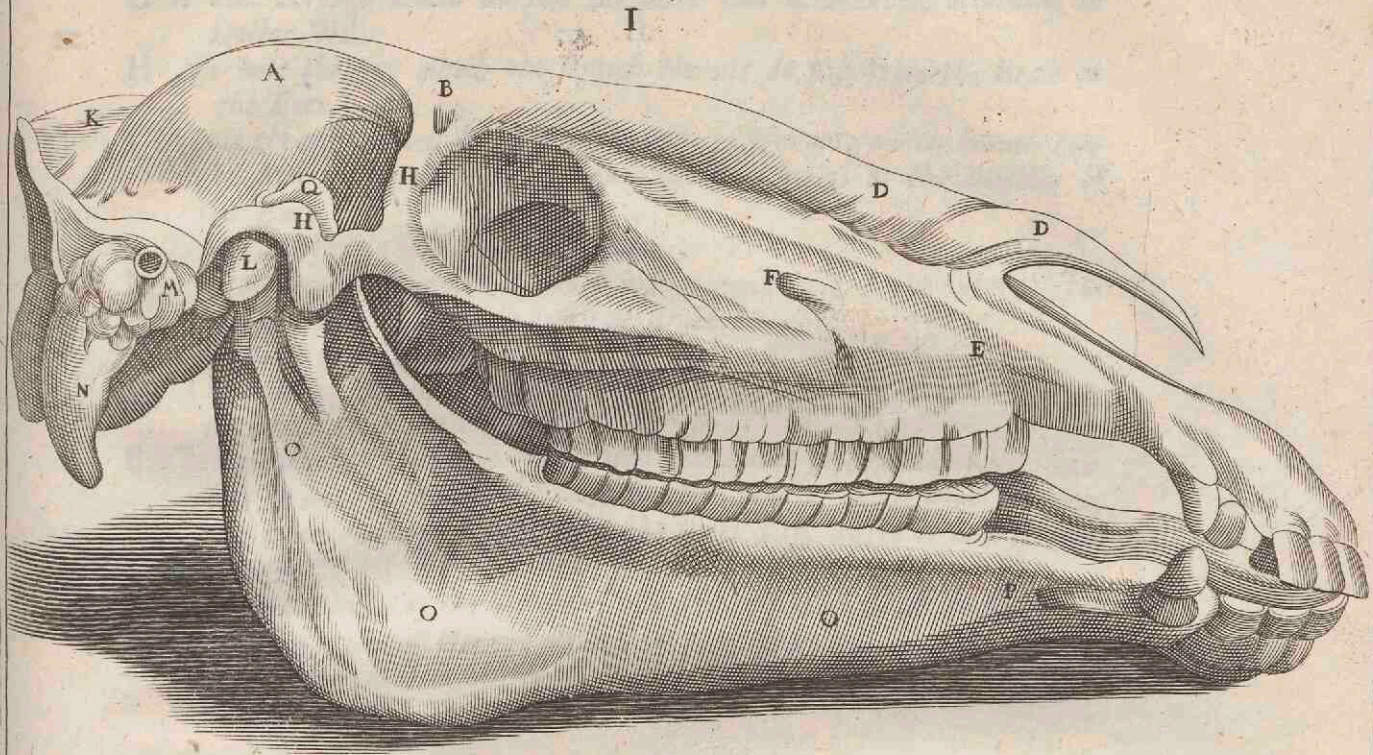
As to their *substance*, it has been always till of late held to be hard and compact flesh; and indeed it handles pretty firm to the touch, and seems to be fleshy to the bare eye. But seeing there is no separation made of any thing from the Blood in other Parts, but by the help of Glands or Kernels; (for so is the Slaver separated in the Mouth, the Choler in the Liver, bad Humours in the Guts upon taking a purge, &c.) I say, for that cause it is reasonable to give credit to those curious Anatomists that by their Magnifying Glasses or Microscopes have discovered the substance of the Kidneys to be for the greatest part made up of such Glands, by means of which the Urine is separated from the Blood, in such manner as we shall shew by and by.

Their *Arteries* and *Veins* are called *Emulgents*, because they do as it were *milk out* the Urine from the mass of Blood. Each Kidney has for the most part but one Artery and one Vein; yet sometimes two or more of a sort. But whether the Trunk be one or more, each as it enters the Kidneys is branched into several, and those into more successively, till they become as small as hairs. The *Emulgent Arteries* spring from the Trunk of the great Artery, and the *Veins* from the hollow Vein: Both these as they enter the Kidney, are destitute of their outer Coat, which makes the proper Coat of the Kidneys, as was observed above: but instead of that loss they are invested in one common Case with the branches of the Ureter, even as we shewed in the fifteenth Chapter that the branches of the Gall-passage in the Liver are included in one common Coat or Case with those of the *Porta*. The Arteries bring blood for their nourishment, and moreover the watery humour that is separated in them and makes the Urine. By the Veins the blood circulates back again to the hollow Vein or *Cava*, and by it ascends up to the Heart.

Besides the innumerable little Kernels which we have shewn the substance of the Kidney to consist of, there are about ten of a more considerable bigness in the middle or centre of it, placed at the entrance into the *pelvis* or *Bason*, which are in Latin called *Carunculae Papillares*, in English Papillary Caruncles, and by some they are called Teat-like Productions, both which names they have from the likeness they have to the Teats or Nipples of Women. They are something harder than the rest of the substance of the Kidney, and also of a fainter colour. They are in bigness as large as a small Horse-bean. They have each several small holes or pores, through which the Urine destills out of the slender Urinary Pipes in the body of the Kidneys, into the cavity of the *pelvis*.

Now this *pelvis* or *Bason* is a membranous cell or cavity in the middle of the Kidney, and is nothing else but the head of the *Ureter* widened. There run out of it several large pipes to the aforesaid Teat-like Kernels, (one pipe to each Kernel) by which the Urine drills into this cavity, and out of it into the *Ureter*.

The *action* of the Kidneys, is to separate the wheyish Humour from the Blood, which they do in this manner and order. We find that an Horse can no more live without drink than meat: Now the drink serves not onely to cool the Body, but much more is it of use to make the Chyle thin, that it may be able to pass through the narrow ways of the milky Veins; so that the water which the Horse drinks, passes along with the more oily Chyle into the mass of Blood, whither having con-



ducted it, the water is now of no more use, and therefore the Emulgent Arteries above-described convey it to the Kidneys together with the Blood, to cast it out: But the Blood, being of a thicker body than the water, cannot enter through those narrow passages which the other destils through, and therefore what is more than serves for their nourishment, returns back from the Kidneys by the Emulgent Veins into the *Cava*, and so returns to the Heart again in its circulation. But the watery or wheyish part running out of the larger into the smaller branches of the Emulgent Arteries successively, and the said branches so often dividing themselves till at last they become as small as an hair and end in the little Kernels towards the outside of the Kidneys, this watery Humour is milked as it were through these Kernels into small urinary pipes, as slender almost as Fibres, by which it drills along to the Papillary Caruncles, and is again strained through them into the Bason, from whence it glides down the Ureters into the Bladder, where when it becomes troublesome either by its quantity or sharpness, &c. it provokes the Horse to stale, and is called Urine. But seeing the Piss is not of the same colour with the water that was drunk, but generally a great deal yellower, it is likely it gains that colour from a little quantity of Choler mixed with it: And as the Choler either retains its natural colour, to wit yellow, or is preternaturally of some other, as black, greenish, &c. the Urine will be tintured accordingly; as any Man may observe in Horses that are distempered. So that in Horses as well as in Men, one may many times gain some knowledge of the Distemper from the Urine.

Deputy-kidneys, their name, situation, bigness and shape.

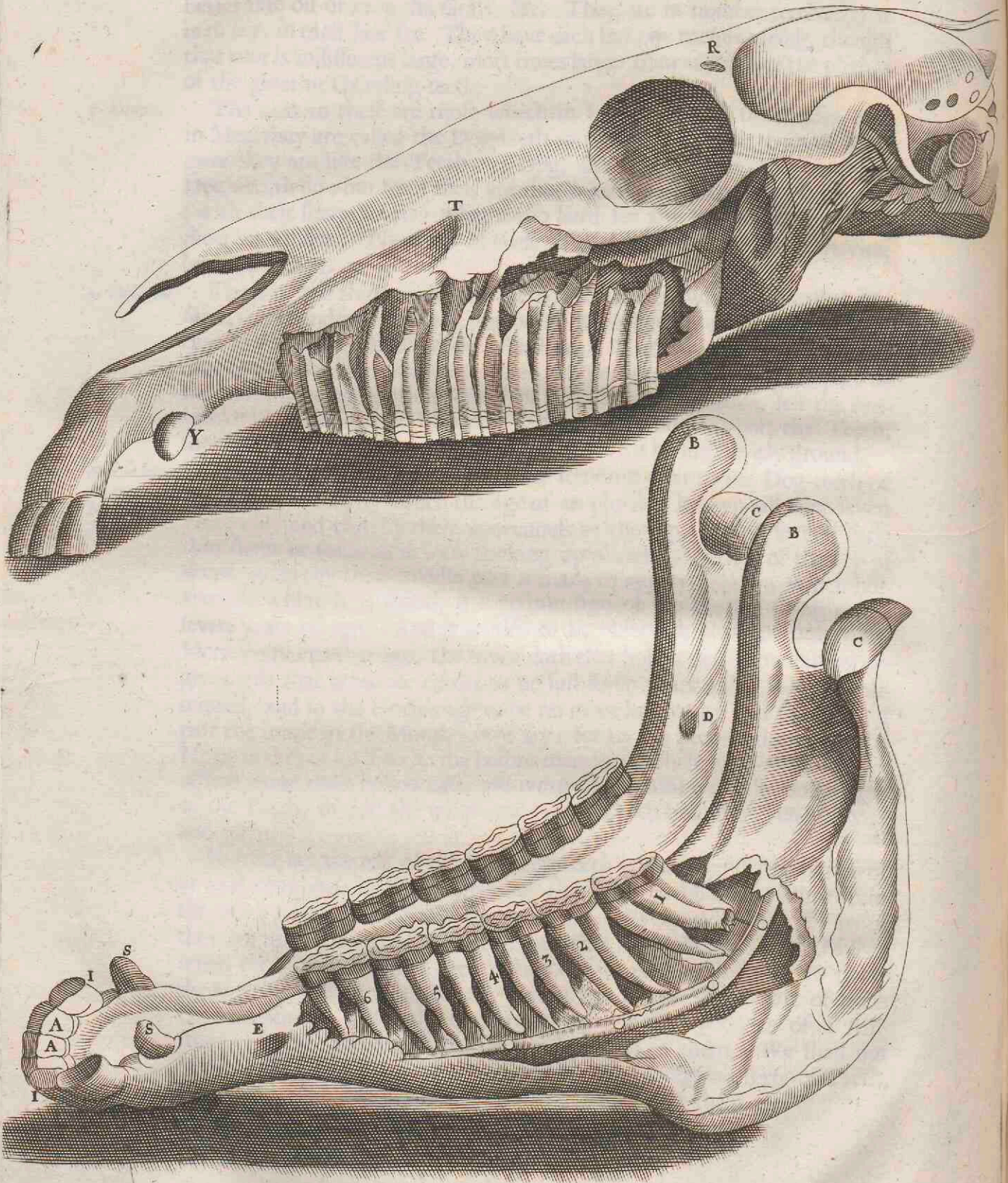
Over the Kidneys a little more outward, and about an inch from them, there stand two Kernels, which are known by several Names, from the several uses that Authors have ascribed to them. Some call them Deputy-kidneys, because of some resemblance they have to the true ones in their frame, and because they have been thought to assist them in separating the Urine. *Bartholine* calls them Black-choler Cases, from an Opinion that they receive black Choler from the Spleen. Others have impos'd other Names on them, which we shall not recite. It is not long since they were first found out. They are in an Horse about as big as a Garden-bean, and of that shape as they are represented in the Figure. They are covered with a single thin skin, which commonly sticks to the fatty skin that invests the Kidneys. They have a small cavity in them.

Their Vessels.

Their Veins and Arteries generally come from the Emulgents, but sometimes immediately from the great Artery and hollow Vein. The Arteries bring them blood for nourishment, from which what remains, returns back by the Veins, as also does that Humour whatever it be that is concocted and separated in them, for there is no other vessel to do it. They have indeed some Lympheducts, but those are common to them with other parts, and have no peculiar use here. Their Nerves spring from that branch of the Intercostal pair that goes to the Stomach, to the Spleen, and to the inner or proper skin that cloaths the Kidneys.

Their Use.

In their Cavity there is commonly found a blackish Humour, which is made of part of the Arterial blood that flows to them; but of what nature or use this Humour should be, is very uncertain. It has no way to go out of the Cavity but by the Veins, which deposite what is contained in them into the Emulgent Veins, or into the *Cava*, and so it must needs pass with the Venal blood to the Heart. If there could be found



found out any way whereby it could probably pass to the Kidneys, then *Bartholine's* Opinion, that they make a ferment for the use of the Reins, for the better separating of the wheyish Humour from the Bloud, were very plausible; but till then, one must suspend their belief of it. As for mine own part, seeing so many learned Anatomists as have treated of them, are at a loss in discovering their true use, I will not be ashamed to confess my own ignorance and unsatisfiedness therein also.

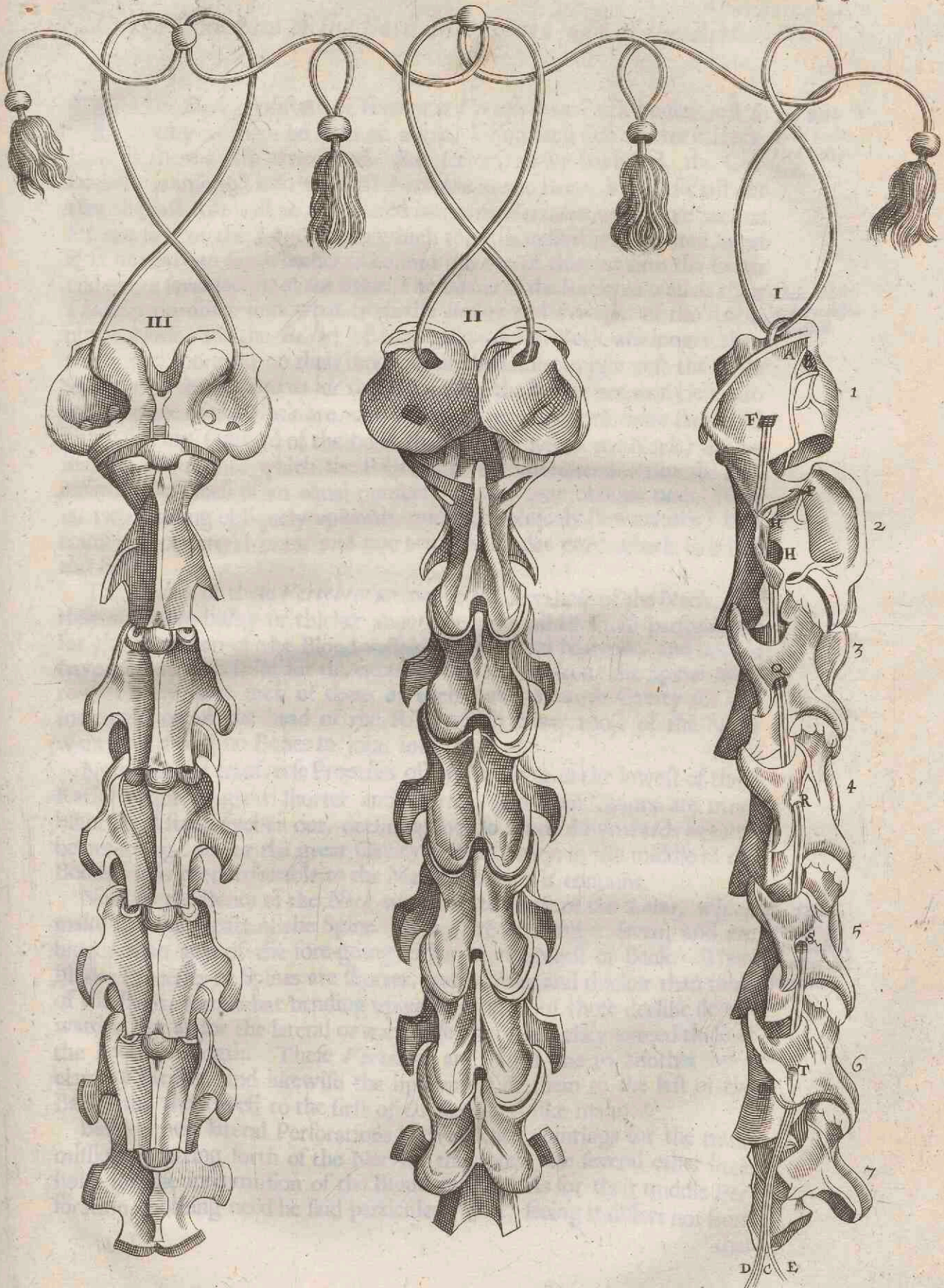
C H A P. XVIII.

Of the Ureters or Passages of Urine.

THE Ureters or Urine-pipes or Channells are in number two, seated *The Ureters.* on each side of the hollow Vein and great Artery, at some distance from them. Their head or beginning is the Bason of the Kidneys, at whose hollow side they come forth, and run in a crooked line like an *f* down to the Bladder, into whose back and lower part they are inserted not far from the Sphincter, running for an inch between its two proper Coats, to prevent the return of the Urine back this way. For when the Bladder is squeezed, its Coats clap close together, and so shut up the mouths of the Ureters.

They are in *substance* much like a Vein, onely whiter and thicker, and more nervous. They are commonly held to consist of two Coats, *Their substance, and Vessels.* an inner which is proper, and an outer which is borrowed from the Rim of the Belly. They have small Veins and Arteries from the neighbouring Vessels, and slips of Nerves in a considerable number from the Intercostals, whence proceeds that intolerable sense of pain when a stone sticks in them.

They are indifferent large, having a hollownes through them which *Their cavity and use.* is so wide, that they will admit of a large straw in a dead Horse, and therefore may be conceived in a living Horse to be much wider. Through these passages or hollownes, the Urine doth pass from the Kidneys to the Bladder, and that is their sole and true use.



C H A P. XIX.

Of the Piss-bladder, or Bladder of Urine.

The situation
and substance
of the Blad-
der.

THE Bladder of Urine is seated at the bottom of the Belly, in that hollowness that is formed of the *Os sacrum*, Hips and the *Os pubis*, between the Coats of the Rim of the Belly; and is of a *substance* partly membranous, for strength, extension and contraction; and partly fleshy, for motion; for by its fleshy Fibres are its Membranes contracted: and these fleshy Fibres are wholly seated in its middle Coat, which is truly muscular, as shall be shewed by and by.

Its Figure.

It is of a round globous *figure*, in shape like a Pear, having within it a large cavity or hollowness, wherein to contain the Urine.

Membranes.

It is composed of a treble *Coat* or Skin. The first and *outwardmost* of which it hath derived to it from the Rim of the Belly, which Skin is very strong and close. The *innermost* is thin, white and bright, of an exquisite sense, and is interwoven with all sorts of Fibres, that it may the better bear enlarging and drawing up together, as need requireth. Within I have often found it covered with a mucous crust, which I take to be an Excrement of the third concoction of the Bladder, and to serve to defend it from being too much grated upon by the acrimony of the Urine. The *middle* betwixt these two, is as thick or thicker than them both, and is stuff with fleshy Fibres, even as the same Coat of the Stomach and Womb are. Its Fibres run lengthways of the Bladder, and by contracting of themselves squeeze out the Urine, forcing open the sphincter Muscle that encompasseth the neck of the Bladder.

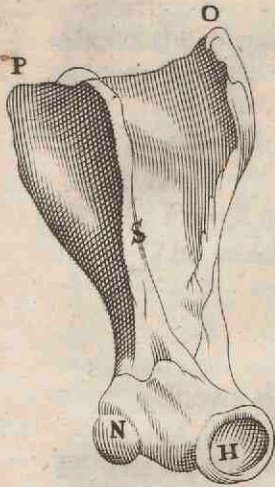
Its perfora-
tions.

It hath three *perforations* or holes, two on the hinder part a little below the neck to let in the Urine from the Ureters, and one in the neck to let the Urine out.

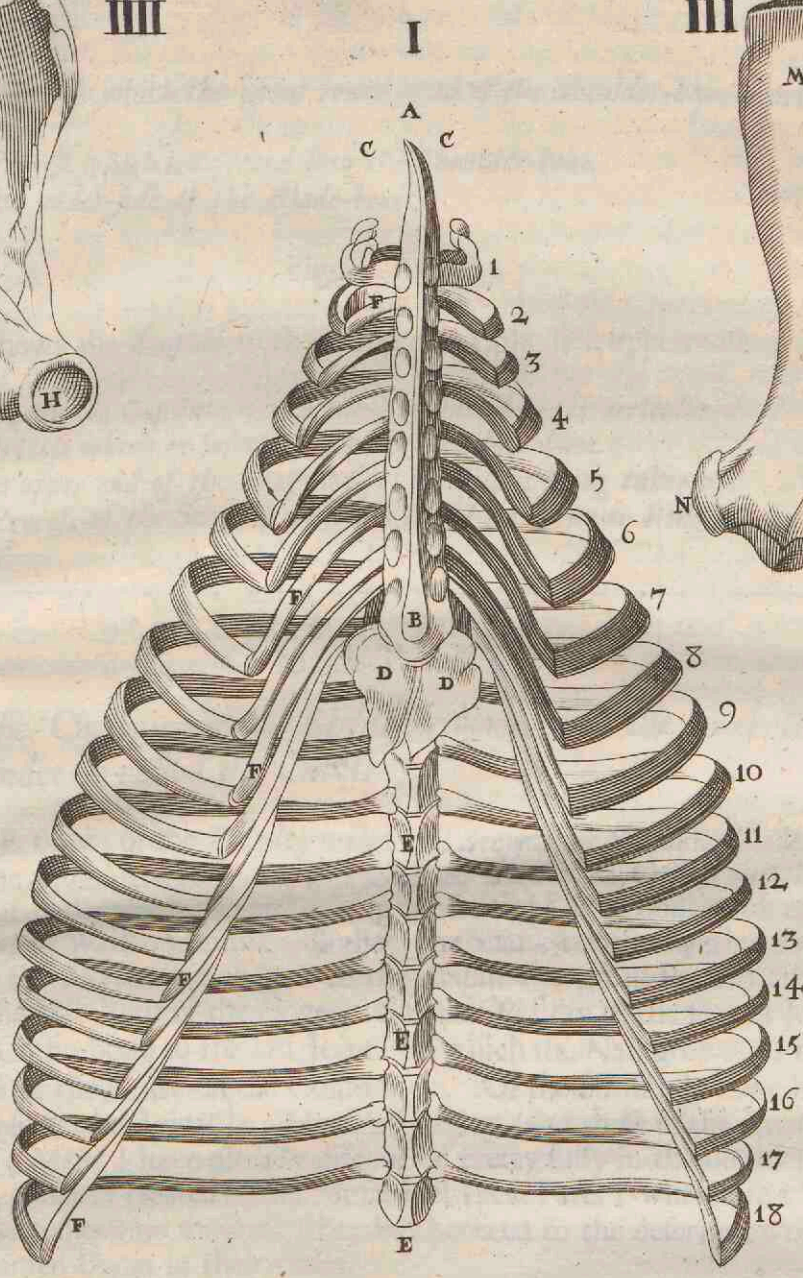
Its parts and
connexion.

The *parts* of the Bladder are two, its bottom and its neck. The bottom is its wider, more capacious part, and its neck, its narrower and more contracted. The bottom is fast tied by a Membrane to the *Intestinum rectum* or Arse-gut, and to the *Aorta* (a little before its division) by the Umbilical Arteries, so that no violent motion can cause it to fall down upon its neck, which if it should happen, would hinder the outgate of the Urine. The neck is narrower but longer in Horses than in Mares, and in both it is fleshy, being encompassed with a sphincter Muscle, which is woven with very many Fibres, some of which are streight, and some overthwart, these last lying under the former. Now this sphincter Muscle seems to be nothing else but the middle Coat of the Bladder made thicker here than in any other part, by the accession of the circular or overthwart Fibres. And its use is to purse up the neck of the Bladder so, as no Urine can pass out, till by its quantity or sharpness it becomes so troublesome to the Beast, as provokes him to force open the Sphincter by contracting the Muscles of the Paunch, and the muscular Coat of the Bladder. If this Sphincter happen to be overcooled, &c. the Horse loseth its use, and so for want of it his Water drops from him as fast as it comes into the Bladder.

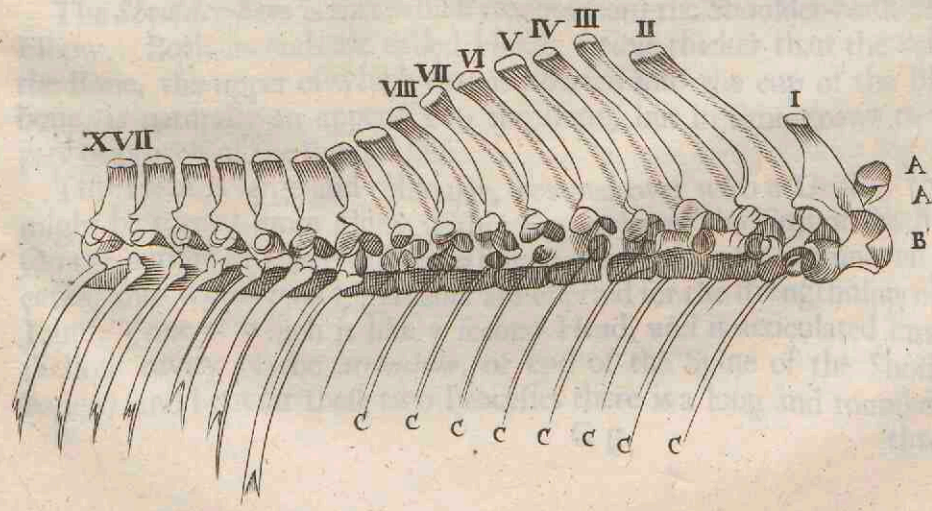
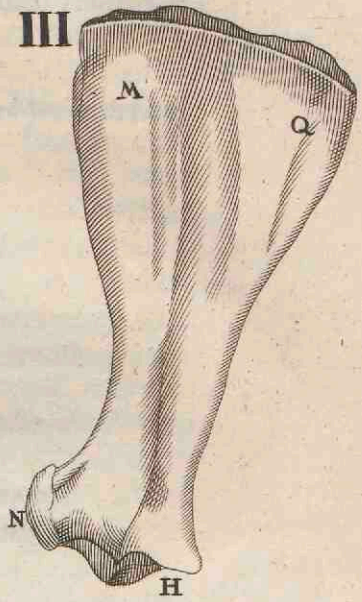
Its



III



III



II

Its *Veins* and *Arteries* proceed from the hypogastrick branches of the hollow Vein and great Artery, and are implanted into its neck, on which, part of them is spent, and the remainder runs through the bottom. Its *Nerves* come partly from the Intercostals and partly from the Marrow of that Bone of the Back that is called *Os sacrum*, that is next to the Crupper.

The use of the Bladder is to receive the Urine from the Kidneys by the Ureters, and to contain it, like a Chamber-pot, till it is so full as to become troublesome and uneasy to the Beast; for as soon as it becomes so, by the help of the Muscles of the Belly and the middle muscular Coat of the Bladder it is pressed out of it by pissing.

C H A P. XX.

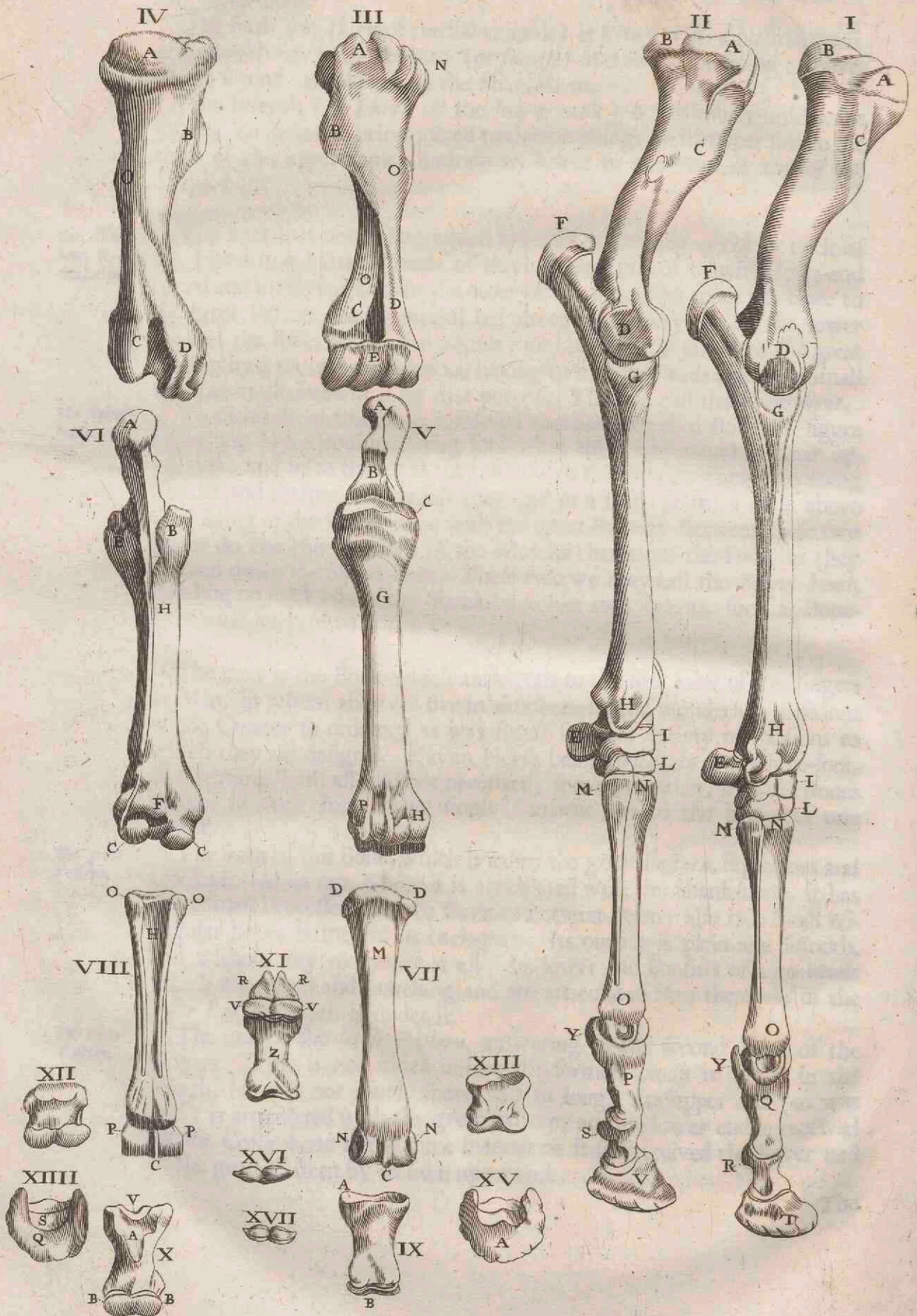
Of the Yard and Sheath.

Because the *Yard* of ston'd Horses besides its principal use which is to copulate with the Mare, has also an inferiour use, *viz.* to discharge the Urine out of the Bladder; and because this latter is the sole use of it in Geldings, we will here treat of it next to the Bladder, in respect to the office it performs to *it*, and not defer it, as many Anatomists of Humane Bodies do, till we have discoursed of the parts that prepare, make and retain the Seed, to which it also ministers.

The *Yard* of an Horse lies hid for the most part within the Sheath, from which, when it is drawn, it borrows its covering, consisting of the Scarf-skin and true Skin, and the carnos Membrane, which are common to it with other parts of the Body: Its *Glans* has a proper Membrane that invests it, as the *Glans* of a Man's *Yard* has; and the whole consists of two Nervous bodies (which make up the greatest part of its bulk) a Partition-skin that goes betwixt them, the *Urethra* or Piss-pipe, the *Glans*, four Muscles and the Vessels; of which in order.

The two *Nervous bodies* are encompassed with a thick, firm and white skin, but their inner substance is very spongy and flaggy unless distended and filled with blood and spirit, consisting for the greatest part of nothing but Vessels, to wit, Veins, Arteries and Nervous threads, which are wonderfully interwoven one with another. They arise from the lower part of the Share-bone at a small distance one from the other, giving the Piss-pipe room to go betwixt them, but in a little while they meet together, and so are extended one by the side of the other the whole length of the *Yard* to the *Glans*, onely a thin skin coming betwixt them. At their rise they resemble the letter Y.

The *Piss-pipe* is seated betwixt these, or rather below them, and is of a substance much like them. On its inside it is membranous and very sensible. It is continued from the neck of the Bladder, and is much of an equal width through its whole length. At its beginning where it is joined to the neck of the Bladder it has a membranous valve, that permits the Urine to come out, but hinders the Seed or any thing squirted into

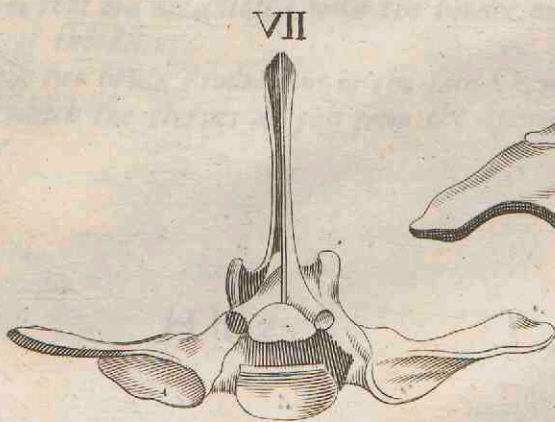
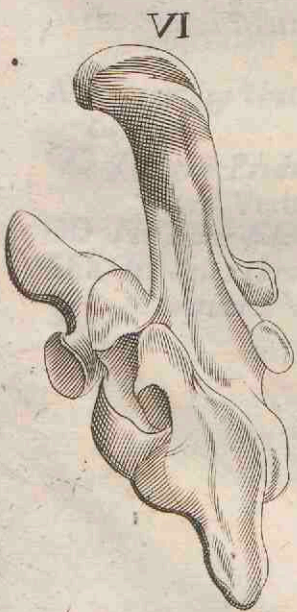
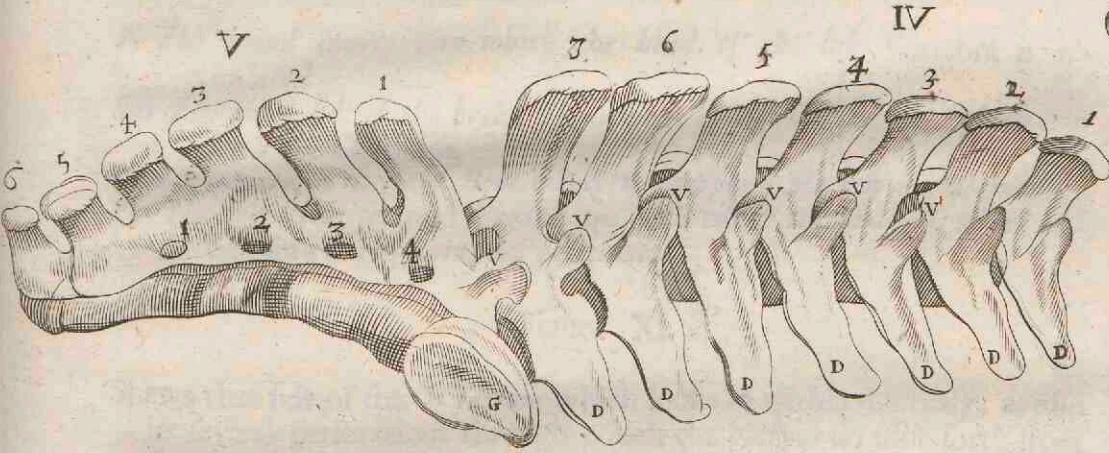
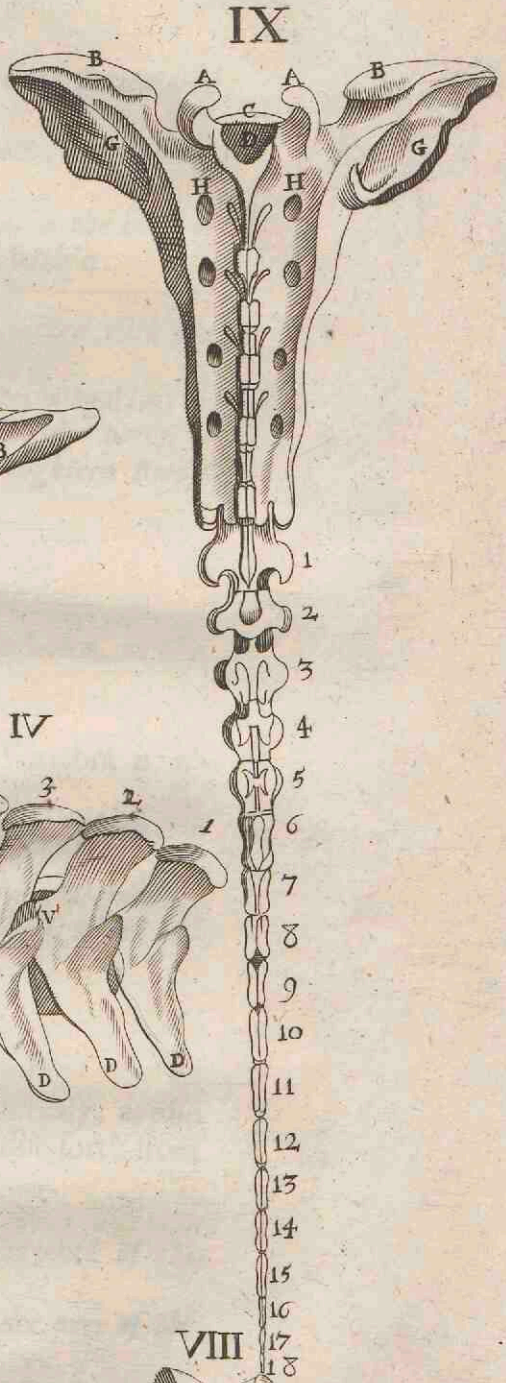
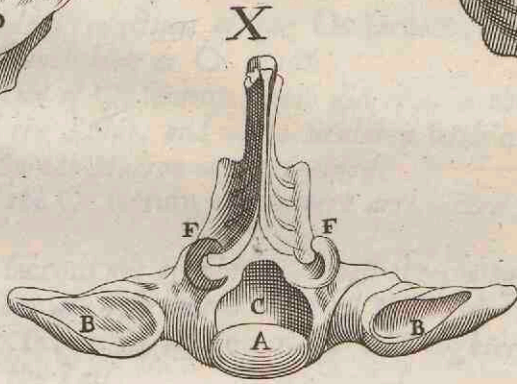
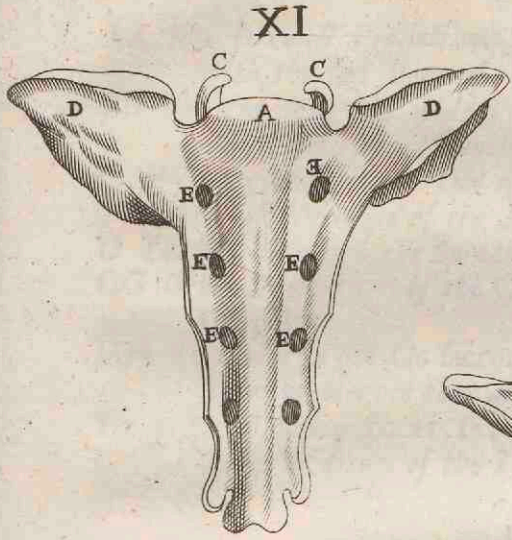


- into the Piss-pipe to go in, unless it be forced open with a Probe or Catheter, or the like.
- The Glans.* Before the ends of the Nervous bodies there is prefixed the *Glans*, which is distinguishable from the rest of the Yard by a round circle like a Crown going between them. This is of a more exquisite sense than the Nervous bodies, but of not much an unlike substance, though some say it is glandulous. When the Yard is drawn, it has no other covering, but one proper thin coat.
- The Muscles.* The Yard has two *Muscles* on each side at its root: The first pair are short and thick, springing from the knob of the Hip-bone, and are inserted into the Nervous bodies near their beginning: they are called *Erectors*, because they help the Yard to stand. The second are longer and smaller, arising from the sphincter Muscle of the Arse-hole, and passing along the sides of the Piss-pipe end about the middle of it, serving to open or widen it for the freer passage of the Seed and Urine, and are therefore called *Dilaters*.
- The Vessels.* Its *Veins* and *Arteries* spring from the Hypogastricks, and enter it at the meeting of the Nervous bodies. Its *Nerves* come from the lowest Vertebral.
- Its Use.* The principal and primary use of the Yard is for copulation, to convey the Seed into the Womb of the Female: but the secondary, and to such Creatures as are gelt, the onely use of it, is to serve as a Tap to the Bladder, to let out the Urine when it becomes troublesome; in which office the *Urethra* or Piss-pipe is chiefly concerned.
- The Sheath.* Except when the Yard is distended with blood and Spirits, (which is called its erection or standing) it lies hid in its Repository, the *Sheath*, of which little need to be said, seeing it is onely a duplicature of the common coverings of the Body, and consists onely of the scarf and true Skin, and the fleshy Membrane, which is here but thin. It seems to answer to the prepuce or Fore-skin in Men: for as that in some Men, when the Yard is erect, turns back towards the root of the *Penis* and leaves the *Glans* wholly bare; so when a Horse's Yard is drawn out to the full length, the Sheath is also drawn out or unfolded, and appears to be knit to the Yard a little behind the *Glans*, even as the prepuce is to a Man's *Penis* at the same place. I shall not need therefore to speak any more of it.

Table VIII. Sheweth the descending Trunks of the hollow Vein and great Artery, the Emulgents, Kidneys, Deputy-kidneys, Ureters, Bladder, Yard, preparing Vessels, Stones, deferent Vessels, Seed-bladders and Prostates.

- A Sheweth the descending Trunk of the hollow Vein.
 B The descending Trunk of the great Artery.
 CC The emulgent Veins arising out of the hollow Vein.
 DD The emulgent Arteries springing out of the great Artery.
 EE The Kidneys.
 FF The Deputy-kidneys, otherwise called the black Choler Boxes.
 GGGG The Ureters.
 H The Bladder.
 I The Bladder cut open that its inside may appear.
 K The neck of the Bladder where it opens into the Piss-pipe of the Yard.
 kk The Ligaments of the Bladder.

L The



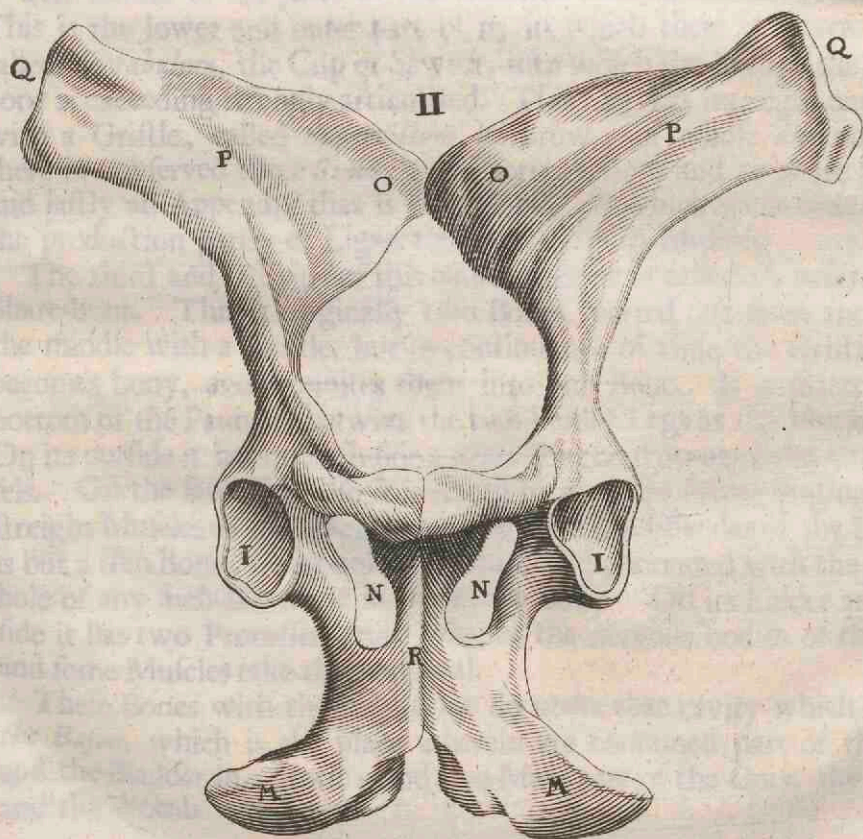
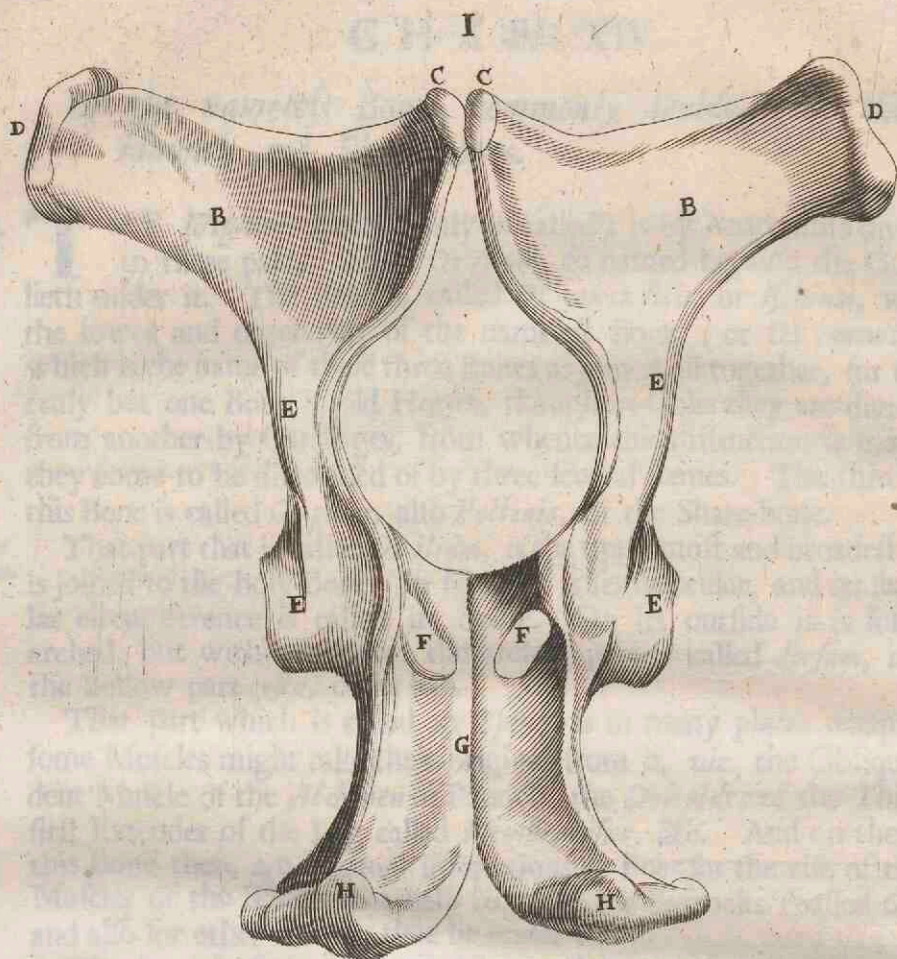
- L *The Nervous bodies of the Tard divided from its back down to the Piss-pipe.*
M *The Urethra or Piss-pipe.*
m *The end or thickest part of the Tard, called its Glans.*
NNNN *The Seed-preparing Veins.*
OO *The Seed-preparing Arteries.*
PP *The Pyramidal bodies, otherwise called Corpora varicosa, or Pampiniformia.*
Q *The right Testicle with its inmost Coat on.*
R *The left Testicle divested of all its Coats.*
S *The Epididymis or parastata of the left Testicle.*
TT *The deferent Vessels.*
UU *The Seed-bladders.*
XX *The Prostates.*

C H A P. XXI.

Of the Parts ministring to Generation in Horses, and First of the Preparing, Spermatick or Seed-vessels.

HAVING shewed the Parts appointed for and subservient to Chylification, and in some measure to *Nutrition* and *Sanguification*, I come in the next place to speak to those serving for *Generation*. And as the former, all except the *Tard* treated of in the last Chapter, are common to and alike in both Male and Female; so these latter differing considerably in the different Sexes, we must treat of them apart: and shall begin with the Generative Parts of an *Horse*, and afterwards treat of those of a *Mare*.

The first in order are the *preparing* or *spermatick* Vessels, *Arteries* and *The preparing Veins*. The *Arteries* carry blood and vital spirit to the *Stones* to make *Seed* of, and the *Veins* bring back from thence so much of the blood as remains superfluous or unfit for that purpose. The *Arteries* spring out of the descending Trunk of the great *Artery*, almost two hands breadth below the *Emulgents*, one on each side: and the *Veins* out of the like Trunk of the hollow *Vein*, two on each side, a pretty deal higher up than the *Arteries*, as you may observe in the foregoing Figure. The left of these *Veins* in *Humane* Bodies commonly springs from the left *Emulgent Vein*, (and is but one) the reason whereof *Anatomists* give to be, left, if it should have sprung from the *Cava*, and thereby been necessitated to have marched over the great *Artery*, the return of the blood from the *Stones* by it should have been hindred by the continual beating of the *Artery*. But seeing Nature has not here made the like caution, where there was as great need of it, I cannot tell whether that be any satisfactory reason. Now these *Arteries* and *Veins* do at a little distance from their beginning meet with one another on their respective sides, to wit the right *Artery* with the right *Veins*, and the left with the left, and at their meeting they acquire one common covering from the *Rim* of the belly, between whose two *Membranes* they descend down the *Loins*,
H
running

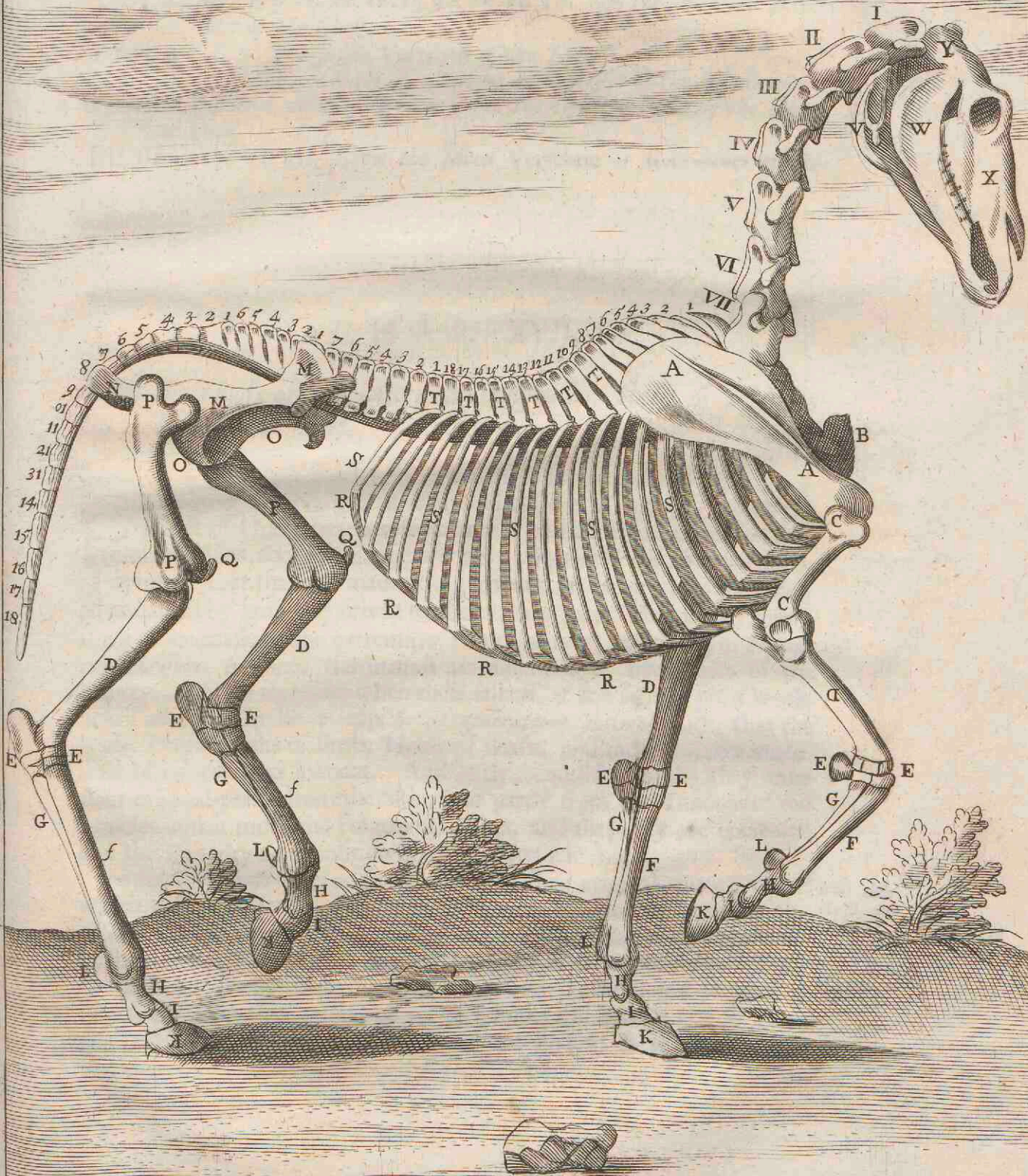


running over the Ureters, as the figure shews. As they descend, they bestow little twigs upon the Rim of the Belly, and the Veins do divide themselves into several, and by and by unite again; but the Arteries pass along a great way by one Pipe onely, though variously twisted and interwoven with the Veins, with which yet they do no where inosculate, or unite into one body, as was generally affirmed they did before the circulation of the blood was found out. For till then it was believed, that the Veins carried blood to the Stones, and the Arteries vital Spirits, and that the Arteries opened into the Veins, and contrarily the Veins into the Arteries, for the mixing the blood and vital spirits together, and thereby preparing matter for the Stones to make Seed of. But since the circulation of the blood was fully understood, and it became certain that blood and spirit flowed to the Stones by the Arteries onely; upon a strict enquiry after these inosculations, they were no where to be found, nor is there any thing like them, saving that both Veins and Arteries pass along in one common Cover, which it is likely gave occasion to the mistake. When these Vessels are arrived within little less than a quarter of a yard of the Stones, the Arteries then begin to branch themselves into several, but the Veins into far more. And both of them pass out of the Belly by the hole of the process of the Rim into the Cod. The space betwixt where these Vessels begin so much to divide themselves, and the Stones, is called the *Pyramidal body*, because from the Stones upwards, it grows smaller and smaller like a Pyramid, as is represented in the Figure. It is also called *Corpus varicosum*, because the Vessels so divided make a thicker body; and lastly *plexus pampiniformis*, the tendril-like *plexus* or interweaving, because the Veins and Arteries twine and clasp about one another like the tendrils of Vines. Both of these Vessels enter the Stones by several branches, but the Veins by a far greater number than the Arteries, which was necessary, for that the blood flows very quick to the Stones by the Arteries, but returns but slowly back again by the Veins, and therefore it was convenient it should have more conducts or chanelles to run in.

Their use.

The *use* of these *Preparing Vessels* may be sufficiently learned by what we have already discoursed of them, by which it is also clear that the name of *Preparers* belongs onely properly to the Arteries that carry blood and spirits to the Stones to nourish them and to make Seed of, and not at all to the Veins, which onely bring back that blood that is not converted to those uses.

As for the *Nerves* and *Lympheducts* that run with the aforesaid Vessels to the Testicles, because the Testicles are the parts for which they are designed, and they are onely in their passage thither while they accompany these Veins and Arteries, we shall say nothing further of them here, but shall shew their origine and use in the following Chapter.



C H A P. XXII.

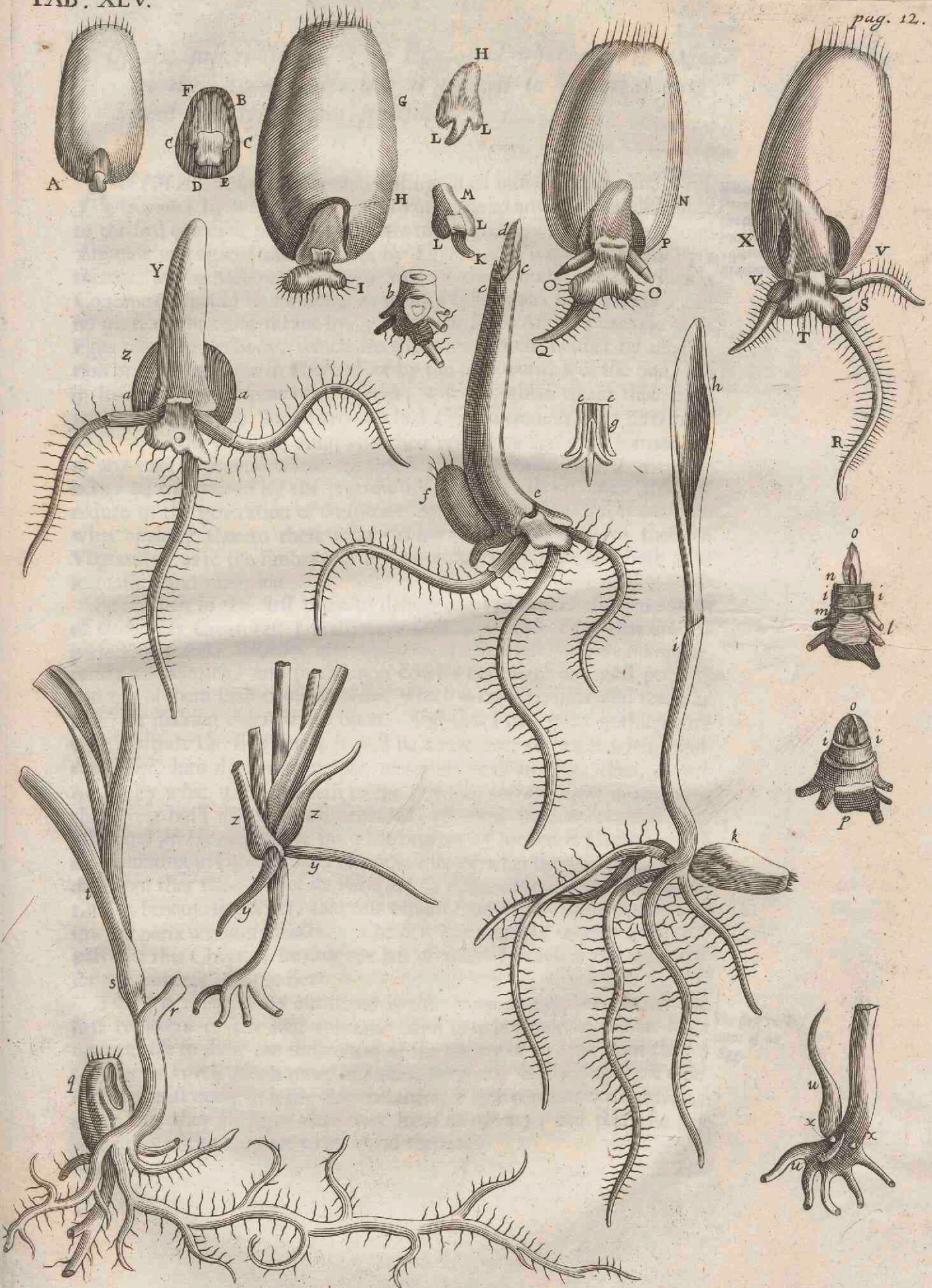
Of the Testicles or Stones, and the Parastatae or Attenders.

THE Testicles or Stones are called in Latin *Testes*, which otherwise Their name. signifies Witnesses, because they witness the strength and courage of the Creature; or perhaps rather, as some think, because no Man amongst the Romans was admitted to be a Witness that had lost his Stones. They are always according to Nature two, and therefore the Greeks call them by a word that signifies *Twins*.

They are of an oval *figure*, but somewhat flattish: and their *substance* Their shape and substance. has been formerly held to be glandulous, as if they were onely two great Kernels, not differing from other Kernels in other parts of the Body saving in bigness and use. But later Anatomists have discovered them to be of no such solid substance as Glands are, but wholly to consist of Vessels that twist and twine this way and that way, and are kept in their order close to one another by the inmost Skin that cloaths the Stones. When they are cut in two, they appear not red, but of that colour the Seed is of, because the blood as soon as it enters them, begins to lose its colour and nature, and to be turned into Seed. And seeing I could never observe any blood in the Stones, it is likely that the Veins reach no further than their Coats, seeing the Seed is not received into the Veins, but into peculiar Vessels called *Deferent* or back-carrying, of which in the next Chapter. I say, I believe the Veins onely run through the Coats of the Stones, and have the superfluous blood transmitted into them from the Arteries, before ever they enter into the body of the Stones: And then those Vessels that the Testicles consist of, will onely be Arteries, run out into very fine and almost innumerable threads, for the elaborating of the Seed.

If this notion of mine be true, then I may say that both *Veins* and *Ar-* Their Vessels. *teries* run through all the Coats wherewith the Testicles are invested, but that they themselves have no Blood-vessels but Arteries. And whether they have any other sort of Vessel, is uncertain. 'Tis true there are both *Nerves* and *Lympheducts* that come towards the Stones, as I observed in the foregoing Chapter; but I question whether they reach any farther than their Coats any more than the Veins. As for the *Nerves*, they spring from a Vertebral pair according to some, from the Intercostal say others, and a third sort think from both. But be their original where it will, I think they are mostly if not altogether spent upon the suspending *Museles* by which the Testicles are sustained, and upon the Coats so often mentioned. So far am I from thinking with some, that these Nerves contribute the greatest or any considerable share of matter for the making of the Seed. The *Lympheducts* spring manifestly from amongst the Coats of the Stones, and ascend up into the Belly by the same hole, by which the preparing Vessels came down, running so far till they reach and empty themselves into the common Receptacle of the Chyle, described above *chap. 10. and 12.*

The Testicles being sensible, tender and noble parts, are defended from Their Coats. the external cold or other Injuries by several *Coats*, of which some are



common to them with other parts of the Body, and some proper to themselves onely. The *common* encompass both the Stones within one cavity, as in a Bag, and make that which we call the Cod. And these are two. The outer of them is the Skin with its Scarf-skin, and the inner the fleshy Membrane. The outer is not divided as it is in Man, by a line that runs along the middle of it lengthways. The inner, as it sticks pretty close to this on one side; so to the next proper one somewhat loosely, by many membranous Fibres, on the other or inner side. The *proper* are also two, though by some they are reckoned to be three. The outmost is called *Vaginalis*, or the Sheath-like Coat, because the Stone is included in it as in a Sheath. This is thick and strong; smooth on the inside, but rough on the outside, by reason of many Fibres or Threads by which it is knit to the inner of the common Coats. It is full of Veins, and is a production of the Rim of the Belly: for as the preparing Vessels descend over the Share-bone into the Cod, the Rim makes a Case for them for their defence and security, and reaches with them down to the Stone, encompassing *it* as well as *them*. Into this Coat is the Muscle inserted that suspends the Stone, (which we shall describe presently.) Some make two Coats of this, the outmost of which retains the name of *sheath-like* above-mentioned; and the inner they call the *red* Coat, from its colour; but indeed this latter is nothing else but the fore-said Muscle spreading it self broad and thin on the Sheath-like Coat. The last and inmost, which immediately cloaths the Stone, (being the second proper one) is called the *nervous*, and otherwise the *white*, Membrane, being thick and strong, and of a whitish colour. It seems to arise from the outer Coat of the preparing Vessels, and is rough on its inside next the Stone, but smooth and slippery on its outside.

Their Muscles.

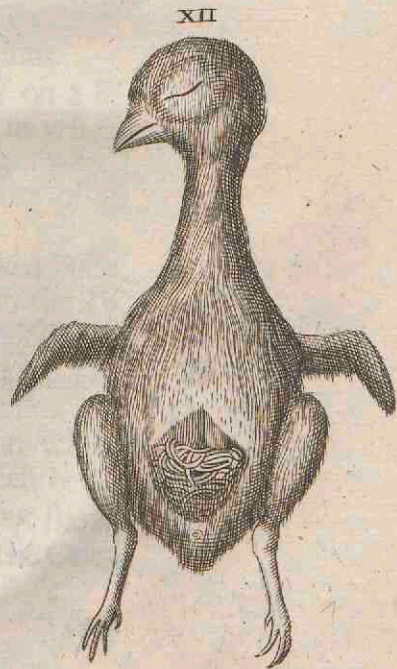
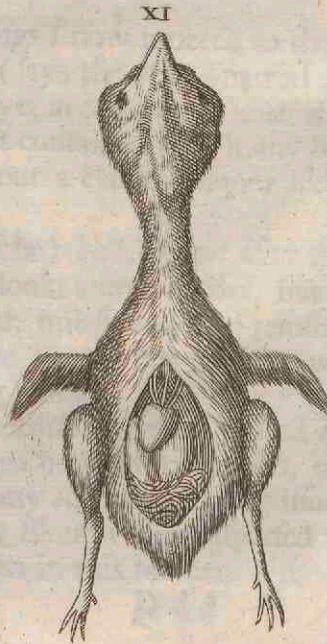
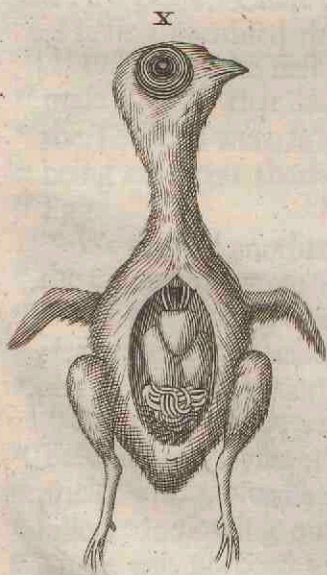
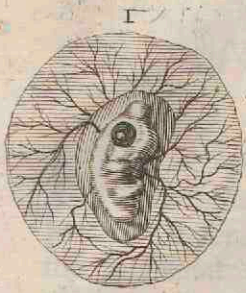
Each Stone is suspended or hangs by a Muscle called *Cremaster*, or the suspender. These Muscles arise from the Ligament of the Share-bone, and descending by the process of the Rim of the Belly (before spoken of) are inserted into the Sheath-like Coat, which they strengthen, the better to sustain the weight of the Stones; and in the act of Copulation are said to pull up the Stones, and thereby to shorten the ways the Seed has to pass.

Parastatae.

On the top or back as it were of each Stone there lies a longish, whitish and somewhat round body, distinguishable very easily from them, though not of much an unlike substance; onely they are not so firm and compact as the Stones are. They are named *Parastatae* or *Attenders*, because they wait as it were on the Stones; and also *Epididymidae*, because they are placed *upon the didymi* or Twins, by which name the Stones are otherwise called. They consist (as the Stones do) wholly of Vessels running this way and that way, all which are united into one Thread or Chord, which is continued into the deferent Vessel, of which in the next Chapter.

The use of the Stones and Parastatae.

From what has been already discoursed of these Parts, their *use* appears to be, to make and elaborate the Seed, for the propagation of the kind. Now the Matter out of which the Seed is made, seems to be onely the Arterial blood, unless one should admit some Animal spirits conveyed hither by the Nerves and mixed therewith. But seeing any inoculations of the Nerves with the Arteries is a thing not yet discovered either in these or any other parts, I incline to believe that the Nerves onely contribute sense to these parts, that the Animal may have the greater pleasure in



in Copulation. A secondary use or rather effect of the Stones, is to cause courage and generosity in the Horse; for we observe that our Ston'd Horses are generally much higher-spirited than Geldings.

C H A P. XXIII.

Of the Deferent or Ejaculatory Vessels, the Seed-bladders and the Prostates.

HAVING done with those Parts that prepare and elaborate the Seed, we come next to those that are the Store-houses or Repositories of it, from whence it is ejected in Copulation. And of these the first are the *deferent* or back-carrying vessels, otherwise called *Ejaculatory* or *squirting*, because in those Animals that have no Seed-bladders to store up the Seed in (such as Dogs and the like) it does immediately squirt through these Vessels from the Stones in Copulation: though in others that have Seed-bladders (as Horses have) it is continually a-passing by these Vessels from the Stones to the Bladders by little and little as it is prepared.

These *deferent Vessels* are two, one on each side; they begin at the smaller end of the *parastatae* (described in the former chapter) and are indeed but a continuation of them. They are whitish and pretty hard; not hollow like a Vein, but more like a Nerve, for their cavity is hardly discernable, unless the Seed-bladders be full of Seed, and so it regurgitate as it were into these Vessels, as I have sometimes observed. As soon as they are arisen from the *Parastatae*, they ascend streight out of the Cod into the Belly by the same process of the Rim of the Belly by which the preparing Vessels descended. Being entred the Belly, by and by they cross over the Ureters from the outside to the inside of them, and taking a little compass they turn back again under the Bladder till they arrive almost at its neck, (towards which they grow wider than before) and there their sides open into the Seed-bladders, into which they destill the Seed; notwithstanding themselves still keep on their course as far as the Piss-pipe between the Prostates, but are grown much smaller before they reach them. These Vessels serve as Conduit-pipes for the Seed to drill along from the Stones to the seminal Bladders; and through their necks, that reach from the Bladders to the Piss-pipe, does the Seed issue in the act of generation.

The place where the Seed is stored up and preserved, is the *Seed-bladders*. Dr. Wharton affirms that in an Horse "they consist of two parts, of which one is a mere membranous or skinny Bladder, the other glandulous. The Bladder, he says, he has found six inches long and near three broad, although it was empty and not opened; but it seem'd capable of being stretched out to a greater length and width, if it had been filled. If one opened the bottom of this Bladder, and put a Probe into it, the Probe pass'd obliquely towards the Piss-pipe, and entred into it through the same hole with the *deferent Vessel* of the same side.

"The

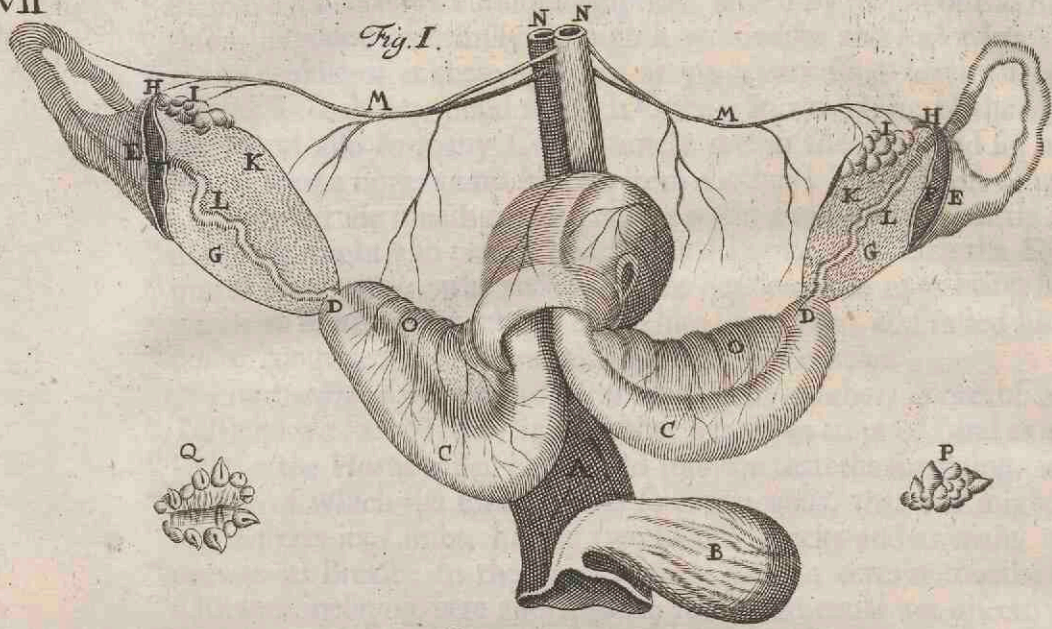
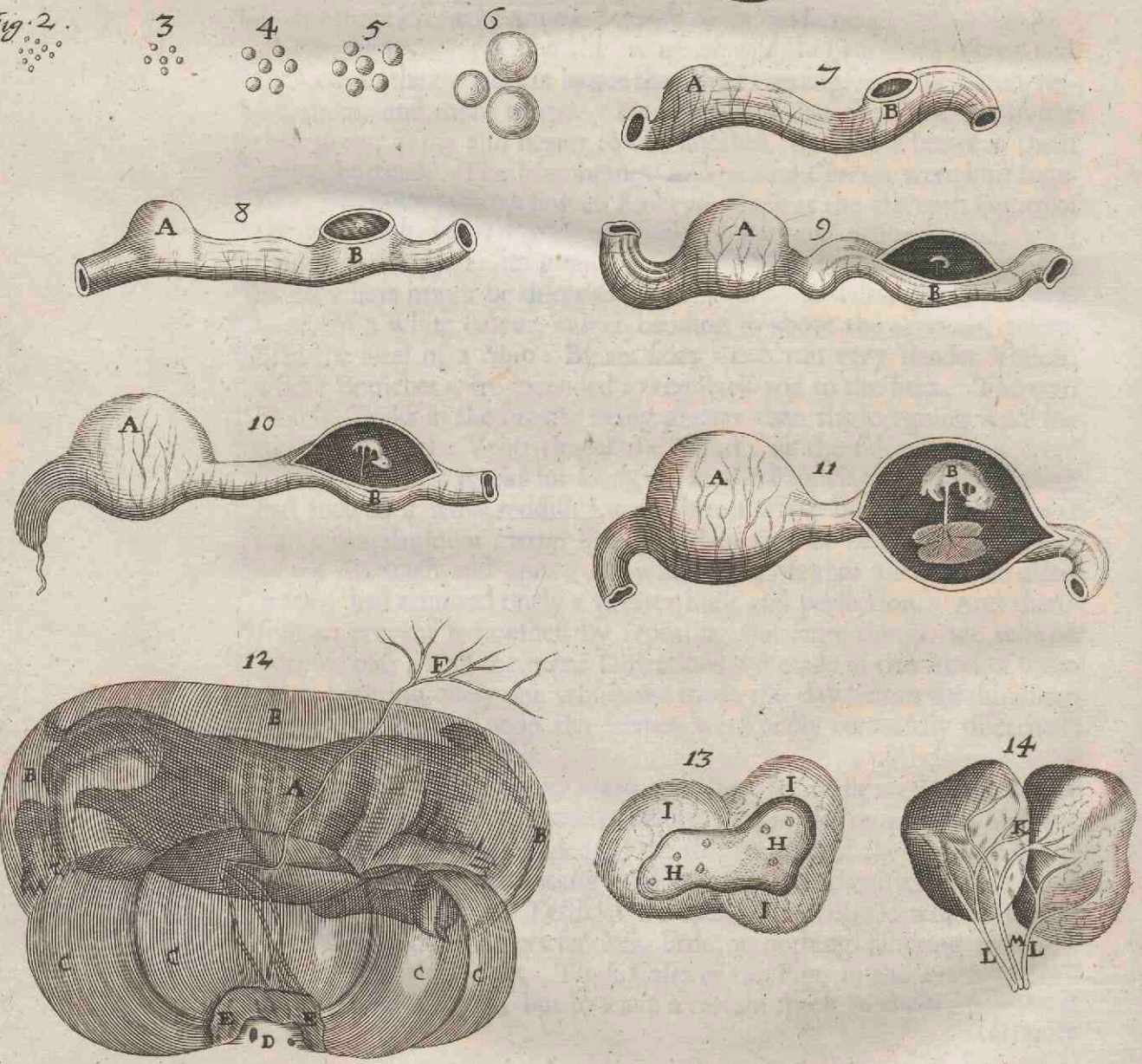


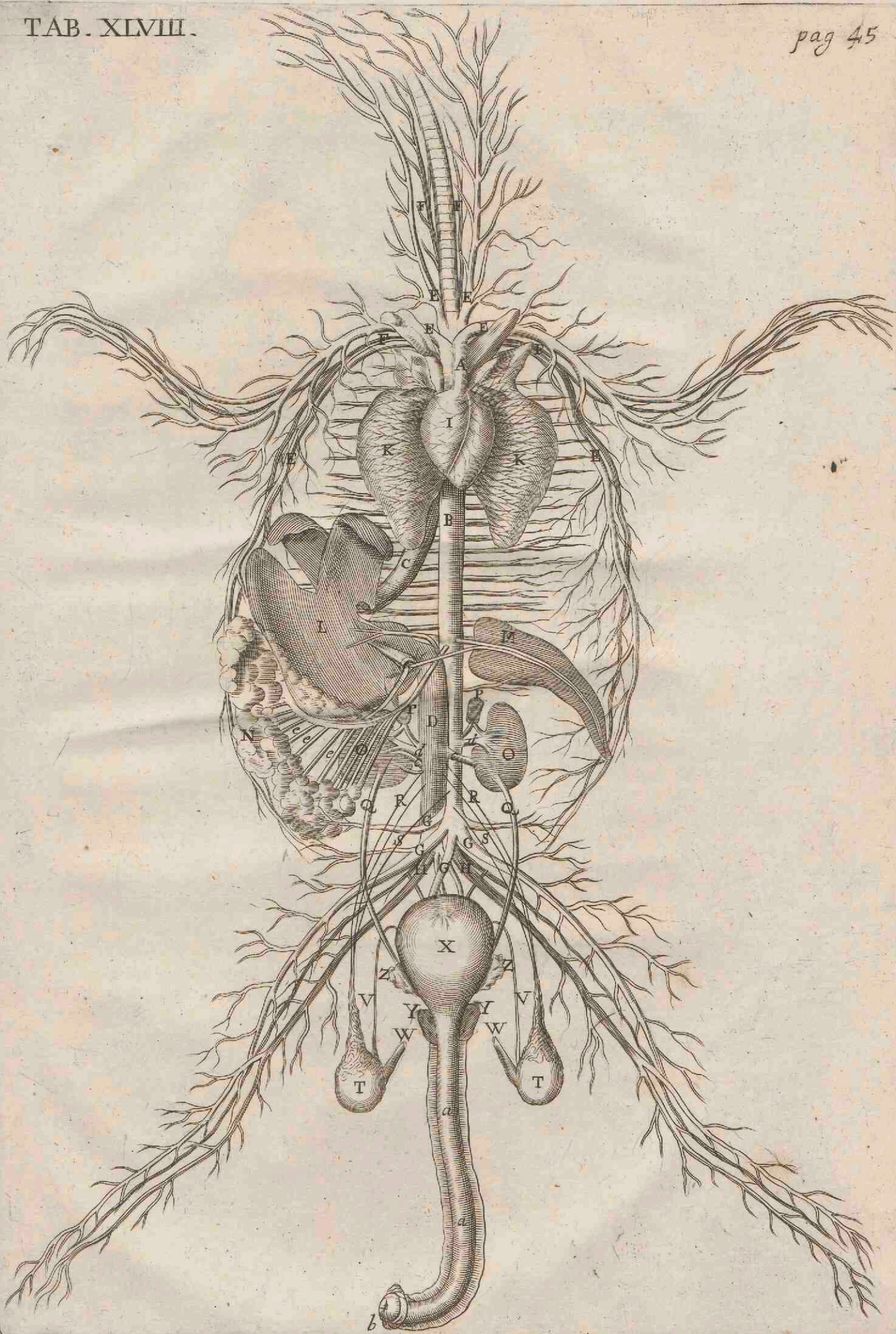
Fig. 2.



"The *other* part of these Bladders, which we called glandulous, was
 "thicker, and broader on that side which joyned to the Piss-pipe; and
 "where the deferent Vessels were inserted, without descending towards
 "the bottom, it grew thinner and thinner like a wedge. The substance
 "of this glandule was not much unlike to that of the Stones, but of a
 "more clayie colour, and had holes within it so apparent that they would
 "admit an indifferent Probe: all which holes were united into one com-
 "mon duct, namely before they reach the *Urethra*. For putting a Probe
 "into any one of the said holes, it was driven easily and without any lett
 "into that common passage. But the passage it self did not quite pene-
 "trate the Piss-pipe, but was covered with the thin and spongie Mem-
 "brane of the *Urethra*. Through this Membrane is the spermatick Mat-
 "ter strained in Copulation. Thus far *Dr. Wharton* in his 30. chap. of
the Glands. Now as for my self, I could never observe so great a diffe-
 rence of one part of the seminal Bladders from another, as that one should
 appear membranous and the other glandulous. And I would not imagine
 that so skillfull an Anatomist should mistake the Prostates for a part of the
 said Bladders, though these are the onely Parts that to me appear glandu-
 lous thereabouts. All the Seed-bladders that I have observed have been
 much of a like substance, though perhaps a little thicker in one place
 than another: they are whitish and very strong, being within all full of
 little Cells like Pomegranates. They have no communication the one
 with the other; for as their bottoms or thicker ends bunch out a little on
 each side of the Bladder (as you see in the Figure) so their smaller ends
 or mouths, that are nearest to one another, do each of them open apart
 into the deferent Vessel of their respective side, by whose neck they pour
 out their Seed in Copulation into the Piss-pipe. The Seed comes into
 them out of the deferent Vessels, and goes out of them again into the
 same Vessels, at one and the same passage or orifice. *Dr. Wharton* says,
 that the seminal Matter contained in them differs much from that which
 is made in the Stones: whence he concludes that the Seed-bladders receive
 not the *matter* which they contain, from the Testicles by the deferent
 Vessels, but do elaborate it in their own glandulous substance; and he
 calls it *Seed of a peculiar kind*. For my own part I have not discovered
 any difference, to speak of, betwixt this and that which I have some-
 times seen in the deferent Vessels, when the Bladders have been very full;
 nor is it probable they can be of a different kind or nature, seeing there
 is that manifest communication between the deferent Vessels and the
 Bladders, that these latter seem to contain or receive nothing, but what
 the former bring into them. Nor do I think that any Part does elabo-
 rate any Liquor that can with any propriety be called Seed, except the
 Testicles contained in the Cod, whose sole office and prerogative it is to
 make it.

Their use.

The *use* of these Bladders (as hath been said) is to receive the Seed
 from the deferent Vessels, and to reserve it untill the time of Copulation.
 Now the Seed may (to satisfy the curiosity of the Ingenious Anatomist)
 be plainly seen, if you take the Bladders in your hand and squeeze them
 with your finger; for by such squeezing you shall force the seminal Mat-
 ter into the Pipe of the Yard, where you may by dissecting the Yard or
 opening that Pipe plainly see it. Or if you think it too much to take
 that pains, you may by dissecting the Bladders themselves see it; but
 then you lose the sight of one of the curious contrivances of Nature,
 which



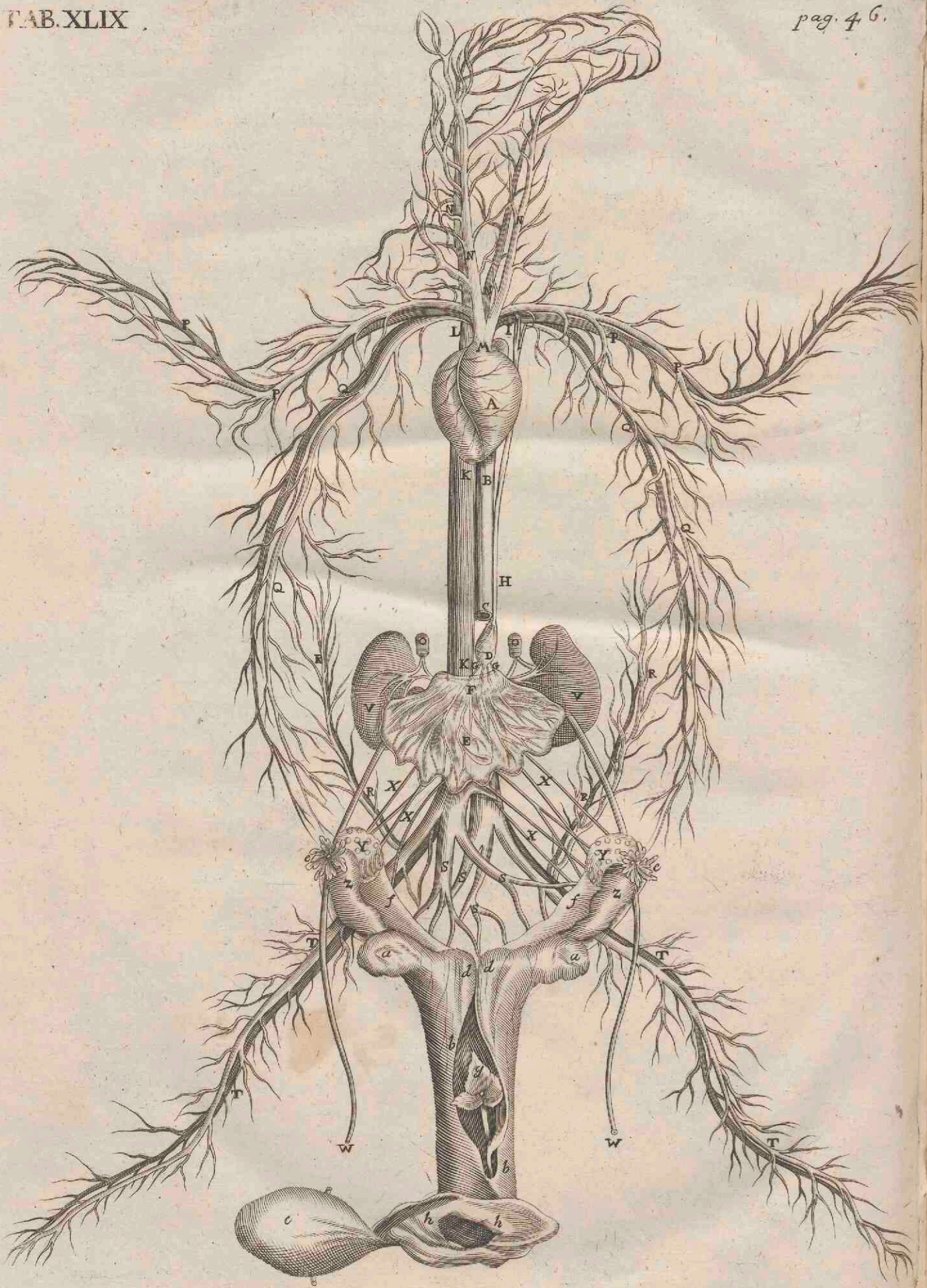
which is a little Caruncle or Kernel that is placed at the mouth of the hole where the Seed distills into the Yard, which Caruncle is by Nature placed there, to prevent the issuing forth of the Seed when there was no need for it; for the continual gleetings of it, which would have happened but for this Caruncle, would be extremely prejudicial to the Creature. This Caruncle in Men being impaired or injured by the Venereal Distemper, or by their overstraining themselves in the act of Copulation, is generally by Physicians believed to be the cause of the running of the Reins. And this Disease Horses are not exempted from, although it doth not happen to them on the like occasions as to men it doth; for this Disease, which in Horses we call the mattering of the Yard, happens to them upon their catching suddain colds after hard riding: Likewise over-hard riding it self will bring it; and very often it is caused by weakness occasioned by great poverty and the like.

In the next place we come to the *Prostates*, which are so called from their *standing before* the Seed-bladders. They are Glandulous bodies, almost of the same nature and substance as other Glandules of the Body. They are situated at the root of the Yard above the sphincter Muscle of the Bladder, being in number two, on each side of the neck of the Bladder one; their quantity about the bigness of a small Burgamy Pear. They are of an oval figure, onely somewhat flat, and are covered with a very thick Coat to hinder the oily substance with which they are well stored, from issuing forth.

They have Veins, Arteries, Nerves and Lympheducts; and besides many Pores that open into the *Urethra*. In most Creatures, especially the lesser sort, these Pores are scarcely discernible in an healthfull state, but in an Horse they are very plain, and open into the upper part of the Piss-pipe about an inch distance from the insertion of the deferent Vessels into the same. Dr. *Wharton* has told twelve such little holes, before each of which as they open into the Piss-pipe, is placed a little Gland, about the bigness of a grain of Mustard-seed, which serve to hinder the entrance of the Urine into these holes, as it runs by them out of the Bladder.

The nature and use of the Liquor that is contained in these Prostates, and that issues out of them into the Piss-pipe, is somewhat difficult to determine. Some take them to be a kind of Testicles, and think that they make a sort of Seed, which though it be not of so noble a nature as that which is made in the Testicles contained in the Cod, yet is as necessary for generation: seeing such Men as are cut for the Stone become incapable of generation, if the Stone be so big and ragged as much to tear the Prostates in pulling of it out. But it is likely, such barrenness happens not so much from the tearing of these, as that the ends of the deferent Vessels are torn likewise, or it may be the Seed-bladders also: and so when the Wound is healed up again, the sides of these Vessels grow together, so that they can neither contain nor convey into the Piss-pipe any Seed. It is probable therefore that this oily clammy Humour that the Prostates discharge into the Piss-pipe, is of a nature far different from that of Seed, even as themselves are bodies of a far other nature than the Stones are. For, as was shewn above, the Stones are wholly vascular, that is, consist wholly of Vessels; whereas these are glandulous, or kernelly. So that I believe this Humour serves onely to make the *Urethra* supple and slippery, and to defend it from the acrimony or sharpness of the Urine.

And



And thus we have done with all the Parts that make or retain the Seed: as for the Yard, which some treat of in this place, because it serves for injecting the Seed into the Womb; we described the Parts thereof above *chap. 20.* next to the Bladder, because it serves as well for making water as for Copulation, and thither the Reader may please to turn back.

C H A P. XXIV.

Of the Parts ministring to Generation in Mares, and First of the Preparing Vessels, so called.

IT was *Galen's* opinion, and from his authority, of many others, that the Parts serving for generation in the Female differed not from those of the Male saving in situation; the Male's Genitals being without the Body, and the Females within. And this diversity of situation they attributed to defect of heat in the Female, so that the Genitals could not be thrust out of the Body as in the Male they are. But the truth is, they differ not onely in situation, but in number, bigness, figure, office and use, as will be apparent as well from the description of them, as from their representation in the Figures.

*Preparing
Vessels.*

The first in order are the preparing Vessels, Arteries and Veins. In these it was till of late believed that the blood was prepared for the Stones the readilier to be turned by them into Seed. But as when we treated above of the preparing Vessels of the Horse, we shewed that the Veins could not properly be called *preparing Vessels*, because they carry nothing to the Stones, but bring blood back again from them: so in Mares we cannot allow the name of *preparers* or *spermatick* to be proper even to the Arteries themselves, seeing neither Mares nor any other Females have any true Seed. For their Stones are but improperly so called, being more truly Ovaries or Egg-beds, as we shall shew by and by in the next Chapter. However we shall retain the old name for distinction's sake, and still call both Veins and Arteries *preparing Vessels*.

1. *Arteries.*

The preparing Arteries of the Horse we shewed to be onely two, one on each side; but in the Mare there are several, three or more on each side. All of them arise out of the great Artery, below the Emulgents, some higher, some lower. They pass down along with the Veins of their respective sides, with which they are very much interwoven, but nowhere open one into the other. Some branches of them go to the Testicles, some to the Horns of the Womb, and some to its Sheath.

2. *Veins.*

The preparing Veins in the Horse were two of each side, though the Arteries were but one; yet in the Mare where the Arteries are several, the Veins are but one of each side. The reason whereof seems to be, That the Arteries in the Mare being not so much intended for the nourishment of her Genitals as of the Foal contained in her Womb, it was requisite there should be several Vessels for the bringing the greater plenty of *nourishing juice* for it; all or the greatest part of which being received by the Foal, there was not need of the like number of Veins to carry back

back the blood that came along with it, that being very inconsiderable for its quantity to what was imported by the Arteries. But now all the blood brought by the preparing Arteries of the Horse, serving for no other use but for the nourishment of the Genitals, and for the making of Seed: As a less quantity of blood will suffice for these two uses, and so there is no need of a plurality of Arteries; so the blood that is brought to the Genitals, is but a very small part of it spent in performing these two offices, and therefore more Veins were necessary to carry the surplussage back again, seeing the motion of the blood in the Arteries is far quicker than of that in the Veins. These two preparing Veins then arise out of the *Cava* a little below the Emulgent, and neither of them from the Emulgent it self, any more than in the Horse, though in Men and Women the Left generally springs from the left Emulgent. They join in like manner with the Arteries as we shewed above that they did in Horses, and go to all those parts of the Genitals to which we just now shewed that the Arteries run.

When the Mare is not with Foal, the Arteries bring onely blood for *Their use*, the nourishment of the several Parts into which they are inserted: but when she is with Foal, they bring besides the blood a nutritious juice, (which is Chyle, impregnated with spirit, but not as yet perfectly changed into blood) for its growth and nourishment, as we shall shew more afterwards when we come to speak how the Foal is nourished in the Womb. And whether she be with Foal or not, the Veins serve to carry back to the *Cava* and so to the Heart, the blood that is superfluous.

C H A P. XXV.

Of the Testicles or Stones in Mares, otherwise called Ovaries; and of the Trampets of the Womb.

THE Testicles in Mares do not agree in their description with those *The Testicles*, of Horses in any one particular thing, nor should I call them by that name, if the general mistake of so many Ages (in thinking the Female's Stones to have the same office with those of the Male) had not made it necessary to retain that appellation, if I would be understood by vulgar Readers of what part I am treating. For it has been an old Opinion, that the Male and Female's Seed being mixed in the Womb, doth make the Conception; and there are many that will not yet be beaten out of it. Whereas the Female hath no Seed at all, but their Testicles (so called) are as it were knots of Eggs, which being impregnated by the Male's Seed, one or more at a time, do each make a Conception. But of this more by and by.

The Mare's Testicles differ from the Horse's in these Particulars.

First, The Horse's Stones hang without the Body in the Cod, but the *Their situation* Mare's lie within the cavity of the Belly, a little distance from the horns of the Womb, to which they are knit by a strong Ligament.

Secondly,

Bigness, and
figure.

Secondly, The Mare's Testicles are hardly half as big as the Horse's, nor are they of the same shape, but more flat and thin, having no *Parastatae* upon them. And besides, they are somewhat uneven in their surface, whereas those of an Horse are smooth.

Coat.

Thirdly, The Horses Testicles are covered with four Coats, two common, and two proper; but the Mare's are clad onely with one for about one half of them, and the other half with two; the outer of which they have immediately from the preparing Vessels that enter into them, but mediately from the Rim of the Belly.

Substance,
and use.

Fourthly and lastly, They differ very much from one another in their substance and use. For we shewed above in *chap. 22.* that the Horse's Stones did wholly consist of Seed-vessels turn'd and roll'd this way and that way: but the Mare's consist principally of numerous Membranes and small Fibres loosely united to one another; amongst which there are several little Bladders, about as big as a Pease, some bigger, some less, that are full of a very clear and thin liquor. Those that were of opinion that the Females made Seed as well as the Males, thought that these Bladders that are chiefly in the surface of the Testicle, answered to the Seed-bladders in the Male, and that the humour contained in them was true Seed. And whereas it might be objected that it is far more clear and watery than the Male's Seed, they thought it sufficient to answer, that that was from the colder and moister nature of the Female, that could not concoct it to that consistency as the Male's is of. But the truth is, it is not Seed; and if it were, there is no way whereby it could possibly arrive at the Womb. For that which was reputed to be the deferent Vessel, appears to be nothing else but a short and broad Ligament for fixing the Testicle in its place; for it has no cavity at all, but is of a solid, firm and close substance. These Bladders therefore must be concluded to be Eggs, answering to those of Fowl and other Creatures: which will be the more manifest if you boil them, for then, as those that have tried it do affirm, they will have the same colour, taste and consistency with the whites of Hens-eggs. Whence these Testicles may more properly be called *Ovaries* or Egg-beds, whose Eggs are nourished by the Bloud-vessels described in the foregoing Chapter; and when upon Copulation one (or more) of them is made fruitfull by the Male's Seed, it separates from the rest, and being received by the mouth of the Trumpet of the Womb, it descends by it into the Horn, and so to the bottom of the Womb, and there becomes a Conception. And whereas it has been thought a strong argument for the Female's having true Seed, and that these Testicles made it, in that when they are cut out of the Body in Bitches, Hogs, or any other Creature, such Creatures are always barren afterwards; this new Opinion shews that there is no strength or certainty at all in that argument. For granting, what is most certainly true, that Females that are gelt or spay'd, have never any Young after; yet it does not at all follow, that therefore their Stones make and conserve Seed; but onely that they contain something that is absolutely necessary for generation and conception: but whether that be Seed or somewhat else, is indifferent. And therefore that Argument will be as strong for the Opinion that the Testicles are *Ovaries*, seeing without the Eggs it is so far from possible that there should be a conception, that they are the very conception it self.

Of the *Bloud-vessels* that run through the Testicles we treated in the foregoing Chapter under the name of Preparing Vessels: As for their

Nerves,

Nerves, they spring from the Intercoſtal pair, and from the Nerves of *Os ſacrum.* Bartholin affirms that they have alſo *Lympheducts.*

There hath not been greater diſpute about the matter of the Conception, than by what way any thing could go to the Womb or its Horns from the Teſticles to make it. Some have pretended to the diſcovery of Veſſels or Pipes for conveyance thereof, which others altogether as ſkilful Anatomifts could find no footſteps of. At laſt *Fallopius* assigned this office to two Ducts, which from their ſhape he called *Tubæ* or Trumpets; and from him (as being the firſt Inventor of them, or at leaſt the firſt that aſcribed this uſe to them) they are commonly known by the name of the Fallopian Trumpets. He ſays, “they are nervous and white, “ariſing from the Horns of the Womb, where they are very ſlender, but “at a ſmall diſtance from it they grow wider, bending this way and that “way, till near their end, where ceaſing their winding they grow pretty “large, and ſeem ſomewhat carnous.] Their ends next the Teſticles are torn and jagged, and lie looſe, being freed from the Membrane that ſuſtains them the greateſt part of their length.

The Trumpets of the Womb.

Their ſubſtance ſeems rather membranous than nervous, (as *Fallopius* would have it.) And they conſiſt of two Membranes; the inner is propagated from the inmoſt Tunicle of the Womb, and the outer from the outmoſt of the ſame. Where they are wideſt they will admit ones little finger, but towards the Horn of the Womb, they are not ſo thick as an ordinary ſtraw, but yet are pervious; and where they open into the inſide of the Horn, their Orifice looks like a little Teat. As to their length, it is ſomething difficult to determine it exactly, becauſe they run ſo to and again in their courſe; but I believe they are very near a quarter of a yard long.

Their ſubſtance, capacity and length.

Their uſe is, both to ſerve as two Funnels whereby ſome ſubtile particles or ſteams may iſſue from the Seed, that is injected by the Male into the Womb, to the Teſticles of the Female for the ſecundating or making fruitful the Eggs thereof, one or more, according to the different ſpecies of living Creatures; (but it is very rare, that there is above one ſo impregnated in a Mare, ſeeing it is ſo ſeldom that any brings forth twins:) and alſo when the Egg is ſecundated by this means, and growing ripe as it were, drops off or ſeparates from the Teſticle, it is received by the jagged mouth of the Trumpet, along which it paſſes till it arrive in the Horn of the Womb, into which (as was ſaid above) the Trumpet is inſerted; and on this conſideration the old name of *deferent Veſſels* may ſtill be granted them, from their conducting the Eggs from the Teſticle to the Womb. Now ſeeing the wide ends of the Trumpets that firſt receive the Eggs lie looſe, and are not faſtened to the Teſticle, it is probable that in Copulation theſe become turgid as well as all the other parts of the Genital, and with their jagged mouths clasp hold upon the *Teſtes* (as a Lamprey's mouth faſtens upon a ſtone) and ſo convey to them a ſeminal air, and afterwards receive from them a ſecundated Egg.

Their uſe.

C H A P. XXVI.

Of the Womb and its Horns.

The shape
and parts of
the Womb.

THE Womb of a Mare is shaped much like the Greek Letter Υ , in which the single stroak that is streight, answers to the *vagina* or Sheath, which receives the Horse's Yard in Copulation, and the two crooked stroaks that turn one the one way, and the other the other, are called *Horns*, because they in some fort resemble them; and that part of the Sheath where the Horns begin to separate, being somewhat wider than the rest, is the *fundus* or bottom of the Womb, where the Foal lies. For though in Dogs, Rabbets, &c. that have many young ones at one time, their burthen is contained wholly in the Horns of the Womb, as well as the Conception is first made there; yet in a Mare that commonly brings forth but one at a time, it is otherwise; for there is little or nothing that belongs to the Foal, contained in them, except some part of the Skins wherein the Foal is covered while it is in the Womb.

Its situation.

The Womb is seated in the lowest part of the Lower Belly, in that wide Cavity that is formed out of and invironed with the Hip-bones, the Share-bone, and the *os sacrum*. It is placed betwixt the Piss-bladder and the Arse-gut, and is firmly tied in its place by two pair of *Ligaments*.

Ligaments.

The first pair arise from the Rim of the Belly, being shorter by much than the other, but broader, being for their shape resembled to Bat's wings. They are of a membranous, loose and soft substance, and are inserted into the Horns of the Womb, taking hold also of the Testicles, and tying them both fast to the Hip-bones, from whence they spring.

The second pair of Ligaments spring from the bottom of the Womb, and are called the round or worm-like Ligaments. They ascend on each side between the two Coats of the Rim of the Belly, towards the Share-bone, over which they pass slantingly, and then parting into many jags as it were, they end near the *clitoris*. This also serves to fasten the Womb the more firmly in its place.

Substance.

It is of a nervous or rather membranous substance, more compact and close in Mares that are not with Foal, but more spongie in such as are. It consists of two Membranes, and a certain fleshy or fibrous parenchyma or substance between, unless one will make this a third Membrane. The outmost Membrane is borrowed from the Rim of the Belly, and therefore is truly double as that is, though we reckon it but for one. This is very strong. The inmost is not so strong nor firm as it, but seems to be somewhat porous. The middle substance betwixt these two is that which makes up the greatest part of its thickness at all times, but particularly when the Mare is with Foal, it imbibes so much of the nutritious Juice that flows plentifully hither at that time, that it is stuf up to almost an inch thickness.

Vessels.

1. Arteries.

Its *Arteries* are branches partly of the Preparing Arteries and partly of the hypogastrick. These do inosculate or communicate by open mouths one with another, but not so with the Veins. They run along the Womb bending and winding, and not in a streight course, lest they should be broken

broken when the Womb is extended to that vast bulk as it is when the Mare is with Foal.

Its *Veins* spring also from the preparing and hypogastrick Veins, but ^{2. Veins.} are much fewer in number than the Arteries. For Nature having formed these Parts not so much for the benefit of the Individual, as for propagating the Kind; and the Foal while it is in the Womb receiving no nourishment but what is brought to it by the Arteries, it was necessary that they should be large and numerous for conveying the greater plenty of it: but seeing the greatest part of that which is brought by the Arteries is spent in the nourishment of the Young and the Parts in which it is contained, a fewer number of Veins are sufficient to convey back again what is not so spent. The Veins do inosculate with one another like as the Arteries did.

It has *Nerves* from the Intercoastal pair, and from the Nerves of ^{os 3. Nerves.} *sacrum.*

Some have also observed many *Lympheducts* creeping along its surface, ^{4. Lympheducts.} which one after another meeting into one, empty themselves into the common receptacle of the Chyle and *Lympha*; and these *Lympheducts* some have mistaken for Milky-veins.

Thus much of the *Womb* properly so called: and what we have said ^{its Horns.} hereof, may be all applied to its *Horns* likewise as to their *substance* and *vessels*. As for their *figure*, you may view it in the following Cut. These Horns are less in Mares than in any other Creature that has them, in proportion to the bigness of their Bodies. From their first rise from the Womb to their end, they grow by degrees narrower and narrower, and about their middle are the Trumpets of the Womb inserted into them. They have a worm-like or successive motion as the Guts have, by which the Egg being received from the Trumpet is driven gently along till it come to the bottom of the Womb in Mares, and there becomes a Conception: but in such Creatures as bring forth many Young at one time, the Conceptions stay in the Horns till they are come to maturity, and never descend into the bottom of the Womb till they are about to be excluded.

By what has been said, it appears, that the *use* of the Womb is to receive the Seed of the Male, from which Seed a certain air or spirit steams through the Trumpets to the Testicles, where impregnating one or more Eggs, those that are so impregnated, are conveyed by the Trumpets into the Horns, and by these into the bottom of the Womb, where they become Conceptions, and stay (according to Nature) so long till all their Parts are finished, and they are become perfect Animals of their proper kind; and then the Womb being irritated by the motion and bigness of the Young, does by the help of the Muscles of the Belly, and the assistance of the Midriff exclude it. But having designed a particular discourse of the generation of Animals to be annexed to this Treatise, we shall pursue it no further here.

C H A P. XXVII.

Of the Vagina or Sheath of the Womb, the Caruncles call'd myrtiformes, (of the shape of Myrtle-berries) the Clitoris and the external Privity.

*The Vagina
or Sheath.*

WE shall not need to enter upon the description of the Vessels running through the *Sheath* of the Womb, they being wholly the same that are dispersed through the Womb it self, and therefore the Reader may have recourse to the former Chapter for them: nor is it necessary to speak much of its substance, that being also much like to that of the Womb, though not so thick and strong, but more soft, nervous and spongie. It is near half a yard long, being much of an equal width from one end to the other, but very uneven and wrinkled in its inner surface. Into its lower side (or that side next the Belly) a very little distance from the external Privity, is the neck of the Bladder inserted; opposite to which in its upper side it is strongly knit to the Sphincter Muscle of the Arse-gut. There is no such neck to distinguish or separate the Sheath from the bottom of the Womb, as Anatomists say there is in Women: but the Sheath it self seems to be widened into what I call the bottom of the Womb.

*The myrti-
form Carun-
cles.*

Whether there be any such Membrane that goes cross the *Vagina* in Mares that have never been cover'd, as Anatomists say there is in Maids, I never made any carefull examination, but believe there is none. But as for those Caruncles or little kernelly knobs that are called *myrtiformes*, from their resembling the Berries of the Myrtle in shape, they are to be found: yea they may be seen without dissection, if one look near the Privity of a Mare when she is lustfull and desires the Horse; for as she opens the Orifice of the *Vagina*, one may discern these Caruncles to strut out. They are said to be four in number, the largest of which stands just at the mouth of the Water-passage, which it helps, partly, to close up. Their use seems to be, by their roughness and unevenness to cause the greater pleasure to the Horse in Copulation.

The Clitoris.

On the same side of the *Vagina* with the Bladder is placed a long spongie body called *Clitoris*, but lies a great deal farther within the *Vagina* than it is said to doe in Women. For, that end of it which is next to the outward Privity is seven or eight fingers breadth from it, whereas in Women it is described to be within an inch. Those that would make the generative Parts of the Male and Female exactly to resemble one the other, say that this body in the Female, answers to the Yard in the Male. And indeed it is of not an unlike substance, but is not the twentieth part so big. It is soft and spongie, but it is likely when the Mare is lustfull and desires the Horse, it plumps up and suffers a sort of erection, being the principal seat of pleasure in the Mare. It has two pair of Muscles belonging to it, as well as the Yard of the Horse. One pair is round, and springs from the Hip-bones: The other from the Sphincter of the Arse-gut. Its *Veins* and *Arteries* spring from those that are called *Pudendæ* (or belonging to the Privity) and its *Nerves*, (which are pretty large,

to

to make it the more sensible) arise from the same origine with those that are dispersed through the Sheath and Womb.

As to the outward Privity, the *Labia* or *Lips* are the first things that offer themselves. Besides the common Coverings, to wit the Skin and fleshy Membrane, they are stuf with a little spongy Fat. They serve to cover the outer orifice of the Sheath for comeliness sake, and to defend it from the cold, and Insects, or other injuries. The closing of these two makes that which is called the *fissure* or chink. If one draw the Lips a little aside, then appear the *Nymphs*, so called because they stand next to the Urine as it spouts out from the Bladder, and hinder it from wetting the Lips. They are two, on each side one, just within the Lips, beginning at the jointing or middle of the Share bone, at the lower side of the Privity, from whence they ascend close by each other to a little above half the breadth of the orifice of the Sheath, and end each in a blunt corner. Their substance is partly fleshy and partly membranous; they are soft and spongy and of a red colour, having the same Vessels with the *Clitoris*. Besides their use to keep off the Piss from wetting the Lips, they serve, as well as the Lips, for closing up and covering the mouth of the *Vagina*, at least so much of it as they reach unto.

And now we have done with all the Parts belonging to Generation, both in Male and Female.

Table IX. Representeth the *Cava* and *Aorta*, the Kidneys, &c. and all the Generative parts of a Mare.

- A Sheweth the hollow Vein.
- B The great Artery.
- CC The Emulgent Veins.
- DD The Emulgent Arteries.
- EE The Kidneys.
- FF The Deputy-kidneys.
- GG The Ureters cut off.
- HHH &c. The Spermatick Veins.
- II The Spermatick Arteries.
- ii The Hypogastrick Veins.
- u The Hypogastrick Arteries.
- KK The Testicles.
- LL The Trumpets of the Womb.
- ll Their jagged Orifices.
- MM The broad Ligament that sustains them, and also connects the Testicles to the Horns, and both to the Hip-bones.
- NN The Horns of the Womb.
- OO The bottom of the Womb where the Foal lies.
- PP The Sheath of the Womb.
- QQ The Sheath cut open that the *q* Clitoris may appear.
- R The Bladder of Urine turned aside.
- S Its insertion into the Sheath near its Orifice.
- TT The outward Orifice of the Sheath.

C H A P. XXVIII.

How the Foal is nourished in the Womb; of the Membranes wherein it is wrapt, and the Liquors contained in them; and lastly of the Navel-string.

HAVING described all the Parts in Mares that do any ways serve for generation, and shewn their severall uses, I should put an end to this First Book, but that it may be convenient to speak somewhat of the Young contained in the Womb, for the conceiving and generating of which all these Parts were formed. But this I shall not do largely in this place, but onely summarily and in short, referring the Reader for his fuller information and satisfaction to the Treatise of the generation of Animals annexed to the latter end of this Volume; where by observing in what order and by what degrees the conceptions in other Creatures arrive to perfect Animals of their kind, he may by the rule of proportion conceive how they proceed in Mares also.

How the Young is nourished.

Now before we come to speak of the Membranes that invest the Foal, &c. which will be the subject of this Chapter, it will be necessary to premise something concerning the ways or Vessels by which nourishment is conveyed to it, whereby it grows from no bigger than a Bee to so vast a bulk.

The first Opinion.

It is not long ago till when it was the general opinion, that the Young was nourished by the Dam's Blood; namely, that the hypogastrick and some of the spermatick Vessels of the Dam did inosculate with or open into the branches of the umbilical or Navel-vessels of the Young, and so the blood run from one to the other in a ready course. And this Opinion had so far prevailed, and was taken for so certain a truth, that after the Young was excluded out of the Womb, and must needs receive its nourishment by the mouth, they believed that it was nourished by Blood still: For they thought that Milk was first Blood, onely it changed its colour, and its taste partly, in the white Kernels of the Dugs. This was a strange fancy, that Nature should thus doe and undoe, first turn Chyle into Blood, and then turn that Blood again into a Liquor resembling Chyle, and in truth differing very little from it. But this by the way. I say, the Dam's Vessels were supposed to inosculate with the Navel-vessels of the Young; whereby Blood was carried to it for its nourishment: but they never troubled their heads about making it out how the Young should be nourished before it had ever a Navel-vessel, or before ever the Conception adhered to any part of the Womb. Now the Embryo or first draught (as I may call it) of the Young is formed in all Creatures before the Navel-vessels, and it is grown to a pretty bulk before they are so well perfected as to be capable of receiving any Liquor into them. And when they are perfectly formed, and can perform their office, whatever it be; in some Creatures, as particularly in a Sow, they never reach further than the *Chorion* or outmost Membrane wherein the Pig is included, and therefore have no contact or communication with those of the Sow, whose Veins and Arteries reach no further than the inmost Membrane of
the

the Womb. And in the Creature we have now under consideration, namely a Mare, it is near six months before the *Chorion* adhere to the inmost Membrane of the Womb, (which how it does, we shall shew by and by.) Now these observations plainly demonstrate that the Young cannot be nourished by the Blood of the Dam, seeing there is no way whereby the Blood can be conveyed to it, in any Creature for a considerable time, and in some Creatures, at all.

Others sufficiently discovering the errors of this Opinion, and inclining to believe that the Young in the Womb was nourished with the same Liquor while it was there, as it is after it comes into the World, namely Chyle a little refined, and not finding any other convenient ways (as they thought) whereby the Chyle could be conveyed to the Womb, have fancied that they have found Lacteal or Milky vessels going thither directly either from the great Kernel at the centre of the Mesentery, or from the common receptacle of the Chyle it self: but others that favour not this Opinion, suppose those Vessels that these have fancied to be Lacteals, to be onely Lympheducts, conveying the *Lympha* or superfluous Water from the Womb to the common Receptacle, whither the *Lympha* of all the other Parts contained in the Lower Belly is by the same Vessels likewise discharged. So that though this Opinion be very plausible for its inventing so ready a way for the Chyles coming to the Womb; yet it is very probable that these supposed Milky-veins are nothing but Lympheducts, and then the whole Supposition falls to the ground.

But yet though this second Opinion be mistaken in the Vessels that bring the Liquor to the Womb whereby the Young is nourished, yet it seems to have hit right on the Liquor it self. For as it cannot be Blood for the reasons I have before given, so there is no other Liquor in the Body but Chyle, that is capable of being turned into nourishment. For though they call that Juice, by which Bodies come to maturity are nourished, (and also the Young in the Womb) *nutritious Juice*, yet that name onely denotes its office, and does not suppose that a Liquor quite distinct in nature from Blood or Chyle is understood by that denomination: but it does indeed partake of the nature both of the Blood and Chyle; for it is Chyle a little exalted or impregnated with the spirit and life of the Blood. Now this Juice arrives at the Womb by these ways. First the Chyle ascending from the common Receptacle by the thoracick Duct to the right Ventricle of the Heart, it is sent out from thence together with the Blood into the Lungs, from whence they both return to the left ventricle of the Heart, out of which they are ejected into the *Aorta* or great Artery, by which means the Chyle runs confounded with the Blood into all the Parts of the Body; but when the Dam is with Young we may conceive that a greater quantity of it may tend towards the Womb than to other parts: even as it is probable that more wheyish or watery Humour accompanies that Blood that flows by the Emulgent Arteries to the Kidneys, than that which flows to other Parts, because Nature has appointed the Kidneys for the separating of it from the Blood. I say it is also likely that more Chyle descends to the Womb by the spermatick and hypogastrick Arteries than to any other part, because a great quantity of it is to be separated from the Blood here for the nourishment of the Young. Now these Arteries, as all others in the Body, do divide themselves so often, till they end in very small capillary or hair-like threads, which terminate in the inmost Membrane of the

Table X. Shews the *Fœtus* or Young lying covered in the Womb; the Stomach, Guts, &c. being removed.

- AA &c. *The body of the Matrix.*
 BB *The Horn of the Womb on the left side.*
 DDD *The Liver.*
 E *The Bladder.*
 FF *The Ligaments of the Bladder.*
 GG *The Ureters.*
 HH *The Iliack Vessels.*
 II *The Hypogastrick Vessels.*
 MM *The Share-bone cut asunder.*
 N *The Privity or Vulva.*
 O *The Dock.*
 PP *The Midriff.*
 Q *The neck of the Bladder joined with the sheath of the Matrix.*
 SS *The Vessels called pudendæ, dispersed into and about the Lips of the Privity.*

Womb. But all the branches of these Arteries about the Womb are much larger when the Female is with Young than at other times, which is an argument that nourishment is indeed brought by them. The greatest difficulty is, how it can be discharged out of the Arteries into the Womb, and no Blood go along with it. To solve this difficulty we must consider, that the Particles of several Liquors are of different figures, as suppose some round, some corner'd, &c. Now we know that if two bodies of the same bulk be one round, and another foursquare, the round will go through a hole which the foursquare body will not, and on the contrary the foursquare body will pass through a hole that the round will not; accordingly as the hole is round or foursquare. And this may be the reason that the Chyle can pass out of the small ends of the Arteries, and yet the Blood cannot accompany it, but must return back by the Veins. And besides the difference of figure, it is probable the Particles of that Chyle that ouzes into the Womb, are of much smaller bulk than those of the Blood, seeing it is a much thinner and watery body; and therefore may as easily be separated from the Blood into the Womb, as the Urine is by the Kidneys into the Ureters. And to further and assist this separation some do believe there is a certain fermentation in the Womb, even as there is in other Parts of the Body, where other Juices are separated from the Blood, as Choler in the Liver, and according to some, Urine in the Kidneys. But be the separation by what means it will, that there is such a thing is most certain, and how the Young comes to partake of it for its nourishment we shall next shew.

While it was believed that a Conception was made of the Male and Female's Seed mixed together, it was somewhat difficult to imagine how such a fluid substance should so speedily acquire so compact Membranes to include it, as we see it has in a few days. But now that it is believed that a Conception is nothing else but an Egg dropt off from the Testicle and received into the Womb, that difficulty vanishes, for those Membranes do originally invest the Egg, even as we see the like Membranes lie under the shells of the Eggs of Fowls, and encompassing the whole. These Membranes are at the first but two, called *Amnios* and *Chorion*; but after a while there is a third commonly called *Allantoides*, or the Pudding-like Membrane.

That

The Membranes that the Foal is wrapt in.

That Membrane or Skin that immediately infolds the Young is called *The Amnios*. It is very thin, smooth and clear, and in it is contained that Liquor out of which the Young is first formed, and by which it is afterwards nourished. That Liquor out of which the Young is formed, is originally in it, even while the Conception is under the form of an Egg: but that by which the Young is nourished and its Parts increased, sweats into this Membrane immediately out of the *Chorion* or outmost Membrane for the first months, till the Navel-string is perfected, and that there grows a new Membrane betwixt these two, that contains a peculiar sort of Liquor, as we shall shew by and by. But the Juice that is in the *Amnios* from first to last (except that out of which the *Embryo* is formed) is Chyle, which at first sweats into it out of the *Chorion*, and afterwards is conveyed into it by the umbilical Arteries of the Young, who first received it by its umbilical Veins. For these Arteries send many branches into the *Amnios*, which discharge themselves into it, even as the hypogastrick and spermatick Arteries do into the Womb. Now this Liquor that is thus collected in this inmost Membrane, does at first nourish the *Embryo* or first rudiments of the Young by apposition, that is, those rudiments do attract to themselves such particles of the Liquor as are suitable for them, and thereby their bulk comes to be encreased by degrees: but as soon as the Young has its Mouth and Stomach perfected, it then sucks it up and drinks it in by its Mouth, and it passes by the same ways to the Heart as it does after the birth.

The second Membrane, that is originally in the Egg, and that invests the Young from first to last, is called the *Chorion*. This is somewhat thicker than the *Amnios*; it is smooth on its inside, but rough and unequal on its outside. This Membrane drinks up that nutritious Juice that is emptied into the Womb from the hypogastrick and spermatick Arteries, which Juice is again filtered as it were out of it into the *Amnios* for the nourishment of the Young. For the Liquor contained in this Membrane is altogether the same with that of the *Amnios*. Now this Membrane for several months (five or six) adheres not to the Womb in any part, but the Young that is clad with it, lies as loose in the Womb, as a Bladder in a Foot-ball that is not at all tied to the leather. (Thus I say it is in a Mare, though in most other Creatures this Membrane begins much sooner to be fasten'd to the Womb.) But at length first of all there begin to grow in the surface of it certain reddish specks or caruncles no bigger than a Vetch, and at the same time the Membrane grows thicker, and there appear innumerable Vessels in it. And these Caruncles as they become more in number, so they grow broader in dimension, insomuch as at last they are spread all over the *Chorion*, so that on its outside it seems to have lost the nature of a Membrane, and to have become a *placenta* or Womb-cake. At the same time that these Caruncles grow thus on this Membrane, the Navel-string penetrating the *Amnios* is inserted into it, and those numerous Vessels that are seen in the *Chorion*, are onely branches of the Navel-arteries and Veins dispersed through it. And now the *Chorion* by means of the Caruncles that grow upon it, adheres to the inner Membrane of the Womb, from whence the Navel-veins imbibe nutritious Juice and carry it to the Young for its sustenance, (as shall be further shewed presently, when we come to speak of the Navel-string.) But the Caruncles do not stick so fast to the Womb, but that they may be separated without tearing, much less are there any Anastomoses or Inosculation

tions of the Vessels that run through the *Chorion* with the hypogastrick or spermatick Vessels of the Dam, as the Ancients believed. Nor is there in a Mare any of those Glandules that are commonly called *Cotyledons* or Sawcers, sticking to the inner Membrane of the Womb, into which the Caruncles of the *Chorion* are inserted, like an Acorn into its cup, such as are in Sheep and Goats: but the so often mentioned Caruncles stick immediately to the Membrane it self, and seem to serve as Sponges to imbibe the nutritious Juice that plentifully bedews it; which having done, the said Juice is sucked up by the mouths of the Navel-vein, as was said before. Part of this Membrane does on each side bag out into the Horns of the Womb.

Allantoides.

As soon as the Navel-string has penetrated the *Amnios*, there begins to appear a third Membrane betwixt these two already described, which contains a Liquor wholly different from what swims in them; for that we have shewn to be *Chyle*, but this is the *Urine* of the Young, which, while the Young is in the Womb, is not emptied out of the Bladder the common way, but there is a Pipe called *Urachus* that passes from the bottom of the Bladder out at its Navel, and empties the *Urine* into this Membrane, in which it is collected to the quantity of many quarts. This Membrane is called *Allantoides* or Pudding-like, because in many Creatures, as Cows, Sheep, &c. it is of that shape, and seems to be onely the *Urachus* a little widened. But it is of another figure in Mares (as it is also in Women) and is of the same dimension with the other two already described, incompassing the whole Young. It is more dense than they, and may be easily distinguished from them by this, that they are full of Vessels, but this has not one, that one can discern. Although this Membrane appear not till the time aforesaid, yet 'tis like it was originally in the Egg; and at its appearance the *Chorion* becomes empty, because there is now no longer passage of any thing out of the *Chorion* into the *Amnios*, by reason of this Membrane and its Liquor interposing. Whence the *Chorion* claps pretty close to the *Allantoides*, so that they cannot be easily separated. In the Liquor contained in the *Allantoides* there swim several gobbets that look like as if they were fleshy, but being pulled to pieces they appear skinny. They are supposed to be concretions of some part of the nutritious Juice that may come along with the *Urine* into this Membrane, wherein by its long stay it curdles into these kind of bodies. But there is one more notable one, that is said to grow on the Forehead of the Colt, of the shape of a Tongue, and is called *hippomanes*, which, Tradition says, the Mare is wont to eat as soon as she has foal'd; which if she do not, she will never care for her Foal. This they were wont to dry and powder, and to put into drink for a Love-potion, as if there were some witchery in it. But such things I can say nothing to, having never experimented them. This Membrane sticking pretty close to the *Chorion*, bags out on each side into the Horns of the Womb as well as it. The Liquor contained in it, is *Urine*, as was said above, which daily increases in quantity, being imported into it by the *Urachus* from the Bladder of the Foal.

Table

Table XI. Shews the Belly of the *Fœtus* opened, the better to shew the Umbilical Vessels; as also two of the Membranes laid open, in which the *Fœtus* is included in the Womb, with the Veins and Arteries branching into them.

AA *The Liver.*

B *The Sternum or Breast-bone.*

CCC *The Gut Colon.*

D *The Bladder of Urine.*

E *The Urachus cut off short, because the Allantoides, into which it is inserted, is not expressed.*

FF *The Umbilical Vein.*

GG *The Umbilical Arteries.*

HHH &c. *The Membrane Amnios.*

II &c. *The Membrane called Chorion, with the branches of the Umbilical Veins and Arteries dispersed through it.*

MM &c. *The like branches running through the Amnios.*

S *The Caruncle called Hippomanes, which is said to grow on the Foal's Forehead, but is indeed found in the middle Membrane called Allantoides.*

Lastly, We are come to the Vessels that make up the Navel-string, and those are four, one Vein, two Arteries, and the *Urachus*. The Navel-vessels. These are all infolded in a common Coat, and are wreathed one about another like a Rope. The greatest part of its length is contained in the *Amnios*, the rest in the *Allantoides*; for as soon as it has penetrated that, it is immediately and directly implanted into the *Chorion*.

The *Vein* is as big as both the Arteries, and arises out of the hollow or lower side of the *Liver* of the Young, and coming out single with the rest at the *Navel*, is immediately divided into two, which as they pass through the *Amnios*, send some twigs to it, and from thence continue their march through the *Allantoides* to the *Chorion*, in which and the *Caruncles* that grow upon it they terminate, being divided into innumerable branches. Its use is to imbibe the nutritious Juice and also the Blood that is superfluous to the nourishing of these Parts, and to convey them to the Young. One Vein.

The *Arteries* being two, do arise on each side from the inner Iliacal Branches of the great Artery, (as is commonly held, but I have always Two Arteries. observed them to spring from the *Aorta* it self before the division) and ascending by the sides of the *Bladder*, they meet the *Vein* at the *Navel*, and there begin to be wreathed with it. Their march and insertions are the same with those of the *Vein*, onely they send more twigs into the *Amnios* than the *Vein* doth. Their use is to carry vital heat and nourishment to the Parts that include the Young, to wit to the *Amnios*, *Chorion* and its *Caruncles*: and besides, its branches that are dispersed through the *Amnios* do distill into it some of that nutritious Juice which could not be turned into Blood by once circulating through the Heart of the Young. Which Juice being collected in the cavity of the *Amnios*, is drunk in by the Young at its mouth, and so passes the same ways as it does after the birth.

The Ura-
chus.

The fourth Vessel included in the Navel-rope is called *Urachus*, from its office of conveying the Urine. It springs from the bottom of the Bladder, and passing out of the Navel with the Vein and Arteries, as soon as it has pierced the *Amnios* it opens it self with a full mouth into the cavity of the *Allantoides*, serving as a Pipe to rack the Urine as it were out of the Bladder of the Young into this Membrane. For though the Young void no Excrements at the Fundament, while it is in the Womb, nor has any Repository or Storehouse for them saving its own Guts, (amongst which the Gut *Cæcum* seems fittest for that office:) yet seeing it is nourished altogether with Liquor that has a good quantity of wheyish humour mixed with it, its better conveyance through those narrow ways by which it is to pass, I say for this reason it is necessary there should be some particular Repository for it, seeing it cannot return to the Dam again, and the Bladder of the Young is not capable of containing a fifth (may be a tenth) part of it; and this Repository is the Membrane *Allantoides*, into which it is poured out of the Bladder by the *Urachus*.

These four Vessels after they come out of the Navel are included in one common Coat, which consists of a double Membrane, borrowed from the Rim of the Belly the inner of them, and the outer from the fleshy Membrane or Pannicle described above *chap. 4*. After the birth of the Foal, these Vessels losing their original use, the two Arteries serve for Ligaments to keep the Bladder in its place, and the Vein performs the same office to the Liver; but the *Urachus* quite disappears.

And thus much of the Membranes and Navel-vessels, that are included in the Womb when the Mare is with Foal; and which at the Foaling make the After-birth or Cleaning as we call it: We might in this place further shew, what Parts of the Foal are first formed, and which soonest perfected; also in what particulars a Foal in the Womb differs from it self when foaled; and lastly we might have been more full in shewing how it is nourished in the Womb: but the discoursing of these things we purposely wave in this place, and refer the Reader to the Discourse of the generation of Animals annexed to this Treatise of Anatomy, wherein we will endeavour to satisfy his curiosity to the uttermost.

Table XII. Shews the Foal taken out of the Matrix, both wrapt in the Membranes with which it was covered, and also quite cleared of them; and lastly, the said Membranes cut open, the Foal as yet remaining in them.

Fig. I. Shews the *Fætus* taken out of the Matrix, remaining in the same posture as in the Womb, and wrapt in its Membranes.

AA The Membranes.

CC The hinder Legs of the Foal.

Fig. II. Shews the *Fætus* cleared of the Membranes, but continuing in the same posture.

BBB The Body of the Foal.

SS The common covering of the Umbilical Vessels turned back, that the four Vessels contained in it may appear.

TT The Umbilical Arteries.

U The

U *The Umbilical Vein.*

X *The Urachus.*

Fig. III. Shews the Foal, and two of its Membranes, as represented by Dr. Walt. Needham.

A *The Foal lying within the Membranes.*

B *The Navel-rope whose production E passes through the cavity of the urinary Membrane toward the Chorion.*

CCC *The Amnios.*

DDDD *The place of the Chorion which naturally grows to the urinary Membrane, but is here removed, that the Fœtus may appear through the Amnios and urinary Membrane.*

E *The production of the Rope which at this place is divided into two, and so is cut off with the Chorion.*

F *The place in the Navel-rope, where the exit of the Urachus is design'd, between two blots. Which Urachus is not indeed a part of the Membrane GG or Urinary, but of CC or Amnios, and seems a duplicature of it turned back even to the Bladder.*

GGG *The urinary Membrane, (which here is not Allantoides, or of the shape of a Pudding) investing the whole Fœtus as well as the Amnios; which is common to it with a Man, Dog, Cat, Coney, and perhaps others that have Womb-cakes; although they differ from one another in several circumstances.*

HH *The progress of this Membrane as also of the Chorion into the Horns of the Womb. Whereas all the whole Fœtus besides, &c. lies in the bottom of the Womb, as a Child does in a Woman's.*

aaaa *The Bloud-vessels dispersed from the Rope into the Amnios, which the urinary Membrane wants wholly; for the rest of the Rope is all spent on the Chorion, and is cut off with it.*

CHAP.

C H A P. XXIX.

Of the Udder.

THOUGH the Udder be an *external* Part of the Lower Belly, yet we have deferr'd the description of it till this place, because of the dependance that it has upon the Womb, and its office of yielding the same nourishment to the Foal when it is excluded out of the Womb, as it was nourish'd by while it remain'd in it.

It is seated at the bottom of the Paunch upon the lower ends of the streight Muscles; very small, if compar'd to the bigness of a Mare's Body, and to its bulk in many other Creatures. When the Mare gives no suck, it almost disappears.

Its substance. It consists of the common coverings, Fat, a multitude of Vessels, Glands or Kernels, and Pipes to convey the Milk to the Paps that is separated from the Vessels in the Glands.

Number. Now though when the Mare gives suck it seems to be but *one* roundish body, like a Breast with two Nipples, yet it truly consists of *two* bodies, one being joined to the other onely by contiguity, for they have each their proper Vessels, Pipes and Pap; and do indeed appear to the eye to be distinct when the Mare is neither with Foal nor suckles one.

Its Glands. The greatest part of its bulk consists of *Glands*, which are many in number, though they be so united to one another as to appear one continued body to an unwary observer, which they come to do from that Fat that fills up the spaces between them, and is much of the same colour with the Glands. There is one Gland greater than the rest seated at the root of each Pap. By means of these Glands it is that the Milk is separated from the Blood, as shall be further shewn by and by.

The Paps. The *Paps* are round in shape and of a spongie substance, cloathed with a thinner Skin than the rest of the Udder. At their head or end they have many little holes through which the Milk issues when the Foal sucks.

The Vessels belonging to the Udder. The Udder has all sorts of *Vessels*, Veins, Arteries, Nerves and Lympheducts; and besides these it has peculiar Pipes for containing and conveying the Milk. The *Veins* and *Arteries* are branches of the *Hypogastricks*, which proceed from the *internal* Iliack branches of the *Cava* and *Aorta*: 'tis likely there come some twigs to it also from the *external* branches, which are called the *Epigastrick* Vessels. Its *Nerves* I have not examin'd, but 'tis very probable they are the same with those dispersed into the Matrix and Sheath, which are twigs of the Intercostal pair and of some of the *Os sacrum*. Its *Lympheducts* are pretty numerous, and tend, as all those of the Lower Belly do, to the common Receptacle of the Chyle at the centre of the Mesentery.

The milk-pipes. It has also a peculiar sort of Vessels, which may be called *Milk-pipes*, being the Repositories or Store-houses of the Milk. At the root of each Pap they are but one on each side, but a great many smaller ones coming from every part of the Udder discharge themselves into this one, when the Pap is suckt by the Foal. But the Pipes belonging to one Pap have no communication with those that belong to the other, but in respect of these

these Vessels the two sides of the Udder are as distinct Parts, as the Breasts of a Woman are distinct one from another, as was noted before. These Pipes have been mistaken by some to be true Milky-veins, as if some of the Milky-veins of the Mesentery reached hither. But seeing there are no footsteps of them in the track betwixt the Mesentery and Udder, we may well deny them to be found in the Udder it self.

The *use* of the Udder is to prepare and separate the Milk for the nourishment of the Foal, which it does in this manner. The Chyle of the Mare being mixed with her Blood in the Heart, flows from thence along with it by the Arteries into all Parts of the Body in the circulation, but most plentifully ('tis probable) towards the Udder, even as it does to the Womb while the Mare is with Foal. The Arteries that convey it immediately to the Udder are the hypogastrick Branches, which terminating in its Glands do squirt or strain the Chyle through them into the Milk-pipes. And as for the Blood that was mixed with the Chyle in the Arteries, that being of a thicker body, or consisting of Particles of another form, cannot enter the narrow pores of the Glands, and therefore is received by the small mouths of the Veins that are likewise inserted into them. So that it appears to be an erroneous Opinion, That Milk is made of Blood, if we speak of Blood properly so called; yet seeing the Chyle, when it is confusedly jumbled with the Blood in the Arteries, is not easily distinguishable from it, but the whole Mass seems to be homogeneal or of the same nature, in a large and less proper sense we may affirm it to be so made. After that the Chyle is thus separated by the Glands, it drills along the Milk-pipes, out of the smaller into the larger, in which it is reserved for the use of the Foal.

The use of the Udder.

The End of the First Book.

L

THE

These Vessels the two sides of the Uterus are as distinct Parts, as the Branches
of a Woman are distinct one from another, as was noted before. These
Parts have been distinguished by some to be the Milky Veins, as in some of
the Milk Veins of the Nephroses reached under. But being that
no connection is to be seen in the trunk between the Milk Veins and Uterus,
they will draw them to be found in the Uterus it self.

The 62 of the Uterus are prepared and separate the Milk for the use
of the Child, which is done in this manner. The Chyle of the
Uterus being mixed with the Blood in the Uterus, flows from thence along
with the Arteries into all Parts of the Body in the circulation, but
most plentifully to the Uterus, even as a flow to
the Womb, which is the same. The Arteries that convey it
are the Uterine Arteries, which are the hypogastric Branches, which termi-
nate in the Uterus, from the Chyle through them into the
Uterus. The Chyle is mixed with the Blood in the
Uterus, the being of a thicker Body, consisting of Particles of ano-
ther nature, enters from the narrow parts of the Chyle, and therefore
is worked by the small quantity of the Blood that are drawn into
it, and thus it appears to be an erroneous Opinion, that
Milk is made of Blood. If the part of Blood properly to called; yet
being the Chyle, which is constantly jumbled with the Blood in the
Uterus, is so easily distinguishable from it, but the whole Milk seems
to be homogeneous or of the same nature, in a large and less proper sense
we may think it so to be made. After that the Chyle is thus separated
by the Chyle, it draws along the Milk-pipe, out of the smaller into the
larger, in which it is retained for the use of the Fœtus.

The End of the First Book.

THE I

THE
ANATOMY
OF AN
HORSE.

BOOK II.

Of the Middle Venter, or Chest.

CHAP. I.

Of the investing and circumscribing Parts of the Chest.

HAVING finished the First Book, wherein I have absolved or explained all the *Natural* Parts contained within the Lower *Venter*, as well nutritive as generative, and annexed a Discourse of the Foal in the Matrix or Womb; order of dissection requires that in the next place I come to treat of the Middle *Venter*, the *Thorax* or Chest, and the *Vital* Parts contained therein.

Where, in this one step higher that I have climbed, I am methinks much delighted to see, how Nature in this place disports her self, having as in a curious Cabinet lockt up, as it were, her most exquisite pieces of Workmanship, the *Vital* Instruments, by whose motion the life of the Creature is continued. Which motion is performed by so just a counterpoise, as no art of Man could ever with all their contrivances be able in the least to imitate. Nay *Aristotle*, that wise Philosopher, who was in his time thought to be the nearest of counsel to Nature, was not able

(notwithstanding his incomparable sagacity) to find out the true cause of the Vital motion, any more than he was, to find out the reciprocal Ebbing and Flowing of the Sea.

The Place wherein these Instruments are contained, is called the *Thorax* or Chest, which is composed of or environed with these Parts following.

By what parts the Thorax is bounded.

First it is bounded or circumscribed, above, by the Coller-bones, and below by the *Diaphragm* or Midriff; on the fore-part by the Breast-bone, and on the hinder part by the Spondyls or Back-bones; and on the two sides by the true and bastard Ribs and Intercostal Muscles. All which Parts are framed and composed by Nature for the benefit of the Creature, as well for the *defence* of the contained Parts from external Injuries, as for the use of *Respiration* or breathing: both which are very needfull; for without them the Creature cannot be preserved. Now that it might serve for these ends, it was necessary it should consist of sundry Parts; for should it have been made all bony, it could not have been contracted and dilated as occasion served, whereby the Lungs could not have had the liberty to play as now they have: And if it had been wholly fleshy, then would not the contained Parts have been sufficiently fenced. It is therefore made partly bony, partly gristly, and partly fleshy, that it might the better perform both the offices aforesaid.

In the next place I come to speak particularly to the *Investing* Parts of the Chest, some of which are *Common*, and others *Proper*.

Its common investing Parts.

The *Common investing* or *containing* Parts are the same as the Lower Belly hath, namely the Scarf-skin, the true Skin, the fleshy Pannicle, the Fat, and the common Membrane of the Muscles. Of all which having discoursed at large in the First Book, we shall say nothing of them here.

Its proper containing Parts.

The *Proper containing* Parts of the Chest are the Muscles, the Bones, the *Pleura* or Membrane that cloaths its inside, the Midriff and the *Mediastinum*, which is the Skin that goes across from the Breast to the Back, and parts the Lungs, called by some, the Partition-wall.

Its contained Parts.

The *contained* or *invested* Parts, are the Heart with the Heart-bag called the *Pericardium*, and by some the Purse of the Heart, the Lungs and part of the Weazand or Wind-pipe, by Anatomists called *Aspera Arteria*, or Rough-artery, and several Vessels, with the Trunks of *Vena cava* and *Arteria magna*, whose ascending branches are underpropped by the *Thymus*, or Kernel in the Throat.

C H A P. II.

Of the Muscles of the Middle Venter or Chest, called the Intercostal Muscles.

TH E R E are several pairs of *Muscles* that lie upon the Chest on the outside of the Ribs; but because one may easily enough cut open the Chest for examining the Parts contained in it, without defacing any part of those *Muscles*, we shall omit to speak of them in this place, referring the Reader to the Book of the *Muscles*; and here onely describe the *Intercostal*, which in laying open the Breast, whiles one breaks the gristly ends of the Ribs, happen part of them to be defaced.

These *Muscles* are called *Intercostal* from their being placed *between the Ribs*, and filling up the spaces between them. Betwixt every two Ribs there are placed two of these *Muscles*, the one lying upon the other; the uppermost being called the *External*, and the undermost the *Internal* one. *Intercostal Muscles why so called.*

The *External* one takes his rise from the lower part of the upper Ribs, and ends in the upper part of the lower. *The External.*

The *Internal* takes his rise contrary to the former; for it arises or takes its original from the upper part of the lower Rib, and ends in the lower part of the upper. *The Internal.*

Now it is to be understood that those are called the upper Ribs that are next to the Head, and those the lower, that are next to the Paunch.

And as these *Muscles* do differ as to their original and insertion, so likewise in the course of their Fibres; for although they be both furnished with oblique or slanting Fibres, yet they run contrary ways, crossing one the other, and making as it were a St. Andrew's Cross, or the letter X.

These *Muscles* are in number sixty four, that is to say on each side thirty two, there being on each side of the Horse seventeen Ribs, and between every Rib two *Muscles*, as I have before intimated. *Their number.*

Now the *action* of these *Muscles* is to assist Respiration by widening and contracting the Chest. First the *external* ones serve to raise the Ribs and draw them backward, whereby the Cavity of the Chest is enlarged, and thereby free room made for the Air to enter into the Lungs in *Inspiration*, or taking in the breath. And on the contrary the *internal* pull in the Ribs by drawing them slanting downwards towards the Breast-bone, whereby the Chest is straitned, and thereby the Air, wherewith the Lungs are puff'd up, expelled, which action is called *Expiration*, or breathing forth. But these *Muscles* are not of themselves alone sufficient for these actions, but they assist towards them, being aided by the other that lie upon the Chest, by the Midriff, and by the Lungs themselves. *Their action.*

C H A P. III.

Of the Pleura, or Coat which invests or lines the Ribs on the Inside.

THIS Coat or Skin called the *Pleura*, is the Skin which covereth all the Ribs on the inside of the Chest, being of the same nature and use here, as the *Peritonæum* or Rim of the Belly is in the Lower Belly. It is also of the same substance as the Rim of the Belly is, but much stronger and thicker, though *Riolanus* affirmeth the contrary as to Men.

It is as it were of a middle nature or temper, that is, neither too hard nor too soft; not too hard, lest it should not reach and yield in the act of Respiration, and so hinder the motion of the Chest; neither too soft, lest the motion of the Chest should violate it: but it is rather hard than soft, the better to defend the Vital Parts.

*The original
of the Pleura
or Rib-skin.*

It is believed to take its *original* from the Coats of the Nerves of the Spinal Marrow, which come out of the Back-bones (or *vertebræ* of the Back) into the Chest, and is therefore thought to be continued with the Coats of the Brain: wherefore it is observed to be thicker upon the back part of the Chest than any where else, where it sticks so close to the Back-bones, that it can hardly be separated.

It is all over double, that the Intercostal-vessels might run without danger between its Membranes, and by it be preserved from the hardness of the Ribs, which would be apt to violate or break them.

The outward Skin of this Coat, namely that which is next to the Cavity of the Chest, is harder and thicker; and the inward (which is fastened to the Ribs) is softer and thinner. Now between these two Skins is bred that mortal Disease (in Men) called the Pleurisie, by which the never to be forgotten Doctor *Willis*, (for being in his time the honour of his University and Country) was notwithstanding the great pains he took in the inquiry into and finding out remedies against this Disease, (as his learned Works make appear, by which great benefit hath accrued to others) was, I say, himself by the tyranny of it taken from amongst the Living.

*Its Perfora-
tions.*

This *Pleura* is perforated in many places, for the Ingate and Outgate of the Vessels. For above, it letteth out the Jugular and Axillary Arteries and Veins, and below, through the Midriff, the Trunks of the hollow Vein and great Artery. Besides where it receiveth in the Nerves of the wandering pair, the Windpipe, and both letteth in and out the Gullet.

Its Vessels.

Its proper *Vessels* are, *Veins* from the *Vena sine pari*, or Vein without a pair, and from the upper Intercostal Vein. Its *Arteries* spring also from the upper Intercostals (as those from the Subclavian) which descend to about the seventh or eighth Rib: below which it receives twigs of Arteries from the back part of the descending great Artery. It has as many pairs of *Nerves* (wanting one) as there are Joints in the Backbone the whole length of the Chest: for betwixt each Joint there comes out a pair; but then the uppermost and lowest Joints being reckoned for the

the two extremes, (and not a pair of Nerves for either extreme) there must be one pair of Nerves less than there are Joints. The Joints therefore (or *vertebræ*) being seventeen, there must onely sixteen pair of Nerves be reckoned to the Chest. Now these Nerves as soon as ever they come out of the Joint, are immediately divided into the *fore* and *hinder-branches*. Of which the *fore-branches* serve the Intercostal Muscles and the *Pleura*; but the *hinder* are bestowed on the Muscles that lie upon the Back.

The *use* of it is much like that of the Rim of the Belly; for (as hath its use. been said) as the Rim of the Belly is stretched about all the Lower Belly, and furnisheth all the Bowels therein contained with Coats or Skins, (every Bowel with a particular Coat) so doth this *Pleura* the Bowels of the Middle *Venter*: for it is stretched about all the Cavity of the Chest, and giveth a Coat to every particular Part therein contained, (either mediately or immediately.) It covers also the Intercostal Muscles, and makes the upper Membrane of the Midriff. Next to the Cavity of the Chest it is bedewed with a watery humour, that the Lungs which lie against it on their outside, may move the more glibly, and not be offended by its roughness.

C H A P. IV.

Of the Midriff or Diaphragm.

THE *Diaphragm* (or *Midriff*) is so called from its office of distinguishing or separating; because it separateth or distinguisheth the Bowels of the *lower*, from the Instruments of Life and Respiration in the *middle* Belly. The Diaphragm why so called.

It is a Muscle, long and round, seated at the lower part of the Chest, overthwart which it runs, sloping a little lower towards the Paunch backward. It hath a figure and action different from all other Muscles.

It is as broad as the Chest is wide: for its edges are knit to the lower part of the Breast-bone, and all round on each side to the Ribs, and to the lowest vertebral Joint of the Chest.

It is said to arise from its two long and fleshy Productions, which its rise. springing from the *vertebræ* of the Loins (to the muscles whereof they are strongly knit) do, as they go upwards, grow wider and wider, till they come to the lowest *vertebræ* of the Chest, where they grow and unite together, and so spread themselves into this Muscle called the Midriff. Others, though they grant that these are part of its original, yet think that it does equally arise from its whole fleshy circumference, by which it adheres to the ends of the lowest Ribs. And a third opinion is, that its original is from its centre or middle where its Nerve is inserted into it, from that common Maxim of *Galen's*, That wherever the Nerve is inserted, *there* is the head of the Muscle. But as that Maxim does not hold in *all other* Muscles, so *this* being a Muscle of a peculiar shape and use, it may well be excepted therefrom, especially seeing the centre of the Midriff is tendinous,

tendinous, which the origine of a Muscle does not use to be, but onely its end.

Its substance. As for its *substance*, it is partly fleshy, partly nervous and partly membranous. For Membranes, because it requireth great strength (it being in continual motion) it is furnished with two, and those very strong ones, the uppermost of which it hath from the *Pleura*, and the lowermost from the *Peritonæum* or Rim of the Belly. To the uppermost the lower part of the *Mediastinum* is knit, (and of the Heart-bag in Men, but not in Horses or other Brutes) and sometimes the lower tips or ends of the two great Lobes of the Lungs. Its circumference is fleshy, and its middle or centre nervous, in which part a wound is mortal, but one in the fleshy sometimes admits of cure.

Its Perforations.

It hath in it several *perforations* or *holes*, some of which are little, and others bigger. The little ones are the *pores*, through which the Vapours are said to ascend from the lower Parts into the Chest; but besides that such ascent of impure Vapours from the Guts, &c. into the Chest, where the Vital Parts are seated, would be very inconvenient and prejudicial, I think the Midriff is so compact a body, and its Membranes so close, that we may either deny any *pores* at all, or however that they admit not any such steams. The *larger* holes (being those that ought to be reckon'd alone for such) are, *first*, that which is very near its middle or centre, but something towards the right side, which gives passage for the Trunk of the hollow Vein ascending from the Liver. The *second* is on the left side of the centre, being bigger than the former, and somewhat backward; and this serves for the letting forth of the Gullet and two Nerves which go to the Stomach. There is also a *third* hole more backwards by the *vertebræ*, for the through-fare of the great Artery, and the Vein without a fellow, and for the Nerve which Doctor *Willis* distinguishes from the wandring or eighth pair, by the name of the Intercostal.

Its Vessels.

The Midriff hath *Vessels* of all sorts; for it hath *Veins* arising from the Trunk of the hollow Vein, which are called *Venæ phrenicæ*, and also some twigs branching to it from the *Vena adiposa*, or Fat-vein, so called because it is mostly bestowed on the fat Membrane that invests the Kidneys.

It hath *Arteries* from the Trunk of the great Artery, called also *Phrenicæ*.

Its *Nerves* are in number two, proceeding from the spinal Marrow at the third or fourth jointing of the Rack-bones or *vertebræ* of the Neck, from whence they descend through the cavity of the Chest, being in their course sustained and strengthened by the *Mediastinum*, lest by any violent motion they should be hurt. As soon as these Nerves reach the Midriff, they enter it in its centre, and thence disperse themselves into its whole substance, terminating in it. But besides these some have observed small twigs to be sent into it from the Nerves of the eighth pair, as they descend through it toward the Stomach.

The several uses of the Midriff.

1. It assists Respiration.

Various are the *Uses* that might be ascribed unto the Midriff, the chief are these that follow. *First*, It is the principal Muscle that assists the action of Respiration. Which action whether it be animal and voluntary, or natural and involuntary, has occasion'd great disputes. True it is, that it moves in breathing as well while we sleep, as when we are awake, so that our Will, which in sleep is dormant as well as the Body, seems not to be necessary to its motion: and yet we can hinder it from moving when we please by holding in our breath. We may therefore call its motion, a mixt motion, to wit, partly

voluntary

voluntary (or rather *spontaneous* in Beasts, because they have not properly any Will) and partly *natural*. Which motion is performed on this manner. In taking in ones breath it is stretched out and becomes plain and stiff, pressing down a little the Parts contained in the Lower Belly: but in letting out ones breath, it is relaxed and ascends somewhat up into the Chest, being partly driven up thither by the ascent of the Bowels of the Lower Belly, which in expiration is a little straitned by its Muscles, and therefore the Parts contained therein as they have less room breadthways, must have more lengthways. Now we must note, that onely one sort of motion agrees to one Muscle, to wit, that of contraction; for that of restitution or relaxation is owing to the opposite Muscle, as was shewed at large in the First Book, *chap. 6.* The proper motion of the Midriff therefore is onely in Inspiration or taking in ones breath, when all its Fibres being contracted quite round, it is stretched out plain, somewhat like the Parchment upon a Drum's head: but when it is relaxed and becomes flabby in Expiration, that is onely a motion of restitution, and is not owing to it self, but to those Muscles that constringe or straiten the Chest, which are that called *sacrolumbus*, and the *triangularis* or three-corner'd one, which two lie on the outside of the Ribs as shall be shewn in the Book of the Muscles; and lastly, the internal Intercostals, described before in the second Chapter, to which some of the Muscles of the Lower Belly perhaps yield some assistance.

Secondly, By its ascending and descending, and so occasioning the Stomach, Guts, &c. to be always in a motion upwards and downwards, it assists them in driving forward the Liquors or whatever else contained in them, and so helps the distribution of the Chyle, which by the worm-like motion of the Guts alone could not so well be sent through those innumerable small Vessels through which it is to pass. And this I take to be a considerable use of it, though few Anatomists have taken any notice of it.

A *third* use is to help forward the expulsion of the Excrements, and assist the Mare in the time of her foaling. For in both those offices the Midriff by holding in the breath is kept on the tenters as it were and pressed down upon the Parts contained in the Lower Belly that are next it, and those do successively bear hard upon others that are next them, whereby every Part contained therein is somewhat straitned, and so whatsoever is contained in any of them, be it the Dung, Urine or Foal, is squeezed out and expelled.

The *last* use is what was mentioned at the beginning of this Chapter, namely, to distinguish the Lower Belly with its natural Parts, from the Chest and its vital Parts; lest from the inferiour ignoble Parts noisom Vapours should ascend up to the more noble, such as are those contained in the Chest.

Table XIII. Represents the External proper Parts of the Chest, as likewise the natural situation of the Midriff.

- A *The Sternum.*
- B *The Midriff.*
- C *The hole by which the hollow Vein ascends from the Liver towards the Heart.*
- D *The hole whereby the Gullet passeth through the Midriff.*

M

E *The*

- E The hole whereby the descendent Trunk of the great Artery passes through the Midriff.
 FF The two Appendices or Productions of the Midriff.
 GG The Muscles termed Ploæ in their natural situation.
 HH The Musculi Quadrati or square Muscles of the Loyns.
 II The Internal cavity of the Flank-bone.
 K The Muscle called Serratus major Anticus in its proper place.
 L The same Muscle removed out of its place and turned back, the better to shew the Serratus minor and other Parts underneath it.
 M The Serratus Anticus minor or lesser fore-side Saw-muscle in its place.
 NNN Several of the External Intercostal Muscles.
 OOO The Cartilaginous or gristly Parts of the Ribs fastened to the Sternum or Breast-bone.

C H A P. V.

Of the Partition-membrane called Mediastinum.

The Mediastinum why so called.

Its rise and substance.

Its Vessels.

THIS Membrane is called by the Latins *Mediastinum*, from its office of partitioning or dividing, because it divides the Chest into two parts, standing across the middle of it.

It is derived or hath its original from the *Pleura* or Rib-coat, of which we have already spoken in the third Chapter. For the *Pleura* springing from the Back-bone, keeps its way on each side of the cavity of the Chest (cloathing the inside of the Ribs) till it comes to the Breast-bone, where the two Membranes join together, but do not unite into one. From the Breast-bone these two Membranes hold a direct course back again towards the Back-bone through the middle of the Chest, but before they have gone an Inch, they begin to separate again, and that so far from one another by degrees, as to make a cavity wide enough for containing the Heart and the Heart-bag. But when they are arrived near the Back, they join together again. Note that the *Mediastinum* being composed of the doubling of the *Pleura*, must consist of four Membranes when united, (though onely of two where divided) seeing the *Pleura* it self consists of two. It is wholly membranous, as is the *Pleura* of which it is formed; smooth on the outside towards the Lungs, but rough on its inside towards the Heart, by reason that the Heart-bag adheres to it by several Fibres.

Between the duplicature of this Membrane there are many small Vessels of all sorts dispersed. For first there are *Veins* branching to it from the *Phrenica* or Midriff-vein and from the solitary Vein or *Vena sine pari*; it has likewise one proper Vein of its own from the subclavian branch, called after its own name, *Mediastina*. Secondly, its *Arteries* come from the *Phrenica* or Midriff-artery, which spring out of the descending Trunk of the great Artery. Thirdly, it hath *Nerves* from the Phrenick or Midriff twigs of those two branches of the eighth pair that descend through it to the upper orifice of the Stomach. *Bartholin* ascribes also *Lympheducts* unto it.

The

The use of the *Mediastinum* is first, to divide the Chest and Lungs into two parts, that if any hurtfull Accident should happen to one of the sides, the other notwithstanding might be preserved. And this hath been observed by Anatomists, who have found in dissections the one side or Lobe of the Lungs wasted and almost dried away in Phthysical and Consumptive Persons, and at the same time the other hath been perfectly fresh and found. And it hath been likewise seen and observed in wounds of the Chest, that if therewith one Lobe of the Lungs should happen to be hurt so much as to occasion the loss of the use of that Lobe, yet the other by performing his part hath preserved life.

The next use of the *Mediastinum* is to permit the Heart in the Heart-bag to hang dangling in a free posture, that in its motion it might not strike against the bony sides of the Chest.

Again, it serves to sustain and preserve the Vessels running through it, and by its being knit to the Midriff, preserves *that* also from being drawn too much downwards by the weight of the Bowels of the Lower Belly, especially by the Liver, whose suspensory Ligament hangs by it.

C H A P. VI.

Of the Thymus or great Kernel at the Throat; and of the Purse of the Heart called Pericardium, together with the water contained therein.

THE *Thymus* (named the Sweet-bread by some) is a glandulous or kernelly body, soft and spongie, placed in the upper part of the Chest near the hole of the Throat, lying upon the ends of the Clavicles or Collar-bones. What the Thymus is.

It hath its name *Thymus* from the leaf of Time, which it very much resembleth in shape.

Its use is to serve as a Boulster or Pillow for the Veins and Arteries to pass over or lie upon, to keep them from the hardness of the Collar-bones, the sharpness of which would else be apt to break them or fret them asunder. Its use.

Now the Vessels which do cross over this *Thymus* are the hollow Vein and the great Artery, with the many divisions and branches of the same, which are in number many, dispersed from thence into most of the extreme Parts of the forepart of the Body, as some to the Shoulder-blades, and so down the Fore-legs; again, some to the Neck and Head, namely the internal and external Jugular Veins, and the Carotid Arteries; as also those branches which run all along the Belly, which are by us Farriers called the Liver-veins. This Kernel is bigger in Foals than it is in grown Horses in proportion to their Bodies; and in Calves it is pretty large, and is reckoned for a dainty delicate bit. The Vessels which pass over it.

Next come we to treat of the *Pericardium*, or Purse of the Heart, for by these several nominations or names it goes. What the Pericardium is.

that Coat or Skin which compasseth the Heart, and in which the Heart hangeth, it being for that purpose made in figure like it.

From whence it takes its original.

It takes its original at the basis or upper and broad end of the Heart, from the outer Coats which compass the Vessels that enter into the Heart, which Coats do spring from the *Pleura*.

The substance of the Pericardium.

Its *substance* is thick and something hard, though not so hard as to hurt the Lungs when it presseth against them, or they against it; neither is it too soft, lest it should itself be hurt by the hardness of the Ribs, which in strong pulsations of the Heart it beats against, the *Mediastinum* onely coming between: but being placed between two contraries, I mean, between the soft Lungs and hard Bones, it ought to have its substance of a middle nature between both. On the outside it is rough and fibrous, adhering in many places to the *Mediastinum*; but within, it is smooth and slippery, that the Heart might move more freely in it.

Its Perforations.

It is perforated in *five* places; namely on the *right* side by the ascending Trunk of the hollow Vein, which comes up from the Liver and enters the right Ventricle of the Heart; and by the Subclavian Vein which descends from the Channel-bones into the same Ventricle; and thirdly by the Pulmonary Artery which goes out of the right Ventricle into the Lungs. On its *left* side it is perforated by the Pulmonary Vein which comes from the Lungs and enters the left Ventricle of the Heart; and lastly by the great Artery that passeth out of the said Ventricle.

Its Vessels.

The *Veins* that it is furnished with, it receiveth at the lower part of it from the *Phrenick* or Midriff-vein, and at the upper part from the Axillaries; but the Vessels from each place are mighty small.

There are no Arteries derived to it from any place, that are visible; and the reason supposed is, because it is so near the Heart, that it is immediately supplied from it with vital heat and spirit. But seeing the Heart itself is not without Arteries, though it be reckon'd the fountain of life, much less can any other part be supposed to be, and therefore neither this, though they are so slender as not to be discernible.

Those small *Nerves* it is furnished with, are branched to it from the left recurrent Nerves of the eighth or wandering pair.

To these Vessels *Bartholin* adds *Lympheducts*, which serve to drink up part of the Liquor contained in the Heart-bag, to hinder its two great encrease.

Its use.

Next come we to the *use* of the Heart-bag, which is, to cover and preserve the Heart, and to contain a certain moisture or Humour in it for the uses after-mentioned. Now concerning this Humour there are various discourses and different opinions of Authours, I mean, as to the fountain from whence it proceeds; for some will have it, that it is fed by Liquors which we drink, of which opinion is the Learned *Hippocrates*, whence in his Book *de Corde* he saith, that the Heart dwelleth in a Bladder, because of the resemblance the Humour in the Heart-bag hath to that in the bladder of Urine; though at the same time he denies this Water or Humour to have any acrimony or brackishness, as the Water contained in the bladder of Urine hath.

Of the Water contained in the Pericardium.

And to confirm this Opinion of his, that this Humour contained in the Heart-bag doth proceed from Liquors taken in at the Mouth, he cites an Experiment to be tried on a Pigg, (though I suppose any other Creature may serve as well) which after it is kept fasting for some time should have given it to drink Water or Milk mingled with Vermillion, and after

it

it hath drunk it, should immediately be killed, and as soon after as possible have his Wind-pipe opened, and also all or most of its branches, in which, saith my Authour, you will find along all its inside, the colour of the Liquor which it drank, even to the extremities or ends of the smallest Pipes; out of which Pipes (saith he) part of it is distilled into the Heart-bag. I confess this is no very probable Opinion, but I mention it for the great antiquity and fame of the Authour of it.

But other Authours are of opinions contrary to this, some saying that it proceeds from a moisture, flaver or spittle, which distils out of the Kernels under the Tongue into the Weazand, and from thence into the Arteries and Heart, and so into the Heart-bag. But this is as improbable as the former.

A late Learned Authour thinks that it issues out of certain Glands or Kernels seated at the basis of the Heart. And this is an Opinion that is somewhat likely, though I think the next is to be preferr'd before it.

Lastly, Others (amongst whom is *Bartholin*) conceive that it proceeds from moist Vapours and Exhalations forced out of the Humours of the Heart by the motion and heat thereof, which being stopt by the closeness of the Heart-bag, are by its respective coldness congealed into Water. See Bartholin, lib. 2. chap. 5.

The use of this Water or Humour is, in the first place, to keep the Heart moist and cool; for the Heart being a very hot Part, requires something of this nature to cool it, especially if that be true which some report of the left Ventricle, that it hath been found in live Dissections so hot, as almost to scald the Dissector's finger which he put into it. The uses of the Water.

By this Humour the Heart also becometh more easy in its motion, for by it, it is as it were born or buoy'd up, so that it swimmeth in a manner, whereby the sense or feeling of the weight of it is taken away.

Such a Humour as this before-spoken of is also found in the cavity of the Chest, onely something of a more ruddy colour, looking like Water and Bloud mingled together; and this I have never found wanting, but that there hath been some either little or much; with which moisture the Parts of the Chest are moistened and cooled, even as the Heart is by the moisture contained in the Heart-bag. Of the Humour contained in the Chest.

Table XIV.

Fig. I. Represents the *Sternum* or Breast-bone cut off, and lifted up or turned back, under which are to be seen the *Mediastinum*, Heart, Lungs and Midriff.

- AA Shew the inner surface or superficies of the Breast-bone, and the Gristles interwoven therein.
- BB The Lungs in their natural situation.
- CC A portion of the Midriff.
- DD The ends of the Ribs where the Breast-bone was cut off.
- E The glandulous body called the Sweet-bread or Thymus.
- F The sides of the Mediastinum plucked off from the Breast-bone.
- G The Heart in its natural situation.
- H A portion of the Heart-bag.

Fig. II.

Fig. II. Represents the Diaphragm and its Proceffes.

- A The left Nerve.
 B The right Nerve.
 C The upper Coat or Skin of the Diaphragm.
 D The naked Substance of the Midriff, or the Diaphragm laid bare.
 E A hole for the Gullet to pass through.
 F A hole for the hollow Vein to pass through.
 G The membranous or nervous part of the Midriff, being its centre.
 HHH The Proceffes or Appendices of the Midriff, betwixt which the Trunk of the great Artery doth descend.

C H A P. VII.

Of the Heart.

The Heart a principal Part.

THERE is none can be so ignorant of the Parts of the Body, as not to know that the Heart is one of the *principal* Parts thereof: for as it is the fountain of the Vital faculty and power, it ought to be so styled. It is also the place of natural heat, the root of the Arteries from whence they all spring. It is moreover the Authour of the Pulse, and the first Bowel living (as I shall more at large declare in the following Chapter) and the last dying.

From whence it derives its name Cor. Its situation.

It is called in Latine *Cor*, à *currendo* from running, because of its continual motion.

It is onely one in number, *situated* in the midst of the cavity of the Chest, as well for its security, as for the equal ballancing of that part of the Body; in which place it is incompass'd by the Lobes of the Lungs.

Yet notwithstanding the situation of it in the middle part of the Chest, it is to be understood that not the whole Heart but onely the basis or root of it is directly in the middle; for the point of it leans toward the left side, by reason of the smallness of the compass it hath to perform its motion in; for it would be apt to strike against the Midriff, should it not be so drawn to one side, which would not onely hinder its *own* motion, but also indanger the violating of the Midriff and hinder *its* motion; for *it* also is known to have a perpetual motion as well as the Heart.

Why the Pulse is felt on the left side and not the right.

And it is from the point of the Heart's inclining to the left side, that the motion of the Heart or its pulse is so plain to be felt on that side: which not being equally to be felt on the right, many, who have not taken the pains of looking or inspecting into Bodies to see the contrary, do conclude, that the Heart is situated altogether on the left side, and that it is not the point alone which they feel beat, but the whole Heart.

Another reason there is why it should incline to the left side, namely, because the ascendent Trunk of *Vena cava* lieth on the right side, so that were the point not drawn something to the other side, it would be apt

to lie upon or strike against that Vessel, and so hinder the ascent of the Blood which is brought from the Liver by that Vein to the Heart.

The Heart has a double motion, Contraction called its *systole*, and Relaxation called its *diastole*. (Though this latter may rather be deemed a ceasing from motion, than a motion.) While it is relaxed or becomes flabby and loose, it receives the Blood into its Ventricles out of the hollow Vein and Lung vein; out of the former into its right Ventricle, and out of the latter into its left. And when it contracts it self, it expels or squirts out the Blood out of its Ventricles into the Lung-artery and great Artery; out of the right Ventricle into the Lung-artery, and out of the left into the great Artery.

As to the pulsation or beating of the Heart, it is very difficult, if not impossible to give any satisfactory reason of it. Some impute it to the flowing in of the Animal Spirits by the Nerves; others to the boiling and rarefaction of the Blood in its Ventricles. 'Tis most certain that the muscular Fibres of the Heart are the immediate instruments of its motion, and that these receive their power to move, from the Animal Spirits conveyed by the Nerves: but what it is that puts these Fibres upon such a reciprocal motion of contraction and relaxation as the Heart observes, is the greatest difficulty to determine. The greatest Anatomists have confessed their ignorance in this point: I shall not therefore pretend to give a reason of it, but admire the wisdom of the great Creator in framing such an Engine, so necessary for the conveying life, heat and nourishment to all the Parts of the Body. Waving this then, I shall proceed to the further description of the Heart.

The *figure* of the Heart is pyramidal or conick, that is, it is broad at the basis or bottom, and narrow at its summity or top. On the fore-side it is bossy or bunching, but on the hinder side more flat. It is sometimes longer and sometimes shorter, as thus: When in its motion it is contracted (at which time it pours out the Blood) then is it shorter, but broader; and again when it is dilated, at which time it receives in the Blood, then is it longer and narrower.

Its *substance* is a solid, thick and compact flesh, that it might the better indure the perpetuity of the motion, and with more force drive the Blood into the extreme or farthest Parts of the Body. It consisteth mostly of musculary or fleshy Fibres, a few of which run streight and are outmost, but the far greatest part run slanting or rather spiral-wise, especially towards its point, resembling somewhat the winding-rings of a Snail's shell.

It is tied by the mediation of the Heart-bag to the *Mediastinum* and by its own Vessels to several Parts of the Body.

Its Parts are some *External* and some *Internal*. Those which be *External* or outward, are the Purse, the Coat, and the Fat; to which may be added some of its Vessels.

As to the *Purse* or Heart-bag, we have treated of it in the foregoing Chapter. As to the *Vessels*, some of them encompass the Heart, as the Coronary Vein and Arteries; others reach into its Entrances and into the Ventricles, and those are the Ascendent and Descendent Trunks of the hollow Vein and Great Artery, also the Pulmonary Vessels. Of the Coronaries we shall speak by and by in this Chapter; but of the rest, in the next.

Its Coat.

It hath a *Coat* proper to it self, like the *Coat* of a *Muscle*, for its greater firmness, which *Coat* sticks so close to it, that it is hard to be separated or removed from it. It is the same with the outer *Coat* of the *Great Artery*, as that *Skin* which cloaths the inside of its *Ventricles* is continued unto and constitutes the inmost *Membrane* of that *Artery*.

Its Fat.

The *Heart* because of its continual motion and great heat, is plentifully stored with *Fat*, to keep it from being over-dried, which *Fat* is most of it placed at the basis or bottom of it; for its point hanging in the *Humour* contained in the *Heart-bag* is continually moistned with that, so that it stands not in need of being moistned or cooled any other way.

The difference between the *Fat* of the *Heart* and other *Fat*.

Yet thus much notice is to be taken, as to this *Fat* which grows to the *Heart*, that it differs in consistence from all or most of the other *Fat* of the whole *Body*, as being much harder: for should the *Heart*, which is a very hot *Part*, have any such soft *Fat* near it, it would certainly melt it. And as the *Fat* which grows or sticks to the remoter *Parts* of the *Body* differs from this in nature, so hath it also a name different from this; for the former is called *pimele*, which signifies a kind of greasie *Fat*; but the latter is called *Adeps*, which is to say *Tallow*, and is indeed as hard as *Tallow*, differing much from *pimele* or *Grease*.

The External Vessels of the *Heart*.

Next come we to the *Vessels* of the *Heart*, and of these it is furnished with all sorts; some of which do compass it round about at its basis, like a *Garland*, which are one *Vein* and two *Arteries*.

One Vein.

The *Vein*, from its encompassing or encircling it round, is called *Coronaria*, or the *Crown-vein*, which *Vein* arises from the *Trunk* of the hollow *Vein* a little before its entrance into the right *Earlet* of the *Heart*. Small branches do spring from this *Coronary Vein*, and are dispersed or sprinkled all down the surface or outside of the *Heart* from the basis to the point.

Two Arteries.

Its *Arteries* are in number two, which are also called *Coronariæ* or *Crown-arteries*, from their encircling the *Heart* as the *Vein* does, where like it they disperse small branches about all the external surface of the *Heart*, furnishing it with arterial *Bloud* for its life and nourishment.

Their Valves.

There is observed at the original of each of these *Arteries*, as is likewise in the *Vein*, a certain *Valve* which is to be seen if you dissect either *Vessel*, opening it a little before it passeth out of the *Heart-bag*; which *Valve* or *Floud-gate* in the *Vein* lets the *Bloud* into the *Heart*, but suffers none to come out again that way; and in the *Artery* it permits the *Bloud* to issue out of the *Heart*, but will let none return back out of it into the *Heart*.

Nerves.

The *Heart* is also furnished with very many but very small *Nerves*, springing from branches of the eighth pair, which branches are those that are sent to the *Heart-bag*.

They branch into and enter the *Heart* in three several places; first, one enters into the *Heart* it self, another into the *Earlets* of the *Heart*, and a third into its *Vessels*.

Thus much of the *Parts* of the *Heart* which in some regard may be called *External*; in the next *Chapter* we shall proceed to those that are more *Internal*.

Table XV. Representeth the Heart and Lungs in their natural posture, but taken out of the Body.

- AA *Shew the Heart in its Proper place.*
- BB *The several Lobes of the Lungs.*
- CC *The remaining part of the Pericardium or Heart-bag, a portion of it being cut off the better to shew the Heart.*
- DD *The Coronary Vessels.*
- E *The Arteria magna or Aorta going out of the Heart.*
- F *Its descending Trunk.*
- G *Its ascending Trunks.*
- H *The Vena cava descendens, or the descending Trunk of the hollow Vein.*
- I *The ascending Trunks of the same.*
- K *A portion of the Aspera Arteria or Wind-pipe.*
- L *Its division or branching into the Lungs.*

C H A P. VIII.

Of the Ventricles, internal Vessels, Valves and Earlets of the Heart.

WE will first speak of the Ventricles or *Sinus's* of the Heart, being in number two, on each side one, distinguished or divided by a fleshy partition into a right and a left.

The right (called the right *Sinus* or Ventricle, and by some the *Cave* or Chamber) is somewhat bigger than the left, because it receives as well that Blood which is spent upon the nourishment of the Lungs, through which the Blood passes from this Ventricle to the left, as that which actually is conveyed into the left, and from thence sent forth by the Arteries into all parts of the Body. But its larger capacity is onely in respect of its width, for the left is rather longer than it, as reaching nearer the tip of the Heart.

It is in *figure* not exactly round, but rather semicircular, or half-moon fashioned.

The *substance* of its sides is not so hard and thick as is that of the left, nor is the surface of its inner cavity so uneven; nor has it so many and so strong fleshy Fibres reaching this way and that way, as the left hath. For it was not necessary it should be of so strong a composition as the left, seeing neither is the Blood rarefied so much in it, nor does it send the Blood out of it to any greater distance than the Lungs, whereas the left pours it into the remotest Parts of the Body, and therefore requires a stronger constitution to squirt it out.

The *use* of this Ventricle is first to receive the Blood out of the hollow Vein returning from the circulation, as also the Chyle and *Lympha* mingled with the Blood, out of the axillar Vein, and then to attenuate, concoct and inspirit them for the nourishment of the Lungs, to which they

are carried under the form of Blood by the Pulmonary Artery, otherwise called the Arterial vein. But it is but a very small portion of the Blood that is spent upon the Lungs, the greatest part of it passing by the Pulmonary Vein to the left Ventricle, there to receive a greater perfection.

Why Fish
have but one
Ventricle.

Now it is worth observation in this place, that such Creatures as live in the Water, as Fish in general, which have no Lungs, have but one Ventricle in their Heart. For the reason why Animals that live upon the Land have two Ventricles, being, that the Blood as it passes from one to the other, should be conveyed through the Lungs, there to be ventilated and cooled by the Air drawn in in inspiration; and seeing Fish live in a cold Element, *viz.* the Water, which encompasses their whole Body, *that*, of it self, is sufficient to attemper the heat of the Blood; therefore as it is impossible they should make any use of Lungs in the Water, so there seems to be no need of them, nor consequently of two Ventricles in the Heart, which are necessary for Land-animals that have Lungs, and breathe in the free Air. How far Water approaches to the nature of Air, or whether there be any truly airy particles contained in the pores of the Water; and if there be, whether there be any way imaginable whereby they can insinuate themselves into the Blood and Hearts of Fishes, are Points too nice and philosophical for me to intermeddle with. But seeing Fish can live so brisk for very many years without respiration (at least properly so called, or that we can conceive of) one would suspect that some of our late Anatomists attribute too much virtue to the Air that we breathe in, as if it were *the All* that continues the Vital flame as they speak, and that the Vital heat and spirit are no otherwise owing to the Heart, than as like an Engine it keeps the Blood in motion, and distributes it with the Spirits into all Parts of the Body by the Arteries. But this by the bye.

The left Ven-
tricle.
Its largeness.

Next come we to the *left* Ventricle, which in magnitude doth not equal the former, it being much less, by reason it is to contain a less quantity of Blood than the right Ventricle doth, part of that Blood that comes out of the right, being spent upon the nourishment of the Lungs, before it reaches the left.

Its figure.

This left Ventricle differs also in *figure* from the right: for as the right is observed to be semicircular, the left is almost round and longer, reaching almost down to the point of the Heart, which the other doth not.

Its sides are
thicker,

Likewise the flesh or *wall* of the left is much *thicker* than that of the other, and that partly because of the smallness of the cavity, which the narrower it is, must needs leave the sides so much the thicker. Onely the left side of this Ventricle near the lower end or tip of the Heart, is thinner than any part of the sides of the right.

and harder
than those of
the right.

Also it is *harder* and more compact than the other, that the Vital Spirits might not exhale or evaporate, and that its constriction might be the stronger, so that the Blood might with more force be thrown or pulst out and vented into the farthest parts of the Body.

Its use.

Into this Ventricle is the Blood received out of the Lungs by the Pulmonary Vein (otherwise called the veinous Artery.) Which Blood when it is squirted out of this Ventricle into the great Artery, differs very much in colour from that which issues out of the right Ventricle into the Pulmonary Artery: for this latter is of a dark purple colour, but the former of a florid scarlet. But most think that this alteration of colour is not

so much owing to any supereminent virtue in this Ventricle above the right, as to the particles of Air that insinuate themselves into the Blood in the Lungs while it passes out of the Pulmonary Artery into the Pulmonary Vein; for Dr. *Lower* affirmeth, that if in Live-dissections one open the Pulmonary Vein in its passage from the Lungs to the left Ventricle, the Blood will appear to be of the same scarlet colour as when it comes out of the said Ventricle. Supposing this to be so (which I think we may do upon the testimony of so worthy and creditable an Authour) yet it cannot be denied but that the airy particles must be more intimately mixed with the Blood by the great agitation it receives in the left Ventricle, so that we may still consent to the Ancients, that Vital Spirits (in which, Air seems to be a main Ingredient) are perfected and rectified to their height (as it were) in it more than in the right. The use therefore of the left Ventricle is to perfect the Vital Spirits, and to transmit them, together with the Blood, by the Arteries over all the Body, for the preservation of the Vital heat, and for the nourishment of each Part.

The insides of both the Ventricles are unequal or uneven and rugged, being hollowed into many furrows distinguished by fleshy Fibres, that the Blood which comes into the Heart might be the more agitated in them, and thereby more intimately mixed with the Chyle and Air that come along with it, the first into the right Ventricle, and both into the left. From these fleshy Fibres are nervous ones extended to the Valves, of which we shall discourse by and by. They are more numerous and stronger in the left Ventricle than in the right, because a stronger constriction was necessary for the former than for the latter, seeing from the former Blood is sent to all Parts of the Body, but from the latter to no greater distance than the Lungs, as was observed before. These Fibres, Furrows and Valves you may see very well express'd in the following Figure.

These Ventricles are divided by a Wall called the *septum* or partition, which is nothing else but the right wall of the left Ventricle; wherefore its right side is bunched, but the left hollow. On its left side it is furrowed and unequal as the rest of the Ventricle is, but on the right it is well nigh smooth. It is a very ancient opinion, that there are a great many large pores or holes in this *septum*, whereby the thinnest and most spirituous part of the Blood passes out of the right Ventricle into the left immediately, without taking that circuit through the Lungs that the rest doth. They are said to be wider on its right side, and going slanting to grow narrower towards the left. There are many Modern as well as Ancient Vouchers of this opinion: amongst whom is *Bartholin*, who having enumerated several Anatomists that have affirmed to have seen them themselves, says that he himself has seen the *septum* of a Hog's Heart slantingly pervious in several places with great and manifest pores, so large as to admit a pretty big Pease, and lying open without a Probe, which being put into any one of them on the right side passed to the left Ventricle, where a thin Membrane did hang before the mouth of the Pore like an Anastomosis (as he calls it, I suppose he means a Valve) which hindered the putting in the Probe on that side, and consequently must have hindered the return of the Blood out of the left Ventricle into the right when the Animal was living. And he thinks that the *septum* is nourished by the Blood that passes through these Pores, seeing the Coronary Veins (above-described) run onely through the surface or outside of the Heart.

he will have not onely the more spirituous part of the Blood, but the thinner part of the Chyle also to pass through them. It would be *tedious* to recite all those Authours that he quotes to second him, as also his Apology for their often not-appearing in many dead Bodies, seeing there are many passages besides these in Live-creatures, that there are no footsteps of after they are dead: for as it seems not likely that the *septum* should be nourished by blood that passes so rapidly through these supposed holes; so by the carefulest examination of other skillfull Anatomists there have been no such holes to be found, unless they were first made by the Probe; though indeed there are several pits that look as if they went through, which I believe to be onely framed for the greater agitation of the blood in the Ventricle.

The internal
Vessels of the
Heart.

In the foregoing Chapter we described those Vessels that may be called *external* from their running chiefly on the outside of the Heart, (commonly named the Coronary) by which it is nourished: but there are another sort that may be termed *internal*, which are such as open into and out of its Ventricles or inward *Sinus's*, but yield no nourishment to it. These are four, the *Vena cava*, and pulmonary Artery; the pulmonary Vein, and great Artery.

Vena cava
and vena Ar-
teriosa be-
long to the
right Ventri-
cle;

Of these, the *Vena cava* or hollow Vein, and the *Vena Arteriosa* or pulmonary Artery do belong to the right Ventricle; the hollow Vein filling it with venal blood returning from all Parts of the Body, which it receives in when the Heart is relaxed, which state is called its *diastole*; and the pulmonary Artery carrying forth the said blood into the Lungs when the Heart is contracted, which state of the Heart is called its *systole*.

Arteria ve-
nosa and
Aorta to the
left.

To the left Ventricle do also belong two Vessels, namely, *Arteria venosa* or the pulmonary Vein, and *Aorta* or the great Artery. The pulmonary Vein within the substance of the Lungs doth receive the blood from the pulmonary Artery, and pours it into the left Ventricle, there to kindle and ventilate the vital flame, and to perfect the arterial blood and spirits. The great Artery is the trunk from which all other Arteries do branch, and through which the arterial blood (after it is in this Ventricle perfected as aforesaid) is dispersed or thrown into all the Parts of the Body, for the life and nourishment thereof.

Three Valves
to the Vena
cava, called
tricuspides.

Now to each of these four Vessels do belong *Valves*, for the better performance of their offices before spoken of. And first to the hollow Vein do belong three, which are of a triangular figure, and are from that figure called *treble-pointed* Valves. They are placed at the basis or bottom of the Heart at the entrance of the said Vein into the Heart, and do look from without inward, that so they may admit of the blood's passing through them into the Heart, but suffer none to pass out again that way.

Three also to
the vena Ar-
teriosa, cal-
led sigmoi-
dez.

To the pulmonary Artery do also belong three Valves, which, contrary to the former, look from within outward, and from the resemblance they have with the letter C, are called *Sigma*-fashioned, the old Greek *Sigma* being of that shape. These Valves as the former are placed at the basis of the Heart, and at the entrance or rather outlet of the Ventricle. And their use is, to let the blood, brought into this Ventricle by the hollow Vein, pass again out of the said Ventricle into the pulmonary Artery, to be carried by it into the Lungs; but they will not admit of any blood to return from the Lungs into it.

To

To the pulmonary Vein do belong two Valves, which look from without inward, as the treble-pointed Valves do, and their use is to admit of the blood brought out of the Lungs by the pulmonary Vein, into the left Ventricle, but they will suffer none to pass by that Vein back to the Lungs again. These, from the resemblance they are said to have with a Bishop's Mitre, are called Mitre-shaped Valves.

Two to the Arteria venosa, called mitratis.

To the *Arteria magna* or great Artery do also belong three Valves, which go by the name of Semilunary or Half-moon-fashioned Valves. Their use is to hinder any blood from returning into the left Ventricle out of the great Artery; but they permit the Blood to pass by them out of the Heart into the said Artery, from whence it is sent by its several branches into all the Parts of the Body.

Three to the Aorta, called semilunares.

Having spoken to the Ventricles, Vessels and Valves of the Heart, we are in the next place come to treat of the two Appendices or Processes which are placed at the bottom or basis of it, and are called the *Ears* or *Earlets* of the Heart, from some resemblance in shape which they have to the Ears of the Head. They are in number two, to each side of the Heart one, answerable to the number of the Ventricles. Of these, the right is larger, but softer; the left lesser, but harder. The right is larger, because the orifice of the hollow Vein belonging to the right Ventricle, is much bigger and larger than the orifice of the pulmonary Vein belonging to the left Ventricle. For it was not needfull that the Lung-vein should be so large as the hollow Vein, seeing the blood that it conducts to the left Ventricle is neither so much as that which is brought by the *cava* to the right, and besides is thinner and more spirituous being impregnated with Air in the Lungs, and therefore passing more quickly needs the narrower channel.

The auricles of the Heart.

The external part or *surface* of them, when full or extended, is smooth and bunching; but when empty, wrinkled.

Their surface.

Their *substance* is peculiar, such as is to be found in no other part, thin and soft that they might be the easier contracted, and yet nervous and strong, that they might endure that continual motion to which they are destin'd. Of the two, the left is the more compact, thick and fleshy. On their inside they have Fibres running from their basis where they are joined to the Heart, towards their top where the Veins enter them, (such as the Ventricles of the Heart themselves have) by help whereof they contract themselves in their *systole*, and squeeze the blood contained in them, into the Ventricles.

Their substance.

These Ears or Earlets have (as the Heart it self hath) two motions, first the *systole* or contractive, next the *diastole* or dilative motion. There is also betwixt these two motions (both in the Ears and Heart) a rest or pause, easy to be discerned in sick Horses, or Horses ready to die, but not so easy to be either discerned or felt in a sound or healthfull Horse; for in such, the motions are performed so swiftly, that there seems to be an immediate passage from one to the other, without any intermission or resting between. This pause or rest between the two motions, is called *perisystole*.

Their motion.

The *systole* and *diastole* of both Earlets do happen at one and the same time; for when the right undergoes its *diastole*, then and at the very same instant the left undergoes the same. And they do the like in the *systole*. But though the Heart hath the same motions as these Earlets have, yet it doth not perform them when these do; for the *systole* of the Earlets happens at the same time with the *diastole* of the Ventricles; and on the

the

the contrary, the *systole* of the Ventricles, with the *diastole* of the Earlets.

Their use.

Now the use of these Ears or Earlets is, to prevent the too violent rushing in of the blood out of the *Cava* and Lung-vein into the Ventricles of the Heart, whereby both the Valves might have been violated, and the Vital faculty suffocated. For these receiving the blood out of the said Veins, do measure it as it were into the Heart, so much blood distilling out of those Veins into these Earlets in each of their *diastole's*, as can be conveniently rarefied and elaborated at one time in the Ventricles.

Table XVI.

Representeth the Earlets, Ventricles and Valves of the Heart.

Figure I.

Shews the *Vena cava* with the right Ventricle dissected, so as to shew the treble-pointed Valves.

A Shews the orifice of the coronary Vein.

B The treble-pointed Valves, which admit of the blood into the right Ventricle, but hinder its return back that way.

CCC The little Fibres which fasten the ends of the Valves to the substance of the Heart.

D The Ventricle cut long-ways, the better to shew the before-named Parts.

Figure II.

Shews the right Ventricle of the Heart laid farther open, to shew the Valves of the pulmonary Artery.

A Shews the Ventricle opened.

BBB The Sigma-fashioned Valves of the pulmonary Artery, that let the blood out of this Ventricle into the Lungs.

CC A Probe thrust through the pulmonary Artery cross the right Ventricle of the Heart.

Figure III.

Shews the left Ventricle opened also long-ways to shew its Valves.

AA The pulmonary Vein coming from the Lungs and bringing the blood from thence, which it pours into the left Ventricle.

BBB The three Mitre-shaped Valves of the said pulmonary Vein.

Figure IV.

Figure IV.

Shews the great Artery cut afunder near the Heart to shew its Valves.

AAA *The said Valves of the Aorta or great Artery.*

BB *A Probe thrust through the pulmonary Vein into the left Ventricle of the Heart.*

C H A P. IX.

Of the Organs of Breathing, and their Use; viz. of the Lungs, and Wind-pipe.

THE *Lungs*, which are the chief Instruments of breathing or respiration, are called in Latin *Pulmones*, in Greek *Pneumones*, from their office of drawing in and blowing out the Breath or Air. The names of the Lungs.

Their *situation* is in the cavity or hollowness of the Chest, which cavity they almost fill up; especially when they are distended or filled with wind. They are divided into two equal parts called *Lobes*, one of which lies on the right side of the *Mediastinum*, or Partition-membrane of the Chest, and the other on the left. Their situation and Lobes.

Their *substance* hath hitherto been taken to be a *parenchyma* or fleshy substance; but by the diligent searching into Nature of some of our Modern Authors, especially of an Italian named *Malpighius*, they have been found of a contrary substance; for he affirms them to be excarnous or without flesh, and merely membranous, made up of the branches of the Wind-pipe and little bladders at the ends of them, likewise of the pulmonary Vessels, and the Skin that cloaths them. But the greatest part of their substance consists of the little bladders. Their substance.

This that worthy Man experienced by casting Water into the Lungs of some Creatures he dissected, while they were yet warm, so often till the whole frame of the Lungs appeared white; then squeezing the water clean out, he with a pair of Bellows or Pipe filled them by the Wind-pipe full of Air, and pent it in by tying the Windpipe; which done, he hung them up to dry; and when they were dried, he could discover (by holding them up to the light) the little bladders at the ends of each little branch of the Wind-pipe, as they are lively represented in Figures by that great Inquirer into Nature, the never to be forgotten Doctor *Willis*, justly stiled the honour of his University and Country, in the second Part of his Book called *Pharmaceutice rationalis*. See Willis Part 2. Sect. 1. cap. 1. of his Pharmaceutice rationalis.

Again, saith the forementioned *Malpighius*, If you cut any part of the Lungs thusdried, you may very plainly see a great number of these bladders looking white. Moreover he affirms that by the help of a Microscope he could discern a certain wonderfull Net as it were, tying all these bladders to one another, which he conceived to be made up of the small branchings of the pulmonary Artery and Vein, which Vessels convey the blood through the

the slender and winding ducts, and through the manifold bendings of the Pipes. And besides these Vessels which make this Net, Doctor *Willis* saith that there are another sort to be perceived in living Dissections, which are called *Lympheducts*, and are dispersed all over the Lungs. Of what nature and use these Vessels are, we have shewn above in the First Book, chap. 12. and shall do further by and by. And *lastly*, he says there are abundance of twigs of *Nerves* distributed every-where through them. Onely one thing further is to be noted concerning the Vessels of the Lungs from the said Doctor's observation, that the Blood-vessels thereof are not onely branches of the pulmonary Artery and Vein, but also some proceed from the *Aorta* it self; which should seem to intimate that the Lungs are truly nourished by these last, as are all other Parts of the Body, and that the blood that comes to the Lungs from the right Ventricle of the Heart by the pulmonary Artery, and returns to the left by the pulmonary Vein, passes not this way for the nourishment of the Lungs, but onely that it may be impregnated with Air, without which as it wants of its perfection, so is it unfit and unable to preserve the vital heat of any Part, or to contribute any nourishment to it. But this onely by the bye.

Table XVII.

Representeth the Wind-pipe descending into the Lungs, as also the whole structure of the Lungs placed as they lie in the Body, to shew their several Lobes, as also the *Lympheducts*, after Doctor *Willis*.

Figure I.

- AA Shew the substance of the Lungs.
- BB The several Lobes.
- CC The Lympheducts.
- DD A portion of the *Aspera Arteria* or Wind-pipe.

Figure II.

- AA Shew the upper part of the Wind-pipe cut off.
- B The *Cartilago scutiformis*.
- C The Glottis.
- DDD The several Gristles that make the Wind-pipe.
- EEE The Membranes betwixt each Cartilage or Gristle, which make the other part of the Wind-pipe.

Now the several things here named, of which the Lungs are composed or framed, do plainly shew their substance is not carnous or fleshy, but merely fistulous, being compacted of Pipes of several kinds and magnitude, and variously and intricately disposed; which Pipes we will particularly speak to in order, and first of the chief of them, which is the Wind-pipe, called *Aspera Arteria* the rough Artery.

The *Aspera Arteria* is a Pipe or Chanel which descends down the Neck beginning in the Throat at the root of the Tongue, and reaches as far as the Lungs, in which it disperses it self into innumerable branches great and small, which branches reach to all the extreme parts of their substance,

The Wind-pipe.

substance, and at last end in little bladders, each of them in resemblance like a Grape, into which they conveigh the Air in inspiration. These Grape-like Bladders are lively represented by Doctor *Willis* in a Lobe of the Lungs of an Ox, as you may see in the first Figure of the third Table in his second Part of the operation of Medicines; of which bladders you may there reade more at large.

Willis Phar. maceut. Ration. Part. 2. sect. 1. cap. 1.

The fore-mentioned Wind-pipe is by Anatomists divided into three principal parts, viz. the *Larynx* or Throttle, which is the upper end of it (of which more afterwards.) The second part between the *Larynx* and the Lungs, being a long Pipe, is called particularly *Trachea* or *aspera Arteria*, the rough Artery; rough, to distinguish it from the smooth Arteries which contain the blood and vital spirits; and an *Artery*, because it keeps or contains the Air in respiration. The last part of the Wind-pipe is distinguish'd by the name of *bronchus* or *bronchia*, which includes the ramifications or branchings of it in the Lungs; though the name *bronchus* is sometimes used to signify all of it.

The Parts of the Wind-pipe.

Now before we pass on further to the description of this Wind-pipe, it will not be amiss to examine whether any part of the Liquors that an Horse drinks pass along it, or whether all go down the Gullet. That part of the drink glides down the Weazand was the opinion of the Ancient Physician *Hippocrates*, who experienced the same in an Hog newly killed, in whose Lungs was found a quantity of Liquor of the same colour with that which the Hog had drunk a little before. And *Bartholin* thinks that the same thing may be proved from an observation of *Julius Fasolin* an Anatomist of the City of *Naples*, who seeking in the Body of a Noble Person the cause of his death, found his Heart-bag so filled with humour, that it being squeezed, some of the said humour came out of his Mouth. But methinks it is an odd inference to conclude from hence, that therefore some part of the drink usually passes down the Wind-pipe. For if one should suppose that it did so pass, it cannot easily be imagined by what ways it could pass from thence to the Heart-bag; seeing all the branches of the Wind-pipe end in the Lungs, which are covered with a Membrane that never adheres to the Heart-bag, and very rarely if ever to the *Mediastinum* that comes between the Heart-bag and the Lungs. 'Tis true it seems somewhat strange, that upon pressing the Heart-bag, the liquor contained in it should come up at the Mouth; but if the matter of fact be true, it must do so by some preternatural passage, seeing every one that is skilled in Anatomy knows, that there is no communication between the *Pericardium* and *aspera Arteria*. Indeed as to the great quantity of humour in the Heart-bag, I have observed the same in Horses, in which I have seen both it and the Chest extremely filled with liquor, but I dare not conclude from thence, that it came thither down the Wind-pipe; for seeing it has been onely in diseased Horses, that have been broken-winded and troubled with coughs, I am much rather inclined to think, that so great quantity of water proceeded from a Dropsie of the Chest, which is a disease not unfrequent in Mankind, in whom yet the best Anatomists deny that the least drop of drink does naturally pass down their Wind-pipe: of which any one may be pretty well satisfied, that has observed in himself or others, how when upon occasion of laughing or the like in drinking, any of the drink passes down the wrong Throat as we say (which is down the Wind-pipe) the party falls presently into a most violent cough. And as to *Hippocrates's* observation, 'tis more likely the Hog's Lungs should

Whether any part of the drink pass by the Wind-pipe into the Lungs.

be tinged by some preternatural and diseased humour lodged in them, of a like colour to which his drink happened to be, than that they were tinged by the drink it self.

The coats of
the Wind-
pipe.

The Wind-pipe is covered with two coats or skins, one *outward* and the other *inward*.

The *outwardmost* is but of a reasonable thickness, neither so thick nor so strong as the other. It springs from the *pleura* or skin which invests the Ribs, and sticks close to the Ligaments of the Gristles, yea does it self serve to knit them more firmly one to another, and is a mean of connecting the whole Pipe more strongly to its neighbouring Parts. It also ushers along the Nerves of the Wind-pipe and Lungs.

The *innermost* is thicker and more solid than the former, in the Throttle especially, whose inside it covers, as also all the inside of the Wind-pipe and its branches from thence to the bottom of the Lungs. It has two rows of Muscular Fibres, the outer streight, the inner slanting; the first serving to shorten the Wind-pipe, the latter to straiten it. And one reason of the great strength of this Membrane seems to be, that it might the better endure the violent motion of coughing without being injured. It is very sensible, and has its inside besmeared usually with a fattish or slimy humour, which likely is separated in the Kernels of the Throat, and this serves to keep it moist and glib, that respiration may be performed with the greater easiness and freedom.

The Gristles
which make
the Wind-
pipe.

Between these two coats or skins is the body or substance of the Wind-pipe, being partly of the nature of a Gristle and partly of a Ligament; for it is made up of many round *Gristles* like Rings, being pretty round on its fore-part, but on the back-part which is next to the Gullet a fourth part of the circle is wanting, in the room of which there is a thick, strong and membranous substance, more soft than the Gristles, that the Gullet which lies upon it on that side, might not be hurt by them.

These Ring-fashioned Gristles are joined together by strong Ligaments, which Ligaments do every-where keep the Gristles at an equal distance one from the other.

Table XVIII.

Fig. I. Shews the lower part of the Wind-pipe with all its branches as they were spread through the Lungs, clearly separated from all other Parts of the Lungs; to which branches are annexed all the bladders of Air, found out by *Malpighius* and here lively represented.

AA Shew a portion of the aspera Arteria or Wind-pipe.

BBBB Its division into branches which run into the several Lobes of the Lungs.

CCCC The several extremities or ends of the said branches.

DDDDDD The innumerable little bladders at the ends of those branches.

E Shews where the Wind-pipe is cut off from the upper part of it.

FFF The several circular Gristles which help to compose the Wind-pipe.

GGG The membranes or skins betwixt each Gristle which are another part of the substance of the Wind-pipe.

Fig. II.

Fig. II. Shews the upper part of the Wind-pipe cut off.

- A Shews the cartilago scutiformis, or Shield-fashioned Gristle.
- B The several Gristles and Membranes that make up the body of the Wind-pipe.

The Wind-pipe like other Parts hath *Vessels* of all sorts; first it hath *its Vessels*. *Veins* from the external Jugulars; *Arteries* from the *Carotides*; and *Nerves* from the recurrent Nerves of the wandering or eighth pair, (commonly reckoned for the sixth.)

When it is descended about two hands-breadth into the Chest, it is divided into two trunks, one whereof goes into the right Lobe of the Lungs, and the other into the left. Into which as soon as they are entered, each is again subdivided, and those subdivisions still branch out into more, till they become very numerous and slender, and are dispersed among the pulmonary Bloud-vessels, but end into the little bladders above-described. *Its division.*

The *use* of the Wind-pipe is, first, to serve as a nozle to a pair of Bel-lows, to wit, that the Lungs by the Air entring in by it may be heaved up. Whence when the inside of it is slabby with too much flegmatick humour, or there happens to be any obstruction in it, or any of its branches in the Lungs, there follows a wheezing and shortness of breath, because the Air has not a free ingress into the Lungs. *Its use.*

The next use of it is to let the Air out from the Lungs, and together with it smoaky vapours steaming through the pores of the Lungs out of the blood. By help of it also, but especially of the Throttle or upper part, does the Horse neigh, or whinney as they call it in some Countryes, while the Air is driven forcibly out of it in expiration. And thus much as to the Wind-pipe.

A second sort of Vessel or Pipe dispersed through the Lungs, and composing a considerable part of their bulk, are the Bloud-vessels, which are partly a branch from the great Artery, but principally the pulmonary Artery and Vein, whose branches are spread to and fro in a great number through its whole substance, and there complicated and twisted with the branches of the Wind-pipe, the Artery running along the under side and the Vein the upper side of it, both cleaving so close to it that they are not easily to be separated. These Arteries and Veins have communication one with another in several places by *anastomoses*, the little twigs of the Arteries opening into those of the Veins, for the readier circulation of the blood through the Lungs. Most admirable is the contexture of these Vessels about the Air-bladders; for their small thred-like twigs are interwoven one with another with the most curious artifice (somewhat resembling a Net) round about all of them; which most probably is so done, to the end that all the particles of the blood may be impregnated with Air, while it passes through these fine Vessels that twine about the Air-bladders on all hands. *The Bloud-vessels of the Lungs.*

Table XIX.

Representeth the pneumonick or pulmonary Artery and Vein cut off from the right and left Ventricles of the Heart, and also freed or separated from the branches of the *bronchia* or Wind-pipe.

AA Shew the pneumonick Artery cut off close by the right Ventricle of the Heart.

BB The pneumonick Vein cut off from the left Ventricle of the Heart.

CCCC Their several branches accompanying the branches of the Wind-pipe from which they were pulled or torn, which are dispersed through the whole substance of the Lungs.

DDDD The ends or extremities of all the said branches which do end in the extreme parts of the Lungs, and which for their smallness are called capillary or hairy.

Their Lympheducts.

A third sort of Vessel branching in the Lungs are the *Lympheducts*, so called from their office, which is to hold and convey a certain kind of water or humour called *Lympha*. These Vessels we described more fully in Book I. chap. 12. Here they wait on the Veins and Arteries through the whole surface of the Lungs, and receive the humour or water that they contain from them, being first separated by the Glands; which humour seems to be a superfluity of the blood and it may be the nervous juice, which after they have received, they discharge into the thoracick duct, into which the greater branches of them are inserted. Though these Vessels be but slender, yet they are of great use and necessity; for as Doctor *Willis* affirms, if at any time any of the branches of them happen to be obstructed or broken, there follows thereupon in Man a Dropsie of the Lungs and Breast, oft-times accompanied with Coughs or Phthisicks: and this happens, because by their being obstructed or broken, the superfluous humour which they like so many chanelles use to contain or let pass through them and carry off, is left behind, or distils into the Chest, which there breeds the fore-mentioned Distempers. Which opinion of his confirms me in my belief of the original of that watery humour in a Horse, which I have very often in a plentiful manner found in his *Thorax* in dissection, as I have above in this Chapter already said.

Their Nerves.

To these three sorts of Vessels a fourth is also added, which are the *Nerves*, with which they are well stored, having innumerable branches of them dispersed through all their substance, accompanying the Blood-vessels and Pipes of the Wind-pipe; which Nerves do branch to them from the recurrent Nerves of the wandering pair.

Their investing Membrane.

Now the Lungs being thus interwoven with these four sorts of Vessels, are covered with a strong *skin*, or indeed two skins, for it is no hard matter to separate it into two.

These skins are furnished with very many pores or holes of an indifferent largeness, plain to be seen (saith *Bartholin*) if you blow up the Lungs with a pair of Bellows or Pipe. Which he doth not onely affirm that himself hath seen, but also quotes *Johannes Walæus*, who (saith he) hath observed them to be in Live-anatomies as large as to contain a pretty big Pease. Such pores, perhaps, there may be discernible in Live-anatomies, though whether so large as to receive a Pease I somewhat question.

question. Indeed I had never my self the opportunity of observing the Lungs in Creatures yet alive, but as soon as they have been dead, though I have made never so great haste to take the Lungs out before they should be any thing cold, yet I could never see any of them, although I have blown the wind through the Wind-pipe with such violence, that I have broke some of the small branches of it, and with the said wind have raised little bladders in the outer skin of the Lungs; I say notwithstanding, I could never see or discern any of these little pores, that did let any of the said wind out, but the wind hath continued in those little bladders several days. Which experiment I alledge not with a design to disprove those worthy and learned Anatomists, that affirm to have seen them; but only to shew that if any such there be, nothing passes through them out of the Lungs into the Chest. But now on the other hand, that something may be received by them out of the cavity of the Chest into the Lungs, is not improbable; seeing one cannot imagine how corrupt purulent matter collected in the Chest from an Imposthume breaking in it, or the like, should by any other way get into the Wind-pipe, so as to be cough'd up, which it often is as well in Horses as in Men. If the investing skins be removed in any part of the Lungs, and afterwards one blow into them through the Wind-pipe, then will the Air issue pretty strongly out at the Breach. The outer of the skins is smooth and thin, but the inner is pretty thick, and on its inside rough, appearing like an Honey-comb, by reason of the extremities of the Vessels, and of the bladders ending at it. Both growing close together as they do, make a very strong Membrane, which is very necessary; for otherwise in anhelation, or deep and violent inspiration, it would have been in danger of breaking when the Lungs are so much distended, to the great inconvenience if not certain death of the Creature to which it should so have happened.

Having finished the description of the several things of which the Lungs *Their action and use.* are compounded or framed, in the next place we proceed to speak of their *action and use.*

Their first *use* then is, (according to *Galen*) to serve as a soft Pillow or Bolster for the Heart to rest upon, that the hardness of the Parts behind them should not offend it in its pulsation.

Secondly, They are the instruments of respiration or breathing, which is their proper *action*. Now respiration is performed by two motions of the Lungs, *viz.* dilatation and contraction. When they are dilated, they receive in Air, and this is termed *inspiration*; but when they are contracted, they expel or drive forth the Air, which is called *expiration*.

While the Air is drawn in in inspiration, a double benefit accrues to the Beast: First his Heart and Blood are thereby cooled; whence we see that the hotter he is, the more frequently he draws his breath, that the blood may be the more fanned by the cool Air. Secondly, hereby the vital flame is continued; for as an ordinary Fire is extinguished by withdrawing the Air from it, so does the Animal die when it is denied Air to breathe in. To these benefits of inspiration may be added, that when the Lungs are heaved up by the Air drawn in, their substance is rarefied, so that there is granted a freer circulation of the blood through them.

The Air having performed these offices, by its stay in the Lungs it becomes hot, and so can be of no further use for cooling the Heart and Blood; and its nitrous particles are consumed by the vital flame that feeds upon them, and therefore it becomes necessary to expel it, that there may be

be room for new and fresh Air to be drawn in for the uses aforesaid. So that this drawing in and expelling the Air succeed one another by turns, and answer to the *systole* and *diastole* of the Heart; onely this motion of the Lungs is partly voluntary and partly natural, but that of the Heart wholly natural.

But neither is *expiration* or breathing forth without its particular uses; for by it are vented or voided the smoaky or sooty steams or excrements of the Heart and arterial Blood, (which excrements are brought from the Heart through the pneumonick Artery with the blood:) also the thin and thick excrements of the Lungs gathered in the branches of the Wind-pipe are by this motion of expiration, (heighten'd into a cough) brought into the one great trunk thereof, through which as through a Reed it is driven by the force of the Air up to the Mouth and Nose, to be by them voided.

Of what nature the motion of the Lungs is, and by what Muscles of the Breast it is assisted, the Reader may inform himself in the fourth Chapter of this Book that treats of the Midriff, whose motion corresponds to this of the Lungs.

C H A P. X.

Of the Neck.

HAVING now finished my Discourse of the two Lower *Venters*, order of Dissection requires that I should ascend to the third and uppermost *Venter*, and treat of the Head and Animal Faculty; but I will first speak to those Parts which lead me thither, and those are the Parts of the Neck.

The Neck is called in Latin *Collum*, à *colle*, from an hillock; for it ariseth out of the Body as an hill doth out of the rest of the Earth.

It comprehends the distance between the Head and Breast, and its Parts are *containing*, or *contained*: as for the former, they are such as are found in the other Parts of the Body; but

The contained Parts of the Neck. The Parts *contained* are peculiar to it self, and are these: the Gullet, the Wind-pipe, the *Vertebræ*, or Joints of the Neck, and its Muscles. Of these two latter we shall discourse in the Fourth and Fifth Books; and of the two former, we treated of one in the First Book, as belonging to the Stomach, and of the other in this as pertaining to the Lungs. But because the uppermost parts of both these next to the Throat are distinguish'd from the rest by peculiar names and have particular uses, we shall treat of them in this Chapter. Now the top of the Wind-pipe is called *Larynx*, and of the Gullet, *Pharynx*.

of the Larynx. The *Larynx* or Throttle is situated, as hath been said, at the upper part of the Neck, adjoining to the root of the Tongue. It is in Humane Bodies the instrument of the Voice, and in whatsoever other Creatures, of that noise which they make, by what name soever it be distinguished, as particularly of the *neighing* of an Horse.

Its

Its *figure* is round and almost circular, onely bunching a little out on the fore-side, and depressed as much on the back-part next to the Gullet, for the Gulletts better and more secure passage, and that the meat in swallowing might not be hindred from descending by it. *Its figure.*

It is framed of five *Cartilages* or *Gristles*, the first of which is called *Scutiformis* or Buckler-like, because it resembles a Shield or Buckler, being hollow within and bunching without. In Humane Bodies (in Men more especially, for Women have it not so far sticking out as Men) this bunching out is by some Anatomists termed *Adam's Apple*, from an old Tradition that a part of the fatal Apple abode sticking in *Adam's* Throat in that place. *Its substance. Five Cartilages.*

The next or second *Gristle* of the *Larynx* is called *Annularis* from the resemblance it hath to a Turkish Ring, wherewith they arm their Thumb when they shoot. This *Gristle* is round, and incompasseth the whole *Larynx*.

The third and fourth, because as they are joined together they resemble the neck of an Ewer, are called *Guttales*. These two *Gristles* many times pass for one, because they have but one skin proper to them both, and untill that skin be removed they are not to be parted. These two form the *glottis* or little tongue, being a chink of that shape.

The fifth is termed *Epiglottis* because it is placed above the *glottis* or chink. The substance of this is soft, and its shape like an Ivy-leaf. Its use is to hinder the falling down of any thing that may be offensive to the Wind-pipe, when the Creature doth swallow either his meat or drink.

These *Cartilages* are moved by several pairs of *Muscles*, which shall be described in the Fourth Book.

Table XX.

Representeth the upper part of the Wind-pipe fastned to the *os Hyoides*, as also to the root of the Tongue; likewise the *os Hyoides* it self separated from all other parts; it containeth also two other figures of the upper part of the Wind-pipe, to shew its several Parts.

Figure I.

Shews the upper part of the Wind-pipe, and the Parts to which it is fasten'd.

- AAAA Shew the *Cartilages* or *Gristles* of the upper part of the *Wind-pipe*.
- BB The head of the said *Wind-pipe* fastned to the *os Hyoides*.
- C The *Ligament* that fastneth the head to the said bone.
- DDDD The *os Hyoides*.
- EE The bones that join with the *os Hyoides* at the bottom of the *Head*.
- FF The *Tongue*.

Figure

Figure II.

Shews the *os Hyoides* separated from the Wind-pipe and from the Tongue.

- AA Shew the two long bones joined to the *os Hyoides*, whose other ends are fastned (when in their places) to the bottom of the Head.
 BBB The several cartilaginous bones that make up the *os Hyoides*.

Figure III.

- A Shews the Epiglottis or Throat-flap turned more upon the upper side, the plainer to shew the back parts of it.
 B The backside of the Scutiformis.
 CCC The Cartilages or Gristles of the Wind-pipe.

Figure IV.

Shews the upper part of the Wind-pipe with the Shield-fashioned Gristle and Throat-flap turned on one side to shew the sides of those Parts.

- A The Epiglottis or Throat-flap.
 B The Shield-fashioned Gristle.
 C A portion of the Wind-pipe.

Its Vessels.

The *Vessels* of the *Larynx* are of all sorts. *Veins* are derived to it from the external Jugulars; *Arteries* from the large branch of the *Carotides*; Its *Nerves* it hath from the recurrent Nerves of the (eighth, commonly reckoned for the) sixth pair, which are called in those Creatures which have voices, *vocales*.

Its Kernels.

There are also two sorts of *Kernels* belonging to it. One pair is called *Tonsillæ*, which are placed at the sides of the *Uvula*, and at the upper part of the *Larynx*. These are those which in Humane Bodies are called the *Almonds of the Ears*, and are of this use, *viz.* to separate that flegmatick humour from the blood that makes the flaver; which humour serves to moisten it, and also the Gullet, that by their glibness or slipperiness they may the better serve for their respective uses.

The other pair of *Kernels* are placed contrary to the former, namely at the lower end of the *Larynx*, in number two, one on each side of the Buckler-like Gristle. In Horses they are much larger than the former, and by them large branches of the external jugular *Veins* and *Arteries* do run. These are those *Kernels* under the Throat or between the Jaws of an Horse that one may plainly feel at any time, but more especially when an Horse has the *Glanders*, for in such they are much swelled.

The *Pharynx* (or top of the Gullet) is so called from a Greek word the Pharynx: that signifies *to carry*, because it conveys the meat and drink from the Mouth toward the Stomach. It is somewhat more fleshy than the rest of the Gullet, and reaches up, *behind*, to the *Uvula*, on the *sides* to the *Tonsils*, and on the *fore-part* to the *Epiglottis*. It has several Muscles by the help of which it performs its motion, of which we shall treat in the Fourth Book. Its use is to receive the meat when it is chewed, and grasping it on every side by contracting it self, to squeeze it down the Gullet, by which it descends to the Stomach.

Thus much of the Parts of the *Neck*, which brings me to

The End of the Second Book.

P

THE

The *Pharynx* (or top of the Gullet) is so called from a Greek word that signifies to carry, because it conveys the meat and drink from the Mouth toward the Stomach. It is somewhat more fleshy than the rest of the Gullet, and reaches up, behind, to the *Os hyoides*, on the left to the *Yaws*, and on the fore part to the *Epiglottis*. It has several Muscles by the help of which it performs its motion, of which we shall treat in the Fourth Book. Its use is to receive the meat when it is chewed, and grinding it on every side by contracting it left, to squeeze it down the Gullet, by which it descends to the Stomach.

Thus much of the Parts of the Neck, which brings me to

The End of the Second Book.

THE

9

THE
ANATOMY
OF AN
HORSE.

BOOK III.

Of the Head.

CHAP. I.

Of the Head and Animal Parts contained therein.

HAVING finished the description of the two Lower *Venters*, which are two of the principal Parts of the Body; I come now in the next place to betake my self to the last principal Part which is the *Head*, being the seat of the Animal Faculty, as the two lower are of the Vital and Natural.

In dissecting of this Part I shall follow the same method as in the two former, examining its Parts in order, as they offer themselves to our sight in dissection, first dividing it into parts to that intent.

But before we begin to divide it, I think it will not be amiss to speak something of its supereminency over all the other Parts; for in respect that it is the seat of the Senses, it is lookt upon by Anatomists to be the chief Mansion-house of the Animal Soul; and Sense is so necessary to every living Creature, that without it, it is not far from being without life. And as the Head in this regard is the most principal Part, so is it accordingly situated in the uppermost place, above all the other Parts of the

Body, for this reason, *viz.* that the Animal spirits as from a fountain might spring from thence, and communicate sense and motion down to all Parts of the Body : but for the Eyes sake more especially has it this high situation, for thereby two conveniencies accrue to the sense of seeing; first, the Eyes being placed as in a Watch-tower, can discover things at the greater distance, and thereby prevent many dangers which might otherwise come unawares : and in the next place by being placed so near the fountain of Animal spirits, the optick Nerves, which are of a soft substance, and could not therefore endure a long passage, are secured from breaking.

As to the *figure* or shape of the Head, I will omit speaking of that, since it is so visible and so common to be seen. And though something might be spoken as to the true and most natural shape of an Horse's Head, yet that being already described by other Authours, and may by me (if God shall so long spare my life) be treated of more at large in another Book which I design to set forth of the several Cures performed by me, by such means and methods as I have experimented since I came to understand Anatomy; I shall wave it at this time, and speak no more of the Head in general, but proceed to treat of its Parts.

The *Parts* of the Head, (as of the other two *Venters* before discoursed of) may be distinguished into Parts *containing* and *contained*. The *containing* are either *common* or *proper*; of which in order.

The common
containing
Parts of the
Head.

First then of its *common containing* Parts; the first of which is the Cuticle with its hairs, of which we have sufficiently treated in the first Chapter of the First Book; the next is the *cutis* or True skin, also the Fat and fleshy Pannicle, of all which we have treated at large in the five first Chapters of the First Book, whither the Reader may please to turn back for his better information.

The proper
containing
Parts.

The *proper containing* Parts of the Head are five, namely the Muscles, the *Pericranium*, the *Periosteum*, the Skull, and the Membranes or *Meninges* contained within it.

The Muscles.

To the *Muscles* we will speak in the next Book which is of the Muscles, as being the most proper place.

The Pericra-
nium.

The fleshy Pannicle or *membrana carnosae* together with the other common investing Parts above it being removed, the *Pericranium* next appears, which is a thin, white and very sensible Membrane spread over the whole Skull, adhering immediately to the *Periosteum* every-where, saving where the temporal Muscles on each side come between them. There are many slender Fibres that pass from this Membrane through the futures or seams of the Skull, which are knit to the *crassa meninx* or outer skin, which cloaths the Brain on the inside of the Skull; whence some are of opinion that the *Pericranium* has its rise from it. Whether that be so or no, these Fibres however serve to stay the *dura mater* in its place, whereby it hinders the Brain which it invests from being clasp'd against the rugged Skull in violent concussions of the Head.

The Perioste-
um.

The next investing Part is the *Periosteum*, which is a Skin of much alike substance with the *Pericranium*, onely thinner. It is of the same nature with that Membrane that invests all the Bones in the whole Body, excepting the Teeth which are bare. From this Membrane it is that the Skull as well as all other bones are sensible, for of themselves they are senseless Parts. It sticks very close to the Skull, and it, as well as the *Pericranium*, has *Arteries* from the external *Carotides*, and *Veins* from the external Jugulars.

We

We should in the next place speak to the Bones of the Head, or the several Bones of the Skull distinguished by several sutures; but I omit them also here, and shall speak to them in their proper place, (*viz.* in the Fifth Book) and proceed to the Parts within the Skull, the first of which is the *dura meninx*, that is, the hard Skin or Membrane, called likewise *crassa meninx*, to distinguish it from the *thinner* that lies next under it, and immediately cloaths the Brain.

This hard or thick Membrane is called by many Authours *dura mater* Dura meninx. or the hard mother, because they conceive that most of the Skins of the whole Body do spring from it, and therefore it is esteemed as their mother.

Its *figure* and *amplitude* answer to the Bones of the Skull, by reason it Its connexion investeth all its cavities. It is knit, and that very strongly, to the bottom of the Skull, to its processes, and to the circles of its holes, from whence it cannot easily be removed. It is suspended also by the Fibres above-spoken of that come through the sutures of the Skull from the *Pericranium*, as likewise by the Bloud-vessels that penetrate the Skull and are inserted into this Membrane. By which Vessels it is in like manner fastened to the Skin under it called the *pia mater*, and in several places to the Brain it self. It consists of two Skins, as the *Peritonæum* of the Lowest *Venter*, and the *Pleura* of the middle do. In its upper part it is doubled, and its duplicature divides the Brain into two parts, the right and left. This duplicature being in the hinder part broad, and growing narrower still as it inclines to the fore-part, I mean towards the Nose, is by Physicians called *falx* or the sickle, because in a Man's Head which is The falx. pretty round, it makes almost an half circle, as a sickle does. We may retain the same name for it in an Horse, though less properly, as differing somewhat in shape.

In this reduplication there are several cavities or hollowneses, commonly called by the Latin name *sinus*, which are accounted receptacles Its Sinus's of abounding bloud and spirits; by *Galen* they are called the Ventracles of the *dura mater*, by others cisterns of bloud. The highest of these, and also the longest, doth run all along the top or upper part of the *falx* from the Nose length-ways of the Head towards the Noll, where it is divided into several branches, two of which descend downwards to the bottom of the *occiput*, and a third runs to the *glandula pinealis*.

Into these hollowneses or *sinus's* the mouths of the Veins and Arteries are said to open, the Arteries pouring bloud into them, and the Veins receiving it from them again, as hath been observed in the dissecting the Heads of living Creatures, for in the long or uppermost *sinus* hath been seen a strong beating or pulse occasioned by the bloud that is discharged into it by the Arteries.

The other Membrane or Skin which invests the Brain is called *tenuis* Tenuis meninx. *meninx* from its thinness, and *pia mater* or tender mother from its immediate covering or close sticking to the Brain, imbracing it as a Mother does her Infant. It is spread over all the cortical or outer part of the Brain, insinuating it self into all its windings, as also into those of the *cerebellum* and *medulla oblongata*, and ties all their processes and parts to one another, that they cannot be displaced or bear hard upon one another. And wherever it goes, the Bloud-vessels run along it, and are dispersed out of it into the Parts that it cloaths.

This Skin is very thin, and of a most exquisite sense, yea this and the *dura mater* seem to be the instruments of all sensation. For as sense is commu-

communicated to every part immediately by the Nerves, so the nervous Fibres are more probably propagated from these Membranes that cloath the Nerves, than from the medullar Part it self of the Nerve which is derived from the *medulla oblongata* and spinal marrow, which of themselves have little or no sense, but onely by virtue of these Membranes that invest them.

Its Vessels.

It is furnished with very many Arteries and Veins, most of which are exceeding small, but in number infinite, interwoven one with another in the manner of a Net. The Arteries do spring from the *Carotides* and Cervical Arteries, and the Veins from the jugular Veins.

The use of the Meninges.

The use of these two Membranes that invest the Brain is to sustain the Vessels that enter into it, to cloath and defend it from the hardness of the Parts that environ it, to keep it in its due form and situation (for of it self it would run all about, it is of so soft a consistency) and lastly to afford a coat to all the Nerves, not onely to those that spring within the Skull, but to all those also that arise out of the Back-bone, for these two Membranes are propagated all along it, investing its pith, (called the spinal marrow) out of which those Nerves spring.

C H A P. II.

Of the Brain in general.

The excellency of the Brain.

BEING come to treat of the *Brain*, it shall not be amiss, if before I speak of its several Parts, I say something as to its excellency, and the eminent offices it performs for the benefit of the Animal. All Authors agree that it is one of the most noble Parts of the whole Body, ranked for its dignity even with the Heart it self. And indeed, as I have intimated in the foregoing Chapter, its situation sheweth plainly as much, it being placed in the highest part of all the Body, and there fenced about as it were with strong walls on every side, to secure it from outward injuries. In it are contained the Animal Faculties, *viz.* those of Sense and Motion. The former of these two Faculties sits in it as in a Throne of Majesty; beholding the forms of all things under her feet, having all the Organs and Instruments of the Senses attending Her, at her command. For first the Eyes are placed near her, that as Spies or Centinels watching day and night they may discover the Enemy. The Ears also are seated near her, at her command to be turned this way or that way, to listen to any dangers that are approaching, that so they may be avoided. Likewise the Instruments of Smelling and Tasting are near her, that at her command those Foods that are profitable and necessary may be received, and that unpleasant or hurtfull Food may be rejected. And as the Faculty of Sensation hath the forementioned Ministers or Instruments placed near her for the execution of her offices; so hath the motive Faculty a dominion extended to the furthest limits of the Body, of which every Limb and Member is perfectly at her beck, to move this way or that way as she directs. I say, both these noble Faculties have their seat in the Brain;

for

for it is not a private or particular Organ of Sense, but an universal one; nor doth the motive Faculty exert it self in the Brain it self, which is incapable of *voluntary* motion; but that motion which it has, is *natural*, and that not owing to it self, but to the Arteries that are dispersed in it, for the beating of these makes it seem to widen, and contract it self, as hath been observed in Wounds of the Heads of both Men and Beasts. This motion, I say, is communicated to it from the Arteries, and in its dilatation it receives arterial blood by the Carotid Arteries, and in its contraction it forces that Blood into the Veins, and the Animal Spirits into the Nerves, by which they are carried into all Parts of the Body, and with them the moving power is imparted; for without such influence from the brain an Animal would be like a Log, it would be able neither to move nor feel, or rather it would cease to be an Animal, and become a dead Carcase.

How absurd and ridiculous a thing is it then for any Man that hath any Brain himself, to imagine a Horse to have none? yet such Men I have my self met withall, yea I know several which to this day will not be convinced of that erroneous opinion by any arguments whatever. Neither will they take the pains to inspect the Parts, to satisfy themselves of the contrary, but will still continue in their false received opinion, merely taken from a silly observation they have made when they have seen Horses and Oxen knocked on the Head, where they see the Skull broken and nothing under it, but a few hard and dry Bones, without any marrowy substance: I say from this observation they draw their conclusion, that a Horse hath no Brain. I much wonder how any such Dolt can have the confidence to take upon him the name of a Farrier, and pretend to cure he knows not what. Such Persons I would desire onely when they see another Horse knockt on the Head, that they prevail with them that doe it, (or otherwise when any Horse is dead) to strike him a blow or two with the same force above the usual place between the Ears or a very little lower, and they shall then be soon convinced that he hath a Brain, (though not so *large* by much as a Man hath, considering the different bulk of their Bodies.) And when they are convinced of that, I hope they will take pains to be satisfied in the other Parts of the Body by searching into them, as by these my Labours they are directed; so shall they improve themselves in their professions, and I have the wished end of my pains, which I have taken to advance them.

That an Horse hath a Brain.

The manner of striking the Skull of a Horse.

Fig. I. Shows the Skull of an Horse, & how situated in such a manner, that the Parts of the Brain may be seen in their natural situation.

FF Shows the substance of the Brain covered with the pia mater, &c. &c.
 HH The Cerebellum as it is situated in its natural situation.
 LL The pons, or medulla oblongata.
 MM A part of the medulla oblongata.
 NN The dura mater, so far as it covers the medulla oblongata, cut in length, and turned back.

CHAP.

Fig. II.

C H A P. III.

Of the several Parts of the Brain, viz. that which is strictly called the Brain, the Cerebellum or After-brain, and the Spinal Marrow.

The Parts of the Brain.

IF we take the *Brain* in a large signification, it comprehends all that marrowy substance that is found in the cavity of the Skull: yet for distinction's sake it is by all Authours divided into three parts; first, the fore-part, being the largest, is called *the Brain*; secondly, the middle-part is called *Cerebellum*, the Brainlet or After-brain; and lastly, the hindmost and lowermost is termed *Medulla oblongata*, being that part of the Spinal Marrow which is within the Skull.

The manner of sawing the Skull asunder.

Now to find out these several Parts we must divide the Skull with a Saw for that purpose, beginning almost as far back as the Noll-bone, or indeed quite as far, dividing the hole of the Noll-bone in the middle, and so go with your Saw first along one side of the Head a little above the auditory passage till you come to the Fore-head a little below the Eyes (or just even with them;) where being come, and having sawed onely just through the Skull, (for you must have a care that your Saw do not pierce the Brain, for that will hinder your seeing the Parts of it) then cross the Fore-head with your Saw and pass along the other side till you come to the hole of the Noll-bone again: by doing which you will loosen the upper part of the Skull, which with care you must take off, that you break not the *dura mater* or Skin next under it, for that Skin is fastened to it in several places. When you have removed that piece of the Skull, then remove the Skin also by parting it lengthways down the middle, whereby you shall plainly see the Brain with its convolutions or folds, also the After-brain with its wormlike processses, &c. in such manner as they are represented in the following Table.

Table XXI.

Fig. I. Shews the Skull of an Horse sawed asunder in such a manner as that the Parts of the Brain may be seen in their natural situation.

- FF Shew the substance of the Brain covered with the pia mater onely, the dura mater being removed for that purpose.
 HH The Cerebellum or After-brain also in its natural situation.
 LL The processus vermiformes or worm-like Processses.
 MM A portion of the medulla oblongata.
 NN The dura mater so far as it contains the medulla oblongata, cut in sunder and turned back.
 OO The Noll-bone cut in sunder.

Fig. II.

Fig. II. Shews the Brain removed and taken out, that the After-brain and its Worm-like Processes might be the plainer seen.

CCCC The Cerebellum or After-brain turned a little downward, to shew its Parts more plain.

B The Wormlike Processes.

D The Spinal Marrow so much as is contained within the Skull.

EE That part of the dura mater which invests the Spinal Marrow within the Skull, opened and turned back.

Of these several Parts of the Brain we shall speak in their order, and first of that which is strictly so called. It is of a marrowy substance, but not equally so, for the upper part of it uses to be called its *cortex* or bark, being of a more dusky colour; whereas the inner or lower part is more white, and is particularly called the marrow or pith of the Brain. It is divided into two parts, a right and a left, by a Membrane that runs length-ways of the Head, from the Fore-head to the Noll; but this division descends no deeper into the Brain than the Ash-coloured part of it reaches. The Skin which divides it, is called *falx* or the fickle, of which I have already spoken in the first Chapter.

The Substance and division of the Brain, (strictly so called.)

The *action* of the Brain is to elaborate the Animal Spirits, which from it are transmitted to the *Medulla oblongata*, and from thence into the Nerves, for the sensation and motion of the whole Body, as has been more fully shewn in the two foregoing Chapters.

Its action.

The second part of the Brain, called the *After-brain*, is situated in the back-part of the Skull next the Noll-bone, onely parted from the Brain on its upper part by the *pia mater* or undermost Skin.

The Cerebellum.

This differeth not much from the Brain either in colour or substance, but onely in its convolutions or foldings: for the Brain observeth no order in its winding, but the Brainlet doth, for all its folds are circular, being extended one over' another like plates, and each is kept apart from other by the *pia mater* that invests each of them severally.

It is framed of four Parts, whereof two are lateral, (or on each side) the right and the left; and these are spherical, or round like a Globe: The other two are in the middle betwixt these, standing before and behind; and these are made up of several orbicular Portions in similitude like the Worms which are found in rotten Timber, and are from thence called Worm-like Processes.

Its Parts.

The *use* of the Brainlet or After-brain is the same as of the Brain.

Q

CHAP.

C H A P. IV.

Of the Spinal Marrow contained within and without the Skull.

The Spinal
Marrow.
Its substance.

THAT part of the Spinal Marrow that is within the Brain, is termed particularly *medulla oblongata*, and is the third part of the Brain, being of an uniform, white and compact substance, something harder than either the Brain or After-brain.

Its rise.

It arises out of the Brain and Brainlet, and that from six roots; two of which spring at the upper and fore-part of the Brain, and are called *corpora striata*, the streaked or chamfered Bodies, being onely the ends of its two Thighs; the other four arise lower and more backward, by which it adheres to the Brainlet, and are those protuberances or jettings out that are called *Nates* and *Testes*, its Buttocks and Testicles.

Its figure.

Its figure (after its rise) is long and round, being thicker near its beginning than afterwards. Its length within the Skull is about two inches, beginning towards the fore-part of the Head, and reaching to the Noll, whence it is lengthned and continued down the Chine as far as the Dock. That part of it which is contained in the Chine, we commonly call in Horses the pith of the Back.

Its Mem-
branes.

Within the Skull it is clad onely with two *Membranes*; but without, it is covered with three. The first of which it hath from the inner Skin of the Brain or *pia mater*; this immediately covers it. The second it hath from the upper Skin of the Brain or *dura mater*; this is next to and covereth the former. And the third is said to spring from a strong Ligament which binds together the fore-part of the Rack-bones, covering both the former, and is very strong.

Its use.

Now the use of the Spinal Marrow is to be the original of all the Nerves, which from it (as from a Fountain) like small Rivulets convey to all Parts of the Body the Animal Spirits. For although the Brain in common speech be accounted the original of the Nerves; that is to be understood in a large sense, when all the three Parts of the Brain are included in that one general appellation: But when the Brain comes to be divided into Parts, which are distinguish'd by particular names, then are both the Brain and Brainlet thrown out of the office of being the original of the Nerves. For ocular Inspection doth testify, that it is from that part of the Spinal Marrow contained within the Skull, from which all the Nerves of the Brain do spring; as likewise from that part of the Spinal Marrow without the Skull, called the Pith or Marrow of the Back, that all the other Nerves of the whole Body do arise. Which large and far distant origination of the Nerves is very necessary; for it would not have been safe (in consideration of the length of the way) that all the Nerves should be carried from the Brain to the inferior or lower Parts; and therefore it is wisely provided by Nature, that from the Marrow or Pith of the back those Nerves should spring which furnish the Parts so remote from the Brain.

As for the *number* of Nerves which spring from the Spinal Marrow without the Skull, they are in a Horse thirty seven pair, according to the number of Joints or *vertebræ* from the Noll-bone or the going out of the Marrow from the head, to the setting on of the tail; for out of the holes or perforations in every Bone do pass a pair of Nerves. Therefore there being so many Bones, there are so many pair of Nerves that spring from the Spinal Marrow. And from the *medulla oblongata* or that part of the Spinal Marrow that is within the Skull, there spring nine pair, as shall be further shewed hereafter.

The number of Nerves springing from it.

C H A P. V.

Of the Parts of the Cerebrum, or Brain properly so called, viz. the Rete mirabile, Glandula pituitaria, Infundibulum, the Ventricles of the Brain, the Corpus callosum, plexus choroides, Nates, Testes, Penis or Glandula pinealis.

HAVING given a short description of the *Cerebrum*, (or Brain properly so called) the *Cerebellum*, and Spinal Marrow; we now return to the *Cerebrum*, to take a more exact view of its several Parts; and we shall begin with the *Rete mirabile* or wonderfull Net.

This Net is framed of innumerable twigs of Arteries which spring from the largest branches of the Carotid and Cervical Arteries, which pass into the Skull by proper holes in the Bones of the Temples. This Net is far more discernable in Oxen and Horses than in other lesser Animals.

The Rete mirabile.

It is called *the wonderfull Net* by reason of its structure, the Arteries of which it is composed crossing one another like the threds of a Net, or rather as if several Nets were spread one over another. It is dispersed all over the bottom of the Brain both without and within the *dura mater*, some of the smallest shoots of it branching into the pituitary Glandule.

Why so called.

The *use* of this Net is said to be for the preparing of the Blood and Vital Spirits to make Animal Spirits of. For which purpose in the twinings and windings of these small Vessels they are a long time detained, for the better elaboration and preparation of them, and lest they might rush into the Brain in too full a stream, and thereby overflow and disturb the Animal Faculty.

Its use.

To see this wonderfull Net, as also the other Parts of the bottom or under-side of the Brain, you must (after having sawn the Skull asunder, as is shewed in the foregoing Chapter) with a pair of sharp Pincers pinch off by little and little the sides of the remaining part of the Skull, all round, untill you come as near the bottom as you can; and you must then with as much care as possible lift up the Brain, beginning at the fore-part of it, where the Bone of the Fore-head a little separates it. After you have lifted it a little way up, there will come in sight the mammillary Processes together with their nervous Filaments or Threds that pass

The manner of taking out the Brain, and in what order the Parts appear.

pass through the Sieve-like Bone, hanging at them; which being loosened and the Brain farther pulled up, the next thing that appeareth are the branches of the Carotid Arteries, which having penetrated the Skull are carried to the Brain; which being cut off and the Brain yet a little farther turned up, the union or coming together, and the going out of the Optick Nerves are to be seen; the Trunks of which if you likewise cut off, there are other Arteries (also branches of the *Carotides*) to be seen, coming in through the Bones of the Temples: which Arteries (as I have already shewed) are (with some small Veins joined with them) those Vessels which make up the *Rete mirabile* or wonderfull Net, discoursed of at the beginning of this Chapter.

After you have cut in sunder these Arteries also, then you may by lifting up the Brain still a little higher, perceive the moving Nerves of the Eyes (for *they* come next to view) and after them the other pairs of Nerves follow in order, in such sort, that one pair of them being cut off and the Brain with its Appendices or Processes more lifted up, the next is still more plainly discerned by the carefull Anatomist. In which method and order all the Nerves, to which I shall particularly speak in a convenient place, (I mean the Nerves arising within the Skull) and also the Arteries, as well the Carotid as Vertebral, being at length cut off, the whole frame of the Brain may be taken out of the Skull.

Table XXII.

Representeth two Skulls, the one to shew the basis or bottom of the Brain and the Head of the Spinal Marrow contained within the Skull, with the rise of the Nerves from it; and the other shews the cavity of the Skull in which the Brain was seated, but now removed, the better to shew the *Glandula pituitaria* and other Parts that lie under the Brain.

Figure I.

Shews the bottom of the Brain and Spinal Marrow.

- AA Shew the Eyes.
- BB The Optick Nerves.
- CC The moving Nerves of the Eyes.
- DD The fourth pair of Nerves, by Doctor Willis called the *Pathetick Nerves*, proper to one of the Muscles of the Eyes onely, by which the Eye is chiefly moved in the Passions of Love, Anger, &c.
- EEEE Several other Nerves arising from the Spinal Marrow within the Skull.
- FFFF The bottom of the Brain.
- GG The Spinal Marrow called here *medulla oblongata*.
- HH The Spinal Marrow cut off at its going out of the Skull.
- III The several barrs of the Palate of the Mouth.
- qq The cavity or hollownes that goes from the Palate of the Mouth to the Nose.
- RRRR The several Teeth.
- SS The *dura mater* cut insunder and turned back.
- T The *Glandula pituitaria*.

Figure

Figure II.

Shews the Skull with the Brain taken out of it.

A Shews the hole where the Spinal Marrow passeth out of the Skull.

B The Glandula pituitaria or Flegm-gland.

CC The Optick Nerves.

DD The bottom of the Skull upon which the Brain did rest.

After you have thus taken out the Brain and viewed all its Parts as they appear before you dissect it, you will at the very middle of its bottom, a little above the uniting of the Optick Nerves, within the hard Skin or *dura mater*, (for that is in the next place to be taken off and removed, otherwise it will hide all other Parts from you; but that Skin being removed in the place aforesaid, I say) you will find a small round Kernel, in compass about the bigness of a Groat, and something flat and round. Its seat is in a little hole made for that purpose at the very bottom of the Skull, in a Bone called the wedge-like Bone. This will be more plainly seen if you take the Brain out and leave the *dura mater* behind; for then you see it in its natural position, as the letter B in Fig. 2. of the foregoing Table shews it: but if you take the *dura mater* out, this comes out with it. This Kernel is called *Glandula pituitaria*, the snotty or flegmey Kernel, from its office, which is to receive the snotty Excrements of the Brain from the *Infundibulum* or Funnel, and afterward to transmit or convey them away, as some Authors say, into the Palate, from thence to be avoided by the Mouth or Nose. But others will have it, that it is sent into the Jugular Veins by two small ducts or passages, one on each side, being branches of one Trunk that begins at the bottom of the said Gland, and is divided into two, after it has penetrated the wedge-like Bone. Which passages they have found out by injecting Liquors of several colours with a syringe into them, for they have observed the said Liquors to pass into the Veins, but none to come to either the Palate or Nose. By which Experiment they conclude, that whatever *serum* or wheyish or flegmatick Humour issues out of the Ventricles of the Brain through the Funnel, distils not upon the Palate, but is poured again into the Blood and mixed with it. Whence we may gather that the Rheum or Snot which issueth so plentifully out of the Noses of Horses that have great Colds, and also of glander'd Horses, falls not (as I have myself sometimes thought) from the Brain, but is separated out of the Arteries from the Blood by the Glands or Kernels of the upper part and inside of the Nose. Which we may the rather believe, when we observe that other Glands are swell'd with Rheum at the same time, as particularly the Kernels under the Horse's Jaws; which is one of the certainest signs we have of a Horse's inclining to the Glanders. And this may serve to convict of error all our ancient Authors who did hold, (and our Practitioners who at this day do hold) that the Glanders proceed from a defect and wasting in the Brain; and that all that snotty matter comes from thence which issues out of the Nose. Which were it so, all the Brain in the Horse's Head would not be sufficient to supply it with matter for three daies, according to the quantity that I have seen come from one in that time. It is therefore a very false opinion, taken up merely upon
guess,

Glandula pituitaria.

From whence the Snot is separated in the Glanders.

gues, without inspecting into the Parts, that our Practitioners do commonly entertain concerning this Disease.

No such Disease as the mourning of the Chine.

Neither is there such a Disease as the mourning of the Chine, as they do to this day hold; for it is impossible any Creature should continue so long alive as till all his Brain be so far wasted by this Disease, that it comes to reach the Spinal Marrow without the Skull, which is that I suppose they call the Chine.

But this Disease, by them called the mourning of the Chine, is distinguished into a different Disease from the former from the Matter's altering its colour; for it is generally observed that after the Horse hath had this Disease running on him for some time, the corrupt Matter or Snot changes by degrees from an indifferent white to a more dull colour, inclining at first to a little reddish, but after a longer time, especially when the Horse begins to grow towards his end, it will be very black and very nauseous both to see and smell.

From this alteration of the colour, as I have said, I do believe they give the Disease this proper and distinguishing name of mourning of the Chine; whereas it is only a greater degree of one and the same Disease, in which the Chine is not at all affected, at least no more than any other Part of the Body, all of which languishes away by this inveterate Distemper. By what steps it proceeds, and how the Matter comes to alter its colour, I will give you my opinion.

The mass of Blood being depraved either by unwholesome Food, or by great Colds, or lastly by infection from the Air and from other Horses (for this Distemper is catching) this flegmatick Matter collected in it is spued out of the ends of the Arteries in the upper part of the Nostrils, about the spongie Bones chiefly; for in an Horse there is little of this Matter comes out of the Mouth, but it still descends by the Nostrils. This Humour, I say, distilling out of the Arteries by the spongie Bones continually, doth in process of time so fill the said Bones with filthy Matter, that like a Sink or Chanel being choaked up with filth, there is not so free a passage for the Humour, as when the Disease first began; so that the Matter by that means is there stayed, and by its continuance there it acquires so bad a quality that it corrodes and cankers those Bones, and indeed ulcerates and gangrenes all the passages of the Nostrils, till it have mortified and consum'd them (as happens sometimes to Venereal Persons) and at length destroy'd the Beast: for indeed it is seldom or never curable when it is once come truly to be a Canker.

Now by the foulness of these Bones (as I have said) that Matter or Snot which doth descend by these passages, (which indeed doth at length drivel down in a greater quantity than before, by reason of the passages being widened from the Parts being gnawn asunder by the cankered Humour; I say that Matter or Snot which doth descend after this) is of a contrary colour to what it used to be, for it is become more black and waterish, mixed with a little Red, and hath a very ill smell: but this alteration happens not from the Matter's flowing from a new Part, but is caused by reason of the foulness of the Parts through which it passeth, for from thence it hath its dye in a great degree.

Not but that there is yet another cause of it, which is the greater foulness of the Blood: for as the beginning of the Distemper did proceed from the corruption or depravation of the Blood, which was become as it were degenerate from its spirituuous, balsamick and volatilised condition, into a flat

flat and vappid state, like to dead Wine; so in process of time for want of the Spirits to quicken it, and cause the fermentations necessary in the proper places of the Body, where the excrementitious parts of the blood should be thrown off, (there being several Bowels of the Body appointed to separate, and some that have Receptacles to receive the same) I say, for want of these Spirits to cause a fermentation whereby the excrementitious parts of the Blood should be thrown off, such Excrements are collected every day in greater quantity, and acquire a greater degree of malignity, being hardly any part of them discharged any other way but this, which is preternatural, and most times becomes destructive to the Beast, after the Disease hath arrived to this height.

Thus have I given you my opinion concerning this Distemper, which though it be new, will I hope to the intelligent Reader appear to be truer than that of our Ancient or Modern Practitioners, few of whom (I may affirm without boasting) have made so diligent an inquiry into this Distemper as I with great pains and charge have done; for if they had, they would with great ease see themselves in an error, and no more believe that there is or can be such a Disease as the mourning of the Chine. But enough of this, (though I hope it will not be deemed to be from the purpose:) I shall therefore return from whence I have digressed, and describe the remaining Parts of the Brain.

Having examined sufficiently the *Rete mirabile* or wonderfull Net, as also the Pituitary Gland, if you then remove the *dura mater* quite from the Brain at the basis or bottom of it, there will appear the head of the Spinal Marrow, so much as is contained within the Skull, of which we have treated in a foregoing Chapter. There may be also plainly seen the rise of the several conjugations or pairs of Nerves, of which we will treat at large in a convenient place; also the bottom of the Cerebel or After-brain, as the next Table doth demonstrate to you.

After these you may take a plain view of the end of the *Infundibulum* The Infundibulum or Funnel. (a cavity so called) which end reaches (before dissection) to the Pituitary Gland, upon which it pours the flegmatick Excrements of the Brain, as hath been already shewed.

This Funnel is so called from its shape; for above, the head thereof is large; but the lower part, is a long and strait Pipe. By some Authors it is called *Pelvis* the Basin. Its beginning is said to be on the fore-part of the *third Ventricle*, by some so called, but I could never in a Horse see more than two that I could properly call Ventricles, between which two this Funnel is seated, and into which they do empty themselves, discharging their serous or waterish moisture into it. This Funnel I have often found near filled with a thickish Flegm; and Doctor *Willis* says that in an Horse's Brain he has observed it wider than a Goose-quill, and full of a clear Water.

Next come we to speak to those Parts of the Brain that lie hid, and cannot well be seen without dissecting of it; and first of the *Buttocks* Corpora striata, Nates, and Testes. and *Stones*. These are four orbicular Prominences or round Bodies jetting out of the *medulla oblongata* (or head of the Spinal Marrow) of which the two first, namely the Buttocks, are largest, and the latter (*viz.* the Stones) seem to be onely accrescences to them. The Buttocks stand lowermost, and adhere to the Brainlet; (as do also the Stones.) They are larger than in a Man, and look of a fleshy colour while they are cloathed with the *pia mater*; but that being removed, they appear yellowish,

yellowish, and of a different colour from the rest of the Marrow. But of these we discoursed before at the beginning of the fourth Chapter; as also of the *corpora striata* or utmost ends of the *medulla oblongata*, that adhere to the Brain properly so called.

These four Prominences are by Doctor *Willis* compared to Mole-hills, and are therefore by him so called. They may be plainly seen if you but lift up the hinder part of the Brain after you have separated it from the Aster-brain, turning it as far back as you can without breaking it.

The Pine-apple Gland.

Between these four Prominences, or rather between the two lower of them, to wit the Buttocks, there is placed a certain Glandule or Kernel, which goes by the name of *glandula pinealis*, or Pine-kernel Glandule, from the resemblance it is said to have with the Kernel of a Pine-apple. It is also called the Yard or Prick of the Brain, from its being placed so near the Buttocks and Stones, as also because it resembleth a Man's Yard. This Gland as also the Buttocks and Testicles before-spoken of are represented in the next Table.

Its use.

Concerning the *use* of this Glandule there are great disputes among the Learned; but I subscribe to *Bartholin's* opinion, who believeth its use to be the same with that of other Kernels, which is to separate the *Lympha* from the Arterial Bloud.

There is as it were a chink between the Buttocks near this Glandule, which I think fit to mention, because most Authours speak of it. Some give it the name of *Anus* or *Arse*, others call it *Vulva*; but why they have imposed such names as these upon these Parts, I cannot judge, nor is it worth the while to inquire, seeing they have no other foundation but fancy: however, since they are known by these names, I did think it fit not to pass them by, finding them as plainly to be seen and as easie to be found in Horses as Anatomists find them in Humane Brains.

The Ventricles.

I come in the next place to speak to the *Ventricles* of the Brain, which are by some accounted four, by others three; but if dissection be made by beginning from beneath, there will appear onely two: and indeed I could never find more; for that which is called the third, I cannot think to be one, but rather a portion of the other two joined together. Nay, some Authours will have it that there is but one, being onely divided at the beginning, but at the end they unite into and become one common Cavity, as any one that will diligently trace them may observe.

The manner of discovering them.

To see these *Ventricles* you must cut the whole substance of the Brain insunder in or as near the middle as you can guess, dividing the upper from the lower side, whereby you will discover them in the middle of the Brain of that shape as the first Figure of the following Table represents them in: for there they are represented to the life, as much of them I mean, as can be seen without farther dissection; and appear to be of a semicircular or Half-moon shape. But if you cut the Brain further, and so follow their Cavities lightly with a Probe *forwards* down towards the Nose (for there they sink deep into the callous body, or white inner part of the Brain) you will trace them as far as the mammillary Processes; and if *backwards*, you will find them to descend as far as the basis or bottom of the Brain; and then if you will take a view of them when you have laid them so far bare both ways, you will find them to resemble in shape an Horse-shoe.

Their uses.

Now the *uses* of these *Ventricles* according to the divers opinions of Authours are many, but I will follow the most Modern in this point.

First

First then they are framed for the more easie passage of the Blood; for along their sides do pass many branches of the Blood-carrying Vessels, which could not so conveniently be conveyed through the substance of the Brain, lest being compressed by the great weight of it, the passage of the Blood should have been obstructed, whereas now it hath a free passage.

Another use of them is, to serve for the reception of the serous or wheyie excrement of the Blood that is separated from it by the glandulous Skin that invests them, and by the *glandula pituitaria*; which serous Humour issuing out of the Arteries, is suckt up again by branches of the Jugular Veins, and is by them returned with the Blood to the Heart.

In the Membrane that cloaths these Ventricles there is a contexture of small Vessels of both Veins and Arteries, which is called *plexus Choroides*. The Vessels that make up this *plexus*, are little branches of the Carotid Arteries, and some of the internal Jugular Veins interwoven with them. The Skin wherein these Vessels are so interwoven has a great many small Kernels sticking in it, which as I have already said, separate the serous Matter from the Blood.

In the Anatomical Discourses of Humane Brains there are several other Parts of the Brain considered, as the *fornix*, the *corpus callosum*, the *septum lucidum* and the like, all which are as discernible in the Brains of Horses as in Men, and might therefore as largely be discoursed of: but it being not very material to treat of them, I will for brevity sake but in a manner name them.

First then, that which is called the *corpus callosum*, is the white substance of the Brain, plainly seen when you cut the Brain asunder in the middle to see its Ventricles; for then you may view its white substance which makes the middle part of the Brain; the outside of it being of an Ash-colour, and going by the name of *cortex*, or *the bark*.

The *septum lucidum* is onely the Partition that divides the two Ventricles above-described, some taking it to be a reduplication of the *pia mater*, and others a portion of the Brain.

The *Fornix* or Vault is a kind of an Arch that stands between the Brain and the *medulla oblongata*. It is of a substance like the *corpus callosum*, and is of a triangular figure. Its use is to bear up the upper part of the Brain, that its weight may not press upon the subjacent Parts.

Table XXIII.

Fig. I. Representeth the Ventricles of the Brain with the *plexus Choroides*.

AA Shew the two Ventricles of the Brain.

BB The corpus callosum or white substance of the Brain, being the middle part of it.

CCC The Cerebellum or After-brain.

DD The plexus Choroides seated in the Ventricles of the Brain.

Fig. II.

Fig. II. Represents the protuberances of the *medulla oblongata* called *Nates* and *Testes*, and also the *Glandula Pinealis*.

D The *Glandula Pinealis* or *Pine-kernel Glandule*.

GG Those two bunchings out of the *medulla oblongata* called *Testes* or *Stones*.

HH Its other two protuberances called *Nates* or *Buttocks*.

II A *Ventricle* between the *Brainlet* and roots of the *medulla oblongata*, by some Authours called the fourth.

MM The *Processus Vermiformes* or *Worm-like Processes*.

NNN The other Parts of the *After-brain*.

OOO Part of the *Cerebrum* or *Brain* to be seen under the *After-brain*.

C H A P. VI.

Of the Action of the Brain, and the exercises of the Animal Faculty by the Nerves and Fibres.

HAVING hitherto spoken of the structure of the Brain, and discoursed of all its Parts; I come in the next place to speak of its *Action*, in general, and to shew, according to the opinion of our most Learned and Modern Authours, how the Animal Faculty exerts it self.

The action of the Brain.

It is generally agreed that the proper *action* of the Brain (taken in a large sense) is the elaborating of Animal Spirits; which Spirits are conveyed from it by the Nerves into the several Parts of the Body for the performing of the Animal actions or motions; for all voluntary motions are performed by the help of these Spirits.

What the Animal Spirits are made of.

These Spirits are made out of the Vital Spirits and Arterial Blood, as out of their proper matter. And the place wherein, or the principal instrument that elaborates them, is not the Vessels, but the very substance of the Brain, into whose parenchyma or marrowy substance the Blood and Vital Spirits are extravasated.

Now concerning the manner how this Work is performed there are great controversies amongst the Learned, and many arguments urged by each, which will be too tedious here to recite: I will therefore give you onely the opinion of a late Worthy Authour as delivered in his own words.

How the Animal Spirits enter into the Nerves;

“The Heart, says he, is like the *primum mobile* of the Body, to which the motion of all the Humours that have once past it, is owing. This by its *systole* impells the Blood as into all other Parts, so into the Brain, by the several branches of the *Carotides*, whose innumerable twigs run partly through the outer *cortex* or greyish part of the Brain, and partly into the inner medullar or white substance of it. These twigs of Arteries spring partly from the *Plexus Choroides* and *Rete mirabile*, and partly from the *Carotides* themselves immediately. The superfluous *serum* of the Blood is separated by the Glands before described;

scribed; and that Blood which is not elaborated into Animal Spirits, is returned again to the Heart by the Veins. But those particles that are fit and proper to be converted into them, are extravasated into the very parenchyma of the Brain, or at least are distributed through it by invisible capillaries, in which being perfected into Spirits, these by the help of the Fibres or Filaments which the inner part or substance of the Brain chiefly consists of, are conveyed into the *Corpora striata* (or other Processes of the *medulla oblongata* that adhere to the Brain) which consist of the like Filaments, and by them to the Nerves, whose inner substance is fibrous like the *medulla* from whence they spring. And the reason of this successive motion from one to another, is the pulse of the Heart, whereby that which comes behind always drives forward what is before. Whence (says my Authour) the true cause of an Apoplexy (wherein motion and sense are almost quite abolished) is from the obstruction or compression of the Arteries of the Brain: whereby both little Blood and Vital Spirits can be conveyed thither to make Animal Spirit of; and also when it is made, it is not impelled out of the Brain along the Fibres into the Nerves, to enable them to perform their functions. These are the words of that worthy Authour concerning this Work.

It remains now to inquire how these Spirits, after they are thus elaborated, do perpetually flow from the Brain through the passages of the Nerves, and how they enter and fill the several sorts of Fibres of which the moving and sensitive Parts consist.

That the Brain and Cerebel are the first fountain of the Animal Spirits I have in my foregoing Discourse already shewed; from whence they flow along the Nerves as by so many rivulets unto differing and distant Parts; till at length they pass out of the most capillary Nerves into the small Fibres interwoven in the Membranes, the muscous Flesh, and other Parts, and last of all into the tendons of the Muscles, making them the organs of Sense and Motion: in which Parts becoming more fixed, they are called the *implanted* Spirits, attending their office whensoever the Nerves with their *influent* Spirits bring from the Brain the instinct for performing the same.

Now concerning these *nervous Fibres* in their several Parts, which are the immediate instruments of the Animal Faculty, we ought to inquire from whence they have their rise: It is plain they do not arise immediately from the Head, or any of its marrowy Parts; neither can we reasonably judge them to spring from the Nerves, because the Fibres in most Parts do much exceed the bulk or bigness of the Nerve that is brought to them, as may be easily seen by the tendon of every Muscle, which being made up of united Fibres, is observed to be far greater than the Nerve that is inserted into the Muscle: so that it is unlikely they should be onely continued portions of the Nerves divided or jagged into fine threds, as some have imagined; and it is more probable that they are spermatick and primigenial Parts, that is, that the rudiments of them were drawn in the first formation of the Parts of the Embryo in the Womb, as well and as soon as the Nerves themselves; unless one would with Doctor *Willis* except the Fibres of the sanguineous Parts, which he thinks to be bred secondarily of the Blood and nervous Juice flowing into those Parts.

They can
move by the
Spirit im-
planted in
them.

One thing further we must note concerning these Fibres, that they are enabled to perform their motion, not onely from the Animal Spirits that flow by the Nerves at the instant of such motion, but also from the Spirits that are stored up in the Fibres themselves; of which any one may satisfy himself in observing an Animal newly killed when its Skin is taken off; for when life is perished, and all the force of the Spirits flowing in through the Nerves hath quite ceased, yet the Spirits implanted in these Fibres breaking forth from the Muscles still move and shake them, and force them into several convulsions and trembling motions. This I have not onely seen my self in several Horses I have caused to be killed on purpose to dissect, but have also shewed it to several Spectators who have been very much pleased at the observation, and at the variety of their motions.

C H A P. VII.

Of the several pair of Nerves arising from within the Skull, particularly of the first, second and third pair.

HAVING sufficiently treated of the Brain and Animal Faculty or Spirits, it is fit that in the next place I should come to speak of the Nerves, beginning according to the order of dissection with those that arise immediately from the Brain, which I find to be of the same number in Horses as Dr. *Willis* hath observed them to be in Humane Bodies, viz. nine pair. I will therefore observe the same method, and begin as the said Learned Doctor hath done, with the *smelling Nerves* first, because they are the foremost, and therefore do first appear in dissection.

The first pair
of Nerves,
viz. the
Smelling.

These Nerves are called the *mammillary Processes*, because they are round at their end like a Pap. They take their rise from the shanks of the *medulla oblongata* betwixt the *corpora striata* or chamfered Bodies, and the chambers of the Optick Nerves; from whence running under the bottom of the Brain they do in their course by degrees increase, and become broader and larger, and at length reach as far as the Sieve-like Bone that is seated at the top of the Nostrils. During all which way they are soft and marrowy, (being hollow within and pretty full of moisture) but being arrived at this Bone, they receive a new covering or coat from the *dura mater*, (being clad before onely with the *pia mater*) with which they are divided into many little Fibres or Filaments like little strings, which do many of them pass through the holes of the Sieve-like Bone into the cavities of the Nostrils, where they are distributed on every side, entring into the Membranes that cover those Parts. These Fibres or Filaments which do thus proceed from the before-named Processes, are believed to be the true organs of Smelling, and of Sensation also. From whence it is that those Persons that do not accustom themselves to draw snuff up their Noses, are upon the least scent of it provoked to sneeze: which is occasioned by the Powder's ascending up the Nose and resting upon the tender Membranes thereof, wherein the little Fibres of the smelling

ling Nerves being dispersed, are immediatly irritated or provoked into a convulsive motion, which is that we call sneezing. It was an old opinion that the Snivel was milked as it were out of the Ventricles of the Brain by these Processes; but having above in the fifth Chapter shewn other Vessels which discharge that flegmatick matter into the Nose, namely the Arteries, it seems more probable that these Mammillary Processes have a nobler use, namely that we have ascribed unto them, to be the instruments of smelling. And therefore they are larger in Horses and all sorts of Cattle than in Men, because it was necessary their Smell should be very exquisite, seeing they can distinguish of the wholesomeness or hurtfulness of their Food by that Sense onely.

Table XXIV.

Fig. I. Shews the Mammillary Processes, and the Bones at the upper part of the Nostrils.

- NN Shew the Cartilaginous or gristly Bones of the Nostrils.
 OO The Mammillary Processes or Smelling Nerves.
 SSSS The Sieve-like Bone through whose holes the Fibres of the Smelling Nerves are branched.

Fig. II. Shews the Brain in its natural situation, and the Parts aforesaid, &c.

- AAAA Shew the Brain in its natural situation covered with the pia mater.
 CCCC The spongy Bones laid bare.
 DE The gristly Bones of the Nostrils.
 GGG The Partition which divides the upper part of the Brain into two parts, a right and a left.
 HHH The os occipitis or Noll-bone.
 OOOO The Sieve-like Bone, upon which the Mammillary Processes do rest.

Next come we to the second conjugation or pair of Nerves, and those are the *Optick* or Seeing Nerves; so called, either because they carry the visive Spirits to the Eyes, or because they convey the representations of visible things from the Eyes to the Brain.

These arise a little behind the former out of the *medulla oblongata*, and having proceeded a while with a certain compass, they are united above the saddle of *os sphenoides*, and that with a total confusion and mingling of their substances, as far as by the naked Eye I could ever discern in all Horses that I have dissected; though some Authours say that in Humane Bodies they do unite indeed, but that it is onely by contact, without confounding their Fibres with one another.

These Nerves after they are thus united, do soon after again separate, and go out of the Skull into the centre of the Eyes, three of whose coats are made out of the substance of these Nerves being dilated.

At their rise and a pretty way in their progress they are very soft, being covered onely with the *pia mater*; but as soon as they reach the *dura mater*, they are covered with it also, and thereby become stronger and harder. This outmost Membrane it is which doth constitute that coat of the Eye called the horney Coat or *sclerotica*; and from the inner or *pia mater* doth proceed the next Coat or Skin of the Eye called *uvea* or Grape-like, from its colour; and lastly the marrowy substance of the Nerve doth make the third Coat called *Retina* or Net-like.

The Sense of *Seeing* like that of *Smelling* is by Doctor *Willis* said to be performed not so much by the help of the Nerve, as of the Fibres which are interwoven with the Organ; namely, saith he, the little Fibres in the Coats of the Eyes, and especially those that are inserted into the *cornea* or sclerotick Coat, and disposed after the manner of a Net, do receive the impresson of the visible species, and by representing the image of the thing so as it is offered without, cause sight: but it is the office of the Nerve it self to transmit inwardly, as it were by the passage of an Optick Tube, that image or sensible species, and to carry it to the common sensory.

The third pair, or Eye-movers.

The next pair are the *Eye-movers*, which are by Ancient Authours accounted the *second* pair, but do by our Modern Authours go for the *third* pair.

These take their beginning from the basis or bottom of the *medulla oblongata* behind the *Funnel*, from whence they proceed forwards by the sides of the Optick Nerves. At their rise they are united, whence is a reason drawn that when one Eye is moved toward any object, the other is directed also towards the same.

They are smaller, yet much harder than the former, and as was said, run along by their sides untill they come to the *os cuneiforme* or Wedge-like Bone; where, as the Optick Nerves passed through the first, so these pass through the second hole of that Bone, and so on untill they come to the Muscles of the Eyes, into several if not all of which they send a twig or small branch, which is in each Muscle subdivided into innumerable other smaller ones, by which the Animal Spirits are conveyed into the Fibres of the Muscles, and by consequence the several motions of the Eye come to be performed, as shall be shewed at large in a more convenient place, when I come to treat of the Muscles of the Eyes in the next Book.

CHAP.

C H A P. VIII.

Of the fourth and fifth pair of Nerves that arise within the Skull.

THE *fourth* pair of Nerves do arise contrary to all other : for where-^{The fourth pair called Pathetick.} as the rest do take their rise from the bottom or sides of the oblong Marrow, these have their beginning at the top of it, behind those round bunchings out of the Brain called *Nates* and *Testes*, (of which we have already treated where we described the Parts of the Brain.) From whence bending a little forwards by the sides of the said oblong Marrow, they are immediately hid by the *dura mater*, under which they run for some time, untill they come to that hole of the Skull, where the other Nerves designed for the Eyes do pass out, which these accompany, but do not unite with, and at length terminate in the Trochlear Muscles of the Eyes.

This pair of Nerves are by Doctor *Willis* called the *Pathetick Nerves*, because, says he, their office is to move the Eyes *pathetically*, according to the force of the *passions* and *instincts of Nature*, delivered and remanded from the Brain to the After-brain, and on the contrary from this to that, through the *Nates* and *Testes* and their Medullar Processes. For, saith that Learned Anatomist, seeing that by the diverse impulse and undulation of the Animal Spirit's dwelling in this by-path, there happen certain mutual commerces between the Brain and *Præcordia* (the Cerebel mediating between either, from whose Ring-like Process he will have the Nerves of the *Præcordia* to arise;) it is necessary that these Nerves that are rooted in the middle way, should be struck upon by every march or remove of the Spirits going this way or that way, whereby the motions of the Eyes must needs follow the affections of those Parts. With these Nerves, (saith he) all perfect Animals are furnished, there being none but are obnoxious to anger, love, hatred, and other Affections, as may be discovered in every little Creature, but much more in this which we are a-discoursing of, there being none the aspect and gesture of whose Eyes do shew them more than a Horse's do.

Next come we to treat of the fifth pair, concerning the rise of which^{The fifth pair.} there are several disputes amongst Authours, (Doctor *Willis*, particularly, affirming that they spring from the Ring-like Process of the Cerebel :) but if their original be strictly inquired into, I cannot find, in an Horse, (however it may be in Humane Brains) but that they do take their beginning as the others do, I mean from the oblong Marrow, onely a little below the former pair.

These consist of very many Fibres gathered together, some of which are soft, and some hard; so that they seem not to be so much one single pair of Nerves, as a collection of many small Nerves into one bundle, some of which are designed for one use and some for another, being for that purpose distributed into several Parts remote one from another; in which they serve, in some for motion, in others for sense: from whence it is, saith Doctor *Willis*, that there is that sympathy and consent of actions

actions in those several Parts to which these Nerves are distributed. As for instance, seeing some twigs go to the Eyes, others to the Palate of the Mouth, Nose, &c. therefore when we see or smell what pleases our Palate, our Mouth waters, as we commonly phrase it.

But that it may be better understood what and how many Parts have consent by means of these Nerves, it will be convenient to discover their division, progress and different insertion. Their Trunks, beginning or arising out of the oblong Marrow, as hath been shewed, are divided each of them into two notable branches, the first whereof tending straight downwards, and going out of the Skull by their proper holes, are in their descent towards the lower Jaw, (for whose Parts, saith my Authour, they are chiefly design'd) divided into many lesser branches, which provide for the Temporal Muscles, as also for the Muscles of the Face and Cheeks. From these branches also there go twigs or little shoots into the Lips, Gums, roots of the Teeth, Jaws, Throat, and to the farther end of the Palate, and also to the Tongue.

The other branches of this pair of Nerves are called the *superiour* or uppermost branches, being larger than the other, and do thus run their course. After their division from the former they go straight forward for a little space under the *dura mater* nigh the side of the Bone called the Turkey chair, and over against the *glandula pituitaria* send little twigs to the Trunk of the *Carotides*, that makes the *wonderfull Net*: then they are inoculated into the Nerves of the sixth pair, and from thence send back sometimes one, sometimes two shoots a-piece, which being united with two other slips turned back from the Nerves of the sixth pair, do constitute the root or first trunk of the intercostal pair of Nerves, reckoned for the ninth pair, of which more shall be spoken by and by in the tenth Chapter.

After they have sent out the slips for the root of the Intercostal Nerve, these same great branches of the fifth pair are again divided each into two notable branches; the *lesser* and upper of which tends towards the globe of the Eye, and being again divided sends forth two other, the *first* of which is parted into two more, that go, one, to the Nose, and the other to the Eye-lids; and the *second* into four or five slips, that are mostly spent on the Eye-lids, but partly on the Coats of the Eye and its Glands.

The second or *greater* branch of the second division of these Nerves, being carried towards the orbit of the Eye, is again divided into two new branches: the *lower* of these being bent downwards, and cleaving it self into many shoots, is bestowed on the Palate and upper region of the Jaws; the other, being the *higher*, is carried beyond the orbit of the Eye, and passeth through a proper hole of the upper Jaw with the Vein and Artery which it twists about, and sends many slips to the Muscles of the Cheeks, Lips, Nose, and roots of the upper Teeth.

The reason of
blushing.

From this pair of Nerves being distributed to so many Parts, I say, may the consent of those Parts one with another be learned: and particularly this is worthy observation, That seeing they twist about the Blood-vessels that go to the Cheeks, &c. hence it is, that when in Men and Women the Animal Spirits are disturbed by the imagination of some uncomely thing; as if they took care to hide the Face, they enter these Nerves disorderly, whereby their twigs that embrace the Blood-vessels do compress and pull them, so that the Blood comes to flow too impetuously into the Cheeks, &c. by the Arteries, and is detained there for some time

by

by straitning the Veins. But such observations belong more to an Anatomist of Humane Bodies to which they are proper, and therefore I shall return from this digression, which yet, I hope, will not be unpleasant to the inquisitive Reader.

Table XXV.

Represents the Brain of an Horse taken out of the Skull, with the Optick, Eye-moving, and Pathetick Nerves; as also the Eyes with their Muscles fastned to them, having been taken out of the Skull without tearing or breaking of them.

AAAA Shew all the bottom of the Brain covered with the dura mater.

BB The Cerebellum or After-brain.

CC Part of the medulla oblongata, or head of the Spinal Marrow.

DD The Glandula pituitaria cut in two in the middle, and turned back to each side with the dura mater, the better to shew the Chink or Funnel.

E The Chink called Vulva.

FF The Mammillary Processes covered with the dura mater, otherwise called the Smelling Nerves or the first pair.

GG The rise of the Optick Nerves, or second pair.

H The uniting of the Optick Nerves.

II Their separating again, and their course down to the Eyes.

KK The moving Nerves of the Eyes or the third pair.

LL The Pathetick Nerves reckoned by Doctor Willis for the fourth pair.

MM Doctor Willis his fifth pair of Nerves.

NN The heads of the Muscles of the Eyes, from whence they were all of them cut, to be separated and placed as in the Figure.

OO The orbicular Muscle of the Eye in its natural situation in this Eye, but in the other Eye it is quite removed, the plainer to shew the course of the Optick Nerve to the Eye.

PP The Muscle that pulls up the Eye, called Attollens, or superbus, the proud Muscle.

QQ The humble Muscle or puller-down of the Eye, called humilis.

RR The Muscle that brings the Eye inwards to the Nose, called Adducens, or bibitorius, the drinking Muscle.

SS The Muscle that pulls the Eye outward, called Abducens, or indignatorius, the angry Muscle.

TT The Muscle that brings the Eye towards its inner corner obliquely, and from that office is called obliquus inferior.

VV The obliquus superior cum trochlea, whose office is to bring the Eye obliquely to its outward corner.

WW The horney Tunicle or Coat of the Eye, with the pupilla or sight,

C H A P. IX.

Of the sixth and seventh pair of Nerves arising within the Skull.

The sixth pair.

THOSE Nerves which are by Doctor *Willis* reckoned for the sixth pair, are in the next place to be spoken to. These take their beginning just by the fifth, and being for a little time hid under the *dura mater*, go at length out of the same hole of the Skull with the before-named fourth and fifth pairs, and are carried each with a single Trunk nigh to the Sockets of the Eyes; but so, that near the side of the Turkey-chair-bone they are inoculated with the second or greater branches of the fifth pair. Whence they send back sometimes one, sometimes two twigs, which being united with the first or recurring branches of the fifth pair, as was noted in the foregoing Chapter, do constitute the beginning of the Intercostal Nerves. Afterward going a little forwards, each of them near the Orbit or Socket of the Eye, is divided into two branches; one of which is inserted into the Abducent Muscle of the Eye (or the Muscle that draws the Eye outward) which is seated in its outer corner; and the other being split into very many Fibres is bestowed on the seventh Muscle of the Eye, which is said to be proper onely to Brutes. Whether Men do wholly want them, let others examine; however, in the Animal we are treating of, they are very conspicuous and most easie to be found, concerning whose use I will speak when I come to a proper place for that purpose.

The seventh pair, or Auditory Nerves.

Next are the seventh pair to be examined, which by the Ancients (and by all untill Dr. *Willis* altered the account) were reckoned for the fifth pair. These are employed about the Sense of *Hearing*, and are therefore called the *Auditory Nerves*. They take their rise in Humane Bodies (according to Doctor *Willis*) out of the lower side of the Annular or ringy protuberance of the Cerebel; but I am sure they do not so in Horses, in whom I have always found them to arise from the sides of the oblong Marrow.

They have each of them two *Processes*, one soft and the other harder; which distinction of them makes many be of the opinion that they are indeed two pair of Nerves, though usually they are accounted but for one.

The *softest* of these two *Processes* is properly called the *Auditory Nerve*, the which is carried through an hole of *os Petrosum* (or the craggy Bone) into the Cells of the Ear, which it cloaths with a most thin Membrane, and by which the sounds are conveyed to the common Sensory.

The *harder* part or process of the Nerve is said to conduce more to Motion than Sense; which passing out also through its proper hole in the aforefaid Bone doth immediately receive a twig from the eighth or wandering pair; after which it is streight divided into two branches; the first of which tending downward is bestowed on the Muscles of the Tongue and the Bone *Hyoides*; the other winding about the auditory passage and bending more upwards, is divided into three Shoots; the first of which answering to the Nerve of the former division, bestows certain slips

slips on the Muscles of the Lips, Mouth, Face and Nose, and so actuates some of the outward organs of the Voice, as the former doth some of the inner. The *second* of these Shoots being divided into many other lesser, is sent into the Muscles of the Forehead, as also to the Eye-lids. And the *third* or last of them doth run towards and spreads it self into the Muscles of the Ears. Whence upon any unusual and astonishing sound the Ear is by a natural instinct prickt up, to listen to it the more attentively, and at the same time the Spirits flowing by other branches of this Nerve into the Muscles of the Eye-lids, cause them to be drawn as far asunder as is possible, that the Beast may have the clearer view of any threatening danger; which posture of the Eyes we call *staring*.

C H A P. X.

Of the eighth and ninth pair of Nerves.

THE next pair of Nerves we are to treat of are the *eighth*, (commonly reckoned for the *sixth*) otherwise called the *wandering pair*, The eighth or wandering pair. from their being distributed into many Parts, wandering as it were not only through the Head and Neck, but through many of the inferiour Parts of the Body both in the Chest and Paunch, furnishing them with Nerves branching from them.

These Nerves do also arise out of the oblong Marrow a little below the Auditory Nerves. Their root or beginning consists of many Fibres, some of which are smaller and some thicker, to which is added a notable Fibre or rather Nerve, much greater than the rest, coming from the Spinal Marrow of the Neck, which is joined with them and wrapped about with one and the same Coat taken from the *dura mater*, as if they were but one Nerve. They continue to be thus united till they have past without the Skull, after which they are dispersed to several Parts. The Accessory Nerve is distributed to the Muscles of the Neck and Shoulders; and one notable Fibre of the eighth pair joins it self on each side to the harder Process of the Auditory or seventh pair, as also two others run to the Muscles of the Gullet and Neck. But the rest of the Fibres of the wandering pair continue together, going forward in one Trunk; and instead of the other companion lately parted from them (I mean the Spinal or Accessory Nerve) they entertain a new one, which is the Intercostal, or Nerve of the ninth pair.

In this place where the said Intercostal Nerve is united with this Nerve of the eighth pair, there is made a notable *Plexus*, (that is, the Trunk of the Nerve in that place swells into a kind of tumour, resembling the joint or knot of a Cane.) For as the Intercostal Nerve is received *into* it, so *out* of it there springs a considerable branch, which being carried towards the Throttle is divided into three twigs; the *first* of which is stretched out into the sphincter of the Gullet; the *second* being hid under the Shield-fashioned Gristle, distributes its Shoots to the upper Muscles of the Throttle, and particularly to the Muscle by which the Chink of the

Throttle is shut up. The *third* of these shoots or twigs going also under the Shield-fashioned Gristle, meets the top of the Recurring Nerve and is united with the same.

Below the aforesaid inoculating of the Intercostal with the wandring pair, which makes that *Plexus* before-named, the Trunk of this latter goes streight down by the sides of the ascending Carotid Artery, on which it bestows some slips, and at the bottom of the Neck it sends out another twig into the Recurrent Nerve, but this it does onely on the left side.

From hence the Trunk of the wandring pair descends without any noted branchings till it comes over against the first or second Rib, where out of a second *Plexus* many shoots and numerous Fibres are sent forth towards the Heart and its appendages, but not altogether in the same manner on both sides. Doctor *Willis* says, many more branches are sent from this pair towards the Heart in Beasts than in Men; for in these latter there are a great many twigs sent thereto from the Intercostal pair, whereas there are very few in Brutes; so that in both, the plenty of the one supplies the defect of the other.

There is (saith the same Authour) one notable difference worthy of note, of the two Recurrent Nerves that spring out of the Trunk of this eighth pair, *viz.* that that on the right side arises out of it higher, and winds about the Axillar Artery; whereas that on the left springs much lower therefrom, and twisting about the descending Trunk of the *Aorta*, returns back from thence, and ascends upwards where in its progress it sends forth shoots to divers Parts.

And that observation of the said Doctor is worthy to be taken notice of, *viz.* That the Nerves that pass towards the Heart of Brutes are much fewer in number than those in Men, of which (as also of their proceeding chiefly from the wandring pair) he gives this ingenious reason; That seeing Beasts want prudence, and are not much liable to various and divers passions, it was not therefore necessary that there should be two ways of deriving the Spirits from the Brain to the *Præcordia*, namely one to bring Spirits to maintain the exercise of the vital function, and the other to minister to the impressions of the affections; but it is sufficient that all the Spirits, for whatsoever office they are destin'd, should be conveyed thither by one and the same path.

Over against the Heart, the *Trunk* of the wandring pair sends forth many notable branches on either hand, which passing to the Lungs, are distributed through their whole substance along with the Bloud-vessels and branches of the Wind-pipe, which they climb upon and twist about: and as it descends by the sides of the Wind-pipe, it distributes also many slips into the Coats of the Gullet. After these branches have grown out of these Nerves, then is each Trunk, as it descends by the Gullet, divided into an *outer* and *inner* branch: but presently the outer branches unite with the outer, and the inner with the inner; and being so united, the *former* descends by the outside of the orifice of the Stomach to its bottom, where it disperses it self; and the *latter* descending by the inside of the orifice of the Stomach, turns back there, and creeps along its upper part. To what other Parts the twigs of this eighth or wandring pair are extended, the Reader may learn in the description of the Parts themselves, in treating of which we have constantly observ'd to shew from whence their Nerves were derived.

After

After the *wandering* or *eighth* pair, by order of dissection the *ninth* and last pair of Nerves that spring from within the Skull are to be spoken to. The ninth or intercostal pair. Concerning the rise of which pair, there are various opinions; for some there be that will have them onely branches of the wandering pair, and that they take their beginning from them: but that opinion is rejected, since it is now made very apparent that they have another original, of which the often before-cited Doctor *Willis* was the first discoverer, whom I may be bold to follow, since none have given, nor 'tis probable can give a better account of them than that Learned man, who saith that the beginnings, (as also the different Trunks in the progress) of these Intercostal Nerves are easily distinguished from the former, notwithstanding they do often communicate or join together by branches sent forth from one to the other.

But though they owe not their original to the wandering pair, and much less are to be reputed as branches of them, yet have they no proper root of their own, but do borrow their original from two or three recurring branches of the fifth and sixth pairs near their origine, growing out of them as a Shrub upon another Tree or Shrub.

These Nerves thus constituted do afterward run out of the Skull by their proper holes, and presently on each side form a *Plexus* near that of the wandering pair, into which two Nervous Processes out of the first vertebral pair are inserted, and out of which there goes one twig or slip into the Sphincter of the Gullet, and another into the *Plexus* aforesaid of the wandering pair. Whence descending by the *vertebræ* of the Neck, by that time they arrive at its middle, they have each another greater *Plexus*, into which a large Nerve from a neighbouring vertebral pair is inserted, and from which proceed some twigs that uniting with others of the wandering pair are distributed all about the *Præcordia*, (that is, to the Heart and Lungs) as also one single one a little lower. 'Tis true, Doctor *Willis* affirms that this *Plexus* last spoken of is proper to Man onely; but since I find so little difference in the other Parts between a Man and the Animal I am treating of, I suspend my belief whether this *Plexus* may not be found in him also, though I have not been yet so diligent as to make any exact inquiry into it.

This *Plexus* is called the *Plexus cervicalis*, because it is formed in the Neck; whence the Trunks of this Intercostal pair descending by the *Claviculæ* or Chanel-bones into the Chest, as soon as they have arrived at the second Rib, each of them receives three or four branches from the Vertebral Nerves next above, whereby is made another notable *Plexus*, commonly called the Intercostal. From whence as its Trunks pass down by the roots of the Ribs, in every one of their Interstices, and even as low as the *Os sacrum* from every jointing of the *Vertebræ* each Trunk receives a Vertebral Nerve.

As soon as they are descended out of the Cavity of the Chest, and are come over against the bottom of the Stomach, they send forth on each side a notable branch, each of which tending towards the Mesentery makes its chief *Plexus's*, being in number seven, *viz.* five large ones which are upper, and two less that are lower. For each branch is presently divided into two other, and every one forms one *Plexus*, which make four; and the fifth is in the middle of these, being the largest: and these are the five upper.

The two lower Plexus are framed of two branches that spring from the Trunks descended as far as the lower part of the Loyns, and are distinguished by the names of *Plexus infimus*, and *minimus*, (i. e. the lowest, and the least) which two Plexus do furnish several Parts of the Lower Belly with Nerves.

Lastly, When this Intercoastal pair have descended as low as the *Os sacrum*, and have furnished in their course the several Parts of the Lower Belly with Nerves, they bend towards one another and seem to be knit together by two or three Processes, and at length each of them ends in small Fibres which are distributed into the Sphincter Muscle of the Arse.

Thus have I given a description of the several pairs of Nerves arising within the Skull, in describing of which I must own my self obliged to several worthy Authours, whose Doctrine I have been forced much to follow and relie on in this particular, having not as yet made a thorow inspection into these most curious Instruments of the Animal Faculty my self: the chieft of which Authours and whom I have most followed, is that accurate Tracer of them, Doctor *Willis*, to whom all that have treated of these Parts since him, have been so much beholding. But onely where he assigns some differences betwixt the course of the Nerves in Men, and all Brutes in general, I cannot easily acquiesce in his opinion in relation to a Horfe, the frame of whose Body comes almost in all respects so near to that of a Man's; however, till I have made a more exact scrutiny, I shall forbear contradiction.

Table XXVI.

Shews the basis or bottom of the Brain of an Horfe taken out of the Skull, having the *dura mater* removed, the better to shew the rise of all the Nerves, and the other Parts of the bottom of the Brain.

- AAAA Shew the substance of the basis or bottom of the Brain.
 BB The Cerebel or After-brain placed in the hinder part of the Head.
 CC The Oblong Marrow.
 DD The Smelling Nerves; being the first pair.
 EE The Optick Nerves, being the second pair.
 FF The third pair of Nerves, which move the Eyes.
 GG The fourth pair of Nerves, by Doctor *Willis* called the Pathetick Nerves.
 HH The fifth pair.
 II The sixth pair.
 KK Doctor *Willis* his seventh pair, being the Auditory Nerves, which went formerly for the fifth pair.
 LLIII The eighth pair of Nerves, called otherwise the wandring pair, which before Doctor *Willis* were reckoned for the sixth pair.
 MM The Spinal Nerves, or Accessory pair, that unite with the wandring pair.
 NN The ninth pair.
 OO The tenth pair (or rather the first of the Neck) arising from the further or hinder part of the Oblong Marrow near its going out of the Skull.
 PP The Trunk of the Carotid Artery cut off where it is divided into the fore and hinder part.

QQ A branch of it going into the substance of the Brain.

R The Infundibulum or Funnel.

SS Two Glands or Kernels placed behind the Funnel.

C H A P. XI.

Of the Nerves arising from the Spinal Marrow, while it is in the Vertebrae of the Neck.

HAVING treated of the several Conjugations or Pairs of Nerves which take their beginning from that part of the Spinal Marrow contained *within* the Skull, the usual and most natural method requires me next to proceed to those that spring from that part of it that is contained in the *Vertebrae* of the Neck and Chine without the Skull.

We observed in a Chapter above, that in its whole progress from the Skull to the Rump-bones there spring from it thirty seven pair of Nerves. Particularly, while it is in the Neck, there arise out of it seven pair; while it is in the Back, seventeen pair; while it is in the Loyns, seven pair; and while it is in the *Os sacrum*, six pair: for as was noted before, such is the number of the Joints in the Rack-bone, betwixt every of which a pair of Nerves issues. Of all which we will treat briefly in order.

The *first* pair of the Neck, though it be commonly reckoned among the pairs of the Spine or Rack-bone, because it comes out from between the first *Vertebra* and the Skull; yet if we consider its rise, it ought rather to be reputed the *tenth* pair of the Brain; for it rises with many Fibres from the Spinal Marrow while it is yet within the Skull, but presently after its rise tends backwards or downwards (whereas all the rest that arise within the Skull go forwards.) This pair is chiefly bestowed on the Muscles of the Neck.

The *second* pair comes out between the first and second *Vertebrae* of the Neck, and is bestowed upon the Neck, Head and Face.

The *third* and *fourth* pair come forth of the holes that are between the second and third, and the third and fourth *Vertebrae*, and are spread into the Muscles of the Cheeks, as also into the Muscles that are common to the Head and Neck.

The *fifth* springeth forth between the fourth and fifth *Vertebrae*. A twig from each Nerve of this pair, being joined with the like twigs of the fourth and sixth, do make that remarkable Nerve that goes to the Midriff, and is called *Nervus Phrenicus*. The other branches of this fifth pair are distributed some of them backward and some forward into several Muscles; some of which do bow the Head; other twigs run toward the Fore-legs, and are distributed into several Muscles about the Shoulders.

The *sixth* pair cometh out under the fifth *Vertebra*, and hath, as the rest, several branches; some of which go to the Muscles of the Fore-legs, and some to the Muscles of the Neck; but one particular twig helps to make

make up the Trunk of the *Nervus Phrenicus*, joining it self with the aforesaid twigs of the fourth and fifth pairs.

The seventh. The *seventh* pair cometh out of the hole common to the sixth and seventh *Vertebrae*, which joining with the foregoing pair, *viz.* the sixth of the Neck, and likewise with the two following, *viz.* the two first of the Chest, is dispersed into several Muscles of both the Shoulders, also to the Neck and Checks.

The Accessory Nerve, that ascends to the Brain, and unites with the wandering pair. About where this seventh pair of Nerves arises, there springs another, found out by Doctor *Willis*, and by him called *Nervus ad par vagum accessorius*, which ascends up by the sides of the Spinal Marrow (growing in its course thicker and thicker) untill it reach up to the Skull, during which way it continues in one body without sending any branches to any Part. When it has entered the Skull, it then joins it self with the Fibres of the eighth pair of the Brain called the wandering pair, with which it takes its progress out of the Skull, but presently after separates from them, and is dispersed into the Muscles of the Neck and Shoulders, as was shewed before in the foregoing Chapter, while we discoursed of the wandering pair.

C H A P. XII.

Of those Nerves that arise out of the Spinal Marrow whilst it is in the Vertebrae of the Back, Loyns, and Os sacrum.

FROM the Marrow of the Back proceed seventeen pair of Nerves, there being in an Horse so many Spondyls or Back-bones; which number exceeds that of the Joints of the Back in Humane Bodies, there being in *them* but twelve, and so accordingly they have no more than twelve pair of Nerves from the Marrow within the Back.

The first pair of the Back. The *first* of these pairs springeth out of the hole which is common to the last *Vertebra* of the Neck and the first of the Chest: Each of them (as are likewise all the following) is presently divided into two branches, of which the *formore* is larger than the *hinder*. The *formore* joineth it self with the two last of the Neck, and so goeth the greatest part of it to the Fore-legs; onely one little twig that ariseth out of it before such conjunction, is bestowed upon some of the Muscles of the Breast and Neck; and the smaller which is the *hinder*, is bestowed upon the Muscles seated on the Back.

The second pair. The *second* pair springs out between the first and second *Vertebrae* of the Chest, whose *formore* branch being united with the first of the Chest, together with it is joined with the sixth and seventh of the Neck, which all together make one *Plexus*, out of which proceed most of the Nerves that are inserted into the Muscles of the Shoulders and Fore-legs. But before the aforesaid *formore* branch unite with the foregoing, it sends forth a twig to the Intercostal Nerve (or Nerve of the ninth pair) descending

ending down the *Thorax* or Chest, as also do all the rest of the remaining fifteen pair.

That branch of this pair which is called the *hinder* branch, hath the same distribution with the hinder of the foregoing pair, and therefore I will omit speaking particularly of it: Neither do I think it necessary to treat of every particular of the remaining pairs that proceed from the Marrow of the Back; first, because my design is to be as brief as possible both in these and all other Parts, that I may not make my Volume swell too big; and in the next place, the remaining pairs coming out of the several holes betwixt the jointings of the other Bones of the Back as these already spoken of do out of the former, it would be but repeating almost the same things over again so to describe particularly every pair. I will therefore onely speak thus much of them in general, that after they are come out of their several holes of the *Vertebræ*, they do each of them immediately divide themselves into two branches, whereof the *formore* (being, as hath been said, the larger) sends one twig to the Intercostal Nerve, and the remainder of it is bestowed on the Muscles between the Ribs, called the Intercostal Muscles, both external and internal, and a few twigs also upon the other Muscles of the Chest that lie upon the Ribs; and lastly, a twig or two on the obliquely descending Muscles of the Lower Belly. The *hinder* and lesser branches presently upon the division bend backward to the Spine, and are spent upon the Muscles and Skin of the Back.

Next come we to speak to those Nerves that spring from that part of the Spinal Marrow that is contained within the *Vertebræ* of the *Loyns*, which are in number seven pair according to the number of Bones in that Part. The *first* of which cometh out between the first *Vertebra* of the *Loyns* and the last of the Back. Each of them, like those of the Back, is presently divided into two branches; the *formore* of which is bestowed upon the fleshy part of the Midriff, especially its two Processes, and partly upon the Muscle *Psoas*; and the *hinder* of them is inserted into the *Musculus longissimus* or longest Muscle of the Back.

The *second* pair come out between the first and second *Vertebræ* of the *Loyns* under the Muscle *Psoas*; the *formore* of whose branches is bestowed upon the Muscle that fills up the Cavity of *Os Ileum* or Haunch-bone (which Muscle is the second bender of the Thigh) also a twig of it is sent to the *Musculus fascialis*, and to other neighbouring Parts. The *hinder* branch passeth into the Buttock Muscles, and doth lose it self in the bodies of those Muscles.

The *third* pair of these Nerves of the *Loyns* come forth between the second and third *Vertebræ* of the *Loyns*, from under the Muscle *Psoas*, as the former did. The *fore* branch is dispersed down the hinder Leg to the Cambrel or Hock, furnishing several Muscles about those Parts with Nerves. The *hinder* branch is bent back and dispersed through the Muscles of the *Loyns*, supplying them with Nerves.

The other four pair of these Nerves of the *Loyns*, like the former, come forth from between the other four *Vertebræ* of the *Loyns*. Their *fore* branches are dispersed into most of the Muscles of the Buttocks and hinder legs; also some twigs are sent from them to the Muscles that raise the Yard, some others to the neck of the Bladder; and in Mares some twigs are sent to the *Matrix* or Womb. And the *hinder* branches are carried backward, and are bestowed upon several Muscles of the Back.

In the next place I come to treat of the remaining Conjugations or pairs of Nerves that spring from the Spinal Marrow, which are those that come forth of the holes of *Os sacrum*, and are in number six pair, there being in the said Bone six *Vertebræ*, with pretty wide holes for the coming forth of the Nerves.

The first pair
of *Os sa-*
crum.

The *first* of these pair issueth out between the last *Vertebra* of the Loyns and the first of *Os sacrum* in the same manner as those that spring out of the *Vertebræ* of the Loyns, and like them is divided into two branches; the *foremost* of which is a great part of it mixed with those other of the *Loyns*, and with them runs down to the hinder Legs, supplying several Muscles of those Parts with Nerves. And the *hinder* furnisheth the biggest Buttock-muscle and other Parts thereabouts with Nerves.

The remain-
ing five pair.

This pair of Nerves, as I have said, come out side-ways like the Nerves of the Loyns, and are divided like them afterwards into a *fore* and a *hinder* branch; but the other five pair come out before and behind; but before they go out of the Bone, they are on each side double, and on each side one Nerve goes into the fore-parts and the other into the hinder. Those that go into the hinder-parts are dispersed as those of the Loyns were, that is, into the Muscles that lie upon the *Os sacrum*, and *Ileum*; but those that go into the fore-parts are dispersed into some Muscles on the fore-part of the Thigh; also some twigs of them are sent to the Cods, the Bladder, and to the Muscles of the Fundament.

Table XXVII.

Represents all the Nerves of the whole Body, as well those that arise from the Oblong Marrow within the Skull, as those that spring from the Spinal Marrow without the Skull, (taken out of a French Authour.)

AAAAAA *Mast of the Nerves that spring from the Oblong Marrow within the Skull.*

B *The said Oblong Marrow.*

CC *The Eyes with the optick and moving Nerves branched to them, the one making their Coats, and the other serving to move them.*

DD *Doctor Willis his eighth pair or the wandring pair of Nerves, with their course through the Middle and Lower Belly.*

From the Figure or Cipher 1 to 7. are shewn the Nerves that spring from the Spinal Marrow while it is in the Vertebræ of the Neck.

From the Figure 1 to 17. are shewn those that spring from it while it is in the Vertebræ of the Back.

From the Cipher 1 to 7. are shewn those that arise out of it while it is contained within the Vertebræ of the Loyns.

*From the Cipher 1 to 6. are shewn those that arise out of it while it is in the *Os sacrum*, which Nerves are branched into all the hinder Parts and down the hinder Legs, imparting to them both Sense and Motion.*

Thus have I given a brief description of the several Conjugations or Pairs of Nerves that spring from the Spinal Marrow, shewing where they arise, which way they pass, and to what Parts they run; which may

may be of great use to our Practitioners, if they will but take the pains to inquire into this part of Anatomy; for by understanding the beginning or rise of the Nerve that furnisheth an affected Part, one may learn where to apply the Remedy. As for instance; When from any outward cause, as from a fall, stroke, bruise or any other accident, any Part hath lost either Sense or Motion or both; or from any inward cause a Palsie happens, by which the use of some particular Limb is taken away; it would conduce very much to the cure if the rise of the Nerves of such Part were known by the undertaker of the cure of those Affections; for the Medicine is to be applied always to the beginning or rise of that Nerve that passeth to that Part, or as near to it as is possible.

I should here put an end to this discourse of the Spinal Nerves, if it were not convenient to add a word of the manner how they arise out of the Marrow, which is very accurately described thus by Doctor *Willis*.

“On each side of the Spinal Marrow, near its outer edge four or five
 “Fibres arise in its upper side, and as many in its lower: both which
 “companies penetrate first the *pia mater* or inmost Coat of the Spinal
 “Marrow, and then the *dura mater* or middle Coat, (which is as it were
 “a common case to them all) with *distinct* Fibres: but afterwards as
 “both companies of Fibres are to pass through the third Membrane (for
 “the Spinal Marrow has three) they meet together, and being invested
 “with the Coat they borrowed from the second Membrane, they become
 “as it were one Trunk: which Trunk passing out of the jointing of the
 “*Vertebrae*, is again divided into several Nerves design'd for fundry Parts.
 “After this manner in the whole tract of the Spinal Marrow have the
 “several vertebral Nerves their origine; and in those places where the
 “brachial (or fore-leg) and crural Nerves pass out, the Spinal Marrow
 “encreases both in thickness and breadth, and the nervous Fibres are lar-
 “ger. All which that it may be the better apprehended, I have thought
 good to annex the following Figure from Him, onely encreasing the number of the pairs of Nerves as they are found to be in an Horse.

How the
Nerves spring
out of the
Spinal Mar-
row.

Table XXVIII.

Shews the Spinal Marrow taken whole out of the Rack-bone, where the Membrane that cloatheth it is dissected and turned back on each side, the better to shew the beginnings and productions of all the vertebral Nerves, (from Doctor *Willis*.)

- AA Shew the top of the Spinal Marrow, where it is cut off from the Oblong Marrow.
- B The Spinal Artery seeming to descend through the whole Marrow, which however is made up of Arteries brought into it from between the several jointings of the *Vertebrae*.
- CC The Spinal Nerve coming from the fifth or sixth *Vertebra* of the Neck to the beginning of the wandering pair.
- DD Portions of the Membrane cloathing the Marrow dissected and turned back.
- EEEE The Spinal Nerves sent out of the upper margin of the Marrow by bands, with which the like bundles springing from the lower margin also meet, and join together all into one Trunk within the junctures

- tures of the *Vertebrae*, then being separated again without them, they are carried into their respective provinces.
- Ff Nerves springing within the region of the Neck.
- Gg Nerves destined for the Shoulders and Fore-legs, where both the Marrow is thicker in bulk, and the Nerves greater.
- Hh Nerves going out about the Back and Loyns, where both the body of the Marrow is again become smaller, and the Nerves are somewhat slenderer.
- Ii Nerves destined for the Buttocks and hinder Legs, where both the Medullar body and the Nerves are again larger.
- K Nerves going out of *Os sacrum*.

C H A P. XIII.

Of the Eye-lids, Eyes and their several Parts, viz. their Coats and Humours.

- T**HE Eyes are termed in Latin *Oculi*, from the word *occludo* to shut, or from *oculto* to hide, because they are hid by the shutting of the Eye-lids. They are the Organs or Instruments of Sight, consisting of many Parts, viz. of Humours, Membranes, &c.
- Their number is by all People known to be two, and that for the security and perfection of sight; that if one be defective, or should by accident be lost, the other may supply its place and office, though not altogether so perfectly.
- The Eye alone, when its Muscles, and the Nerves and Bloud-vessels that enter into it, are removed, is of a round figure, both that it might move the better, and also that it might the better receive the visible Rays.
- Adjoining unto the Eyes are the *Eye-lids*, which contain them as it were, and serve as a safeguard or cover to preserve them from external injuries: United with them are the Fat and Muscles: and lastly the Parts that constitute the Eye it self are the Membranes, Humours, and Vessels.
- The *Eye-lids* do serve as Curtains to the Eyes, by which dust, Flies, or any thing else that might annoy them, is kept out. They are made up of the Skin, the *membrana Carnosa* or fleshy Pannicle, and Muscles; but both the Muscles and fleshy Pannicle are in these Parts very thin. On the inside next the Eye they are lined with a Membrane that is propagated from the *Pericranium*, which is very smooth, that it may move glibly upon the Eye. The extremities or edges of the Eye-lids are hard and gristly, partly to strengthen them, and partly that they may meet the more exactly, and not fall one over the other. And thus much shall suffice for the outward or containing Parts of the Eyes, viz. the Eye-lids.
- As for the *Muscles*, we shall defer speaking of them till the next Book. And as to the *Fat*, it differs not from that which is intermixed among the Muscles in other Parts, and serves here to keep the hinder-part of the Eye and parts adjoining moist, that the Eye may move the more glibly in its Socket.

We shall therefore next proceed to the Eye it self, and describe the Parts ^{The Tunicles} of which it consists, and first its Tunicles or Coats, the first or outmost ^{of the Eyes.} of which is a *common* Coat, arising from the *Pexicranium*, and is spread ^{1. Adnata.} over all the white of the Eye. By this is the Eye kept firmly within its Socket or Orbit. It is of exquisite sense, and hath many small Arteries and Veins creeping through it, which are very discernible when there is any inflammation in that Part. It is called *Adnata*.

This *Adnata* being removed, the *proper* Tunicles or Coats do appear, ^{2. Sclerotica.} being in number three; the first of which from its hardness is called *sclerotica*. This arises from the *dura mater*, or (which is all one) from the outmost Coat of the Optick Nerve. It is somewhat hard, and opaque on its backside; but on its fore-part, because it is transparent like an Horn, it loses its name of *sclerotica* which it had from its hardness, and is called *tunica cornea* or horney Coat from its clearness.

The *second* proper Coat lieth next under this, and goeth by the name ^{3. Choroides.} of *Choroides*, because it resembles that Membrane that inwraps the Foal in the Womb, called *Chorion*. As the former did arise from the *dura mater*, so doth this from the *pia mater*, (or if you will, from the inner Coat of the Optick Nerve.) All over the back-part of the Eye, this Coat on its inside is blackish, that the Idea's received in might appear the more illustrious.

This Coat is perforated before as wide as the *pupilla* or sight of the Eye is in compass, to permit the rays of visible Species to pass in to the crystalline Humour. Which fore-part, because so much of it as is from under the white is somewhat of the colour of a Grape, is called *uvea*: by which name the fore-part of this Coat is distinguished from its hinder-part, as the former was by the name of *cornea*, from *sclerotica*; which I thought fit to take notice of in this place, that the Reader might not take the four names for four several Coats, when they are but two, and so might go about to find what indeed there is not.

From the circumference of the *uvea*, where its duplicated Membrane bends it self back to the crystalline Humour, there is formed a Ligament called *ligamentum Ciliare*, because it consists of slender Filaments or Fibres like the hairs that grow upon the Eye-lids in Humane Bodies, running like so many black lines from the circumference of the *uvea* to the sides of the crystalline Humour; which Humour they encompass, and widen or constrict it as there is occasion, by contracting or opening the perforation of the *uvea*.

The *third* or inmost proper Tunicle of the Eye is called *Retina* or the ^{4. Retinal.} Net-fashioned Coat, because it encompasses the vitreous or glassy Humour like a Net.

This Coat is made of the medullar substance of the Optick Nerve, being very thin, and rather of a dark than lightfom colour, mixed with an obscure redness. Its figure is semicircular, round on its outside, and hollow within, containing in it the vitreous Humour, and receiving into its bosom the crystalline Humour also, having its Fibres extended as far as the *ligamentum Ciliare*, to which these Fibres afford animal Spirits for the continuance of its motion. It is observed that if this Coat be taken and put into warm Water, shaking it a little to wash off the mucous or snotty matter that cleaves to it, and then be held up to the light, the Fibres or Filaments will appear very numerous like the threads of the finest Lawn.

Having

The Humours
of the Eyes.

Having done with the *Tunicles* or Coats of the Eyes, I come next to speak of the *Humours* contained within those Coats, which are in number three, that is the *Aqueus* or watery, the *Vitreus* or glassy, and the *Crystalline*: of which the last for its use is the most noble, and is placed almost in the centre of the Eyes.

The watery
Humour.

Of these Humours the *Aqueus* or watery is outermost, being thin and fluxive like Water, from whence it hath its name. It fills up that space that is betwixt the horney or outmost Coat and the crystalline Humour in the fore-part of the Eye. It is observed in Men, that if any clotted and coloured bits or motes swim in this Humour, the shapes of several Insects, as Gnats, Flies, Spiders and the like, will seem to be flying before their Eyes, as hath been oft declared by Men who have had this Affection. I am therefore apt to believe that many Horses are not without such kind of congealed bits floating in this Humour, that without any evident or external cause to occasion it, are much given to start, especially with their Head; the representation of the aforesaid Insects moving before the crystalline Humour, which makes them fear something or other is still flying into their Eye.

Yea it is in Humane Bodies farther observed, that oft times several of these coloured Particles in the watery Humour do gather together, and unite so close, that they grow as it were into a skin or film, spreading before the sight of the Eye, which causes an absolute blindness, and is that Disease which Physicians call a *Cataract*; which Disease the Animal we are treating of is much subject to, though we have not so proper a term for it as this is.

The Crystalline.

The next Humour is the *Crystalline*, which is so called from its exceeding bright and shining colour, being as transparent as Crystal; It is itself of no distinguishable colour, that it might receive the Idea's of all colours.

It is placed betwixt the watery and glassy Humours, but not exactly in the middle or centre of the Eye, but rather towards its fore-part. It is inclosed in the bosom, as it were, of the glassy Humour, and is flattish on the fore-side, but rounder behind.

This Humour is believed to be the primary or chief instrument of the sight, because it collects or receives the rayes of visible things; though the *tunica Retina* doth afterwards stop them by its dark body, and communicate them to the common Sensory by the Optick Nerve.

The Glassy.

The third and last of the Humours of the Eye is the *Vitreus* or glassy, so called because in colour it is like to molten glass. This is not of so thick a consistence as the crystalline; but it much exceeds both it and the watery in quantity. It is round in its hinder part but plane before, onely it has a little hollownes in the middle wherein the crystalline Humour is placed as in a mold or case. It fills up all the hinder part of the globe of the Eye, as also some part of the sides.

The uses of this Humour are said to be, first, to nourish the crystalline Humour, as *Galen* conceived; next, that the visible species received into the crystalline Humour might not be reflected, or return defiled by dark and coloured tinctures, whereby the sight should be disturbed; but that they might have a free passage through it to the *Retina*.

Table XXIX.

Represents the several Coats, Humours and Muscles of the Eyes.

Figure I.

- A Shews the *crystalline Humour*.
B The *Iris or circle about the sight of the Eye*.

Figure II.

- A The *crystalline Humour*.
B The *watery Humour encompassing the crystalline on its fore-side*.

Figure III.

- A The *back-side of the crystalline Humour*.
B The *vitreous or glassy Humour receiving the crystalline into its bosom*.

Figure IV.

- AAAA The *common Coat of the Eye or Adnata, cut asunder and thrown back*.
B The *Cornea or horney Coat*.
C The *Choroides, whose fore-part is called uvea by reason it is of the colour of a Grape*.

Figure V.

Shews the *Eye taken out of the Head with its Muscles in situ, not being loosened from either their rise or termination*.

- A The *Optick Nerve cut off near the Brain*.
B The *rise of the Muscles*.
CC Their *several terminations or endings into the Coats of the Eye*.
D The *common Coat of the Eye called Adnata or Conjunctiva*.
E The *Cornea or horney Coat*.
F The *Apple of the Eye*.

Figure

Figure VI.

Shews the fore-part of the Eye with its Muscles removed from their originals, and placed round the Eye according to the motions they perform.

- AAAA The right Muscle that lifts up the Eye, called Attollens.
 B The Adnata Tunicle.
 C The Tunica cornea or horney Coat.
 D The Pupilla or Apple of the Eye.
 E The right Muscle that draws down the Eye, called Deprimens.
 F The Muscle that draweth the Eye from the Nose towards the outer corner, called Indignatorius.
 G The Muscle called Bibitorius, which brings the Eye inwards towards the Nose.
 H The superiour oblique Muscle called Trochlearis, which carries the Eye slantingly to its outward angle.
 I The inferiour oblique Muscle, that moves the Eye slantingly to its inward angle.

C H A P. XIV.

Of the Ears and their several Parts.

THE Ears (which according to order we come now to speak to) are the instruments of Hearing, framed by Nature with no less Art than the Eyes; yea so full of intricate Meanders they are, and consist of so many Parts, that they will be very hard to be deciphered. Notwithstanding I will endeavour to give what satisfaction I can, by what I have learned by Inspection, as well as by the Writings of the most accurate Anatomists.

The Auricle. First then the Parts of the Ear are either *Outward* or *Inward*. The *outward* part is called *Auricula*, which is onely an adjuvant or assisting instrument of Hearing, collecting in its hollownes some part of the Air that is the vehicle of the sound, as it is passing by.

Its Parts. The Parts whereof the outward Ear is framed, are either *proper*, or *common*. The *common* are the Scarf-skin, the true Skin, and *membrana nervea*, or nervous Membrane. The *proper* are the Muscles, Veins, Arteries, Nerves, and the Gristle. Of the *Muscles* we shall speak in their proper place, *viz.* in the next Book that treats of the Muscles. The *Veins* of the Ear are branched to it from the external Jugular Vein; the *Arteries* from the Carotid Arteries; and the Nerves from the second pair of the Neck being joined with the harder Procces of the seventh pair. As to the *Gristle* of which for the greatest part it consists, that is a substance that is fittest for this place; for if it had been bony, the Ear would both have been immoveable,

moveable, and so could not have turned it self toward the sound, as we see the Horse can now move it; and also it would have been in continual danger of being broken off: and if it had been fleshy or membranous onely, the Horse's Ears would have flap'd down like Hounds Ears, which would have been a great deformity.

The *uses* of this outward Ear are, first, to serve for an ornament to *Its use.* the Head; secondly to receive, or at least to help to receive the sounds; for first, it gathereth them being dispersed in the Air; secondly, it doth moderate the fierceness of their motion, so that they come gently to the *Tympanum*, or Drum, and beat moderately against it.

The internal or inward Ear hath also sundry Parts, contained *in the* *The inward Ear.* *Os petrosum*, as the outward Ear is fasten'd upon it.

These Parts are first the Drum with its Cord and Muscles; secondly, *Its Parts.* four little Bones; thirdly, its Cavities with the implanted Air; and lastly, its Vessels.

The *Drum*, called *Tympanum*, is a nervous, round and transparent *The Drum.* Membrane, of most exquisite sense, arising from the softer process of the Auditory Nerve expanded. It is exceeding dry, that it might give the better Echo to the sound. It is also strong, that it should the better endure outward harms or injuries. It hath a *Cord* behind it for strengthening and stretching of it, even as the Military Drum hath. As for its *Muscles*, we shall describe them in the next Book.

Within the Membrane of this *Tympanum* or Drum there is an internal *Four little Bones.* Cavity, called *Concha*, in which are several little dry Bones, which have in them no Marrow, nor are covered with any Membrane or *periosteum*: yet at their ends where they are joined together, they are bound with a small Ligament, proceeding from the before mentioned Cord of the Drum.

These little Bones are four in number; the *first* of which is called *mal-* *The Hammer.* *leolus*, that is, a little Hammer. This Hammer hath a round head, which by a loose Ligament is jointed into the Cavity of the second little Bone that is called the Anvil; which head is continued into a small neck, that reacheth beyond the middle of the Drum and adhereth to it. About its middle it hath two Processes, the one of which, being shorter, hath the tendon of the internal Muscle inserted into it; and the other, being longer, hath the tendon of the external, the Drum intervening.

The next of these little Bones is by Anatomists called *Incus*, the *Anvil*, *The Anvil.* having one head and two feet, being therefore more like to one of the grinding Double-teeth than to an Anvil.

The head of this is indifferent thick, having in the top of it a little smooth hollowness, which receives the knob or head of the Hammer. The smaller foot of the Anvil is tied to the top of the Stirrop by a loose but firm Ligament, but the thicker foot resteth upon the *Os squamosum*, or scaly Bone.

The third is called the *Stirrop*, having a perforation in the middle, and *The Stirrop.* is fixed before or rather round that passage that is called the oval Window, by which sounds pass out of the first Cavity into the second called the Labyrinth. Which Cavities are wrought by Nature in the Rocky-bone, and contain in them the inbred Air. Now as the crystalline Humour of the Eye is the chief instrument of the Sight, in respect of the reception of visible Images or Forms; so is this inbred Air of the Ear, the chief instrument which receiveth the forms of Sounds, although there be another more noble Organ which judgeth of them, as shall be shewn by and by.

The figure of this Bone is in Horses triangular, very like the Greek Letter Δ , (but in Men it is represented to be of somewhat another shape) which Letter is like such a Stirrop as we often see in old Hangings (not such Stirrops as are used now-a-daies) from its similitude unto which I suppose it hath its name.

The upper part of this Stirrop is small, as you may see by the figure of it, upon which the longest foot of the Anvil stands.

The orbicular Bone.

The fourth and last of these little Bones of the Ear was not long since found out by a diligent Anatomist, named *Franc. Sylvius*, till whose time there were but three Bones of the Ear reckoned.

This Bone from its round shape is called *orbiculare*. It is tied by a slender Ligament to the side of the Stirrop, in that part where the Stirrop is fastned to the Anvil.

The use of these Bones.

The use of these four Bones is not, that by hitting one against another they should produce a sound, but first, to defend the Membrane of the *Tympanum* or Drum, lest it should be torn and beat inwards by the violent shaking of the outward Air against it, in loud sounds, such as Thunder, or the noise of great Guns and the like.

Secondly, They are assisting to the Sense of Hearing on this manner: The external Air beats against the Drum, which is driven against the Hammer, and this strikes upon the Anvil, as the Anvil bears against the Stirrop; which as it does, more strongly or weakly, so does the Stirrop open the oval Window more or less, and proportionably the sound appears to the common Sensory, louder, or lower.

The Cavities of the Ear.

We come in the next place to speak of the Caverns or *Cavities*, by some called *Dens*, which are formed in the midst of the *Os petrosum* or Rockey-bone where it bunches out most, and are three in number.

Concha.

The first of them is to be seen as soon as the Membrane of the Drum is taken away, and is called *Concha*, from its resemblance to the shell of a Taber. Others call it the Basin, and some the Den. It has its first denomination, (which is that which it is most commonly known by) not so much from its shape, as from its use; for when the Membrane is struck upon by any outward sound, the Echo is made in this Cavity, even as it is in the hollow of a Taber, or in our common Drum when the Parchment is beat upon; for in all these the sound is principally occasion'd by the Air included in the Cavity.

Nature hath placed in this Cavity divers Instruments; as first, some serving for pulsation, such are the four Bones, the Cord and the Muscles, (of all which before.) Secondly, others for conduction into the other Cavities; such are two *perforations* or little holes, commonly called Windows. And lastly, a third sort for Expurgation; such are the passages which lead, one into the Palate, and another into the Nostrils, by the help of which the pituitous Matter which is collected in this Cavity is discharged.

Fenestra ovalis.

The first of the *perforations* being the upper and larger, has added to it the Epithet *Oval*, alluding to its figure. This opens inwards or backwards, and that with a pretty wide mouth, into the Labyrinth; but is kept shut next the *Concha* by the basis of the Stirrop, when sound ceases. The other being the less and lower, is of a round shape (and therefore styled *Rotunda*.) This is always open having no covering, and is divided by the *Os squamosum* into two Pipes, one of which tends to the *Cochlea*, the other into the Labyrinth.

Fenestra rotunda.

The *second* of these Cavities of the inward Ear is (from its windings and turnings) called *Labyrinthus*, the Labyrinth. If one consider it in its whole dimension it is round, and much less than the former. Its windings are circular, yet the circles run not quite round the Cavity, but come as much short of an intire circle as the Gristles of the Wind-pipe in the Throat do, or rather more, so that they are commonly termed semi-circular. Their use is to modulate the sounds so as they may be leisurely communicated to the Auditory Nerve which is dispersed through the Membrane that invests this Cavity, or rather makes it. It has three pretty wide holes, two opening *into* it, and one *out of* it. The two that open *into* it, are the oval and round holes, mentioned in the foregoing Paragraph. By these the internal agitated Air passes out of the *Concha* into the Labyrinth. That which opens *out of* it is that which passes towards the third Cavity called *Cochlea*, into which the aforesaid Air passes further by it out of the Labyrinth. Besides these there are four other very small holes for the ingress of the nervous Fibres that are inserted into the Membrane that cloaths this Cavity.

The *third* and last inner Cavity is called *Cochlea* or the Snail-shell, from the resemblance it hath with that Shell, especially in its Spiral winding; which, if you take off the upper part of the Bone, will plainly appear.

This Cavity is far less than the former two, being indifferent long but crooked. Into this endeth one Pipe from the round hole of the *first* Cavity, and another from the second, just now mentioned.

It is invested, as the other Cavities are, with a soft and thin Membrane (after the same manner as the sockets of the Teeth are) into which (as into that of the Labyrinth) the slender Fibres of the Auditory Nerve do enter, and that through three or four several holes which are all very small.

It is filled with the internal inbred Air as well as the former, by which the Echo is made to the impulse of the external Air upon the *Tympanum* that is the vehicle of the sound: And the Auditory Nerve being inserted into the Membrane that cloaths the Cavities, is affected therewith, whereby it comes to be communicated to the original of the Nerves where the common Sensory is seated, that judgeth and distinguisheth of them.

Into these three Cavities that make up the Internal Ear, are the same Blood-vessels distributed as to the External: The Nerves are also from the same conjugation, namely the seventh pair; onely whereas the harder Process of the Nerve goes to the External Ear, it is the softer that comes to the Internal.

Table XXX.

Represents the inner structure of the Ear or Organ of Hearing, with the Auditory Bones as well lesser as bigger.

Figure I.

- AA The inside of the Temple-bone, or Os temporis.
- BB The spongy Bone, or Os spongiosum.
- C The hole into which the Auditory Nerve is inserted.
- D The greater winding of the Cochlea or Snail-shell.

U 2

E The

- E *The three bony half-circles that form the Labyrinth.*
 F *The Malleus or Hammer in its situation.*
 G *The Incus or Anvil.*
 H *The Stapes or Stirrop.*
 I *The External Muscle of the Ear.*
 K *The Internal Muscle.*

Figure II.

- aaa *Shew the Labyrinth.*
 b *The Cochlea or Snail-shell.*
 c *The oval hole before which the Stirrop is seated.*
 d *The Aqueduct found out by Fallopius.*
 ee *Little holes to let out the Veins and Arteries.*
 f *The Fenestra rotunda, or round Window.*

Figure III.

Shews the Cochlea and Labyrinth dissected.

- aa *The intermediate space dividing the Cochlea into two wreaths.*
 b *The round hole that makes the passage out of the Concha, into the lower wreath of the Cochlea.*
 c *The windings or circumvolutions of the Labyrinth opened.*
 d *The Fenestra ovalis, or oval Window.*

Figure IV.

Shews the *Os petrosum* cut through the middle, the plainer to shew the round circle over which the Drum is placed.

- A *The round circle covered with the Tympanum or Drum.*
 B *The Malleus or Hammer in its natural situation.*
 C *The Incus or Anvil in the like.*
 D *The Stapes or Stirrop also in situ.*

Figure V.

Shews the *Incus* or Anvil taken out and freed from the Hammer.

Figure VI.

Is the Hammer taken out also and freed from the other Parts.

Figure VII.

Is the Stirrop out of its place.

C H A P. XV.

Of the Nose, Lips and Mouth.

HAVING described all the Organs of *Seeing* and *Hearing*, we come in the next place to the third outward Sense which is the *Smelling*, of which the Nose being the Instrument, we are now to enter upon its description.

As therefore the Ear is divided into an External or outward, and an Internal or inward part; so will we divide the Nose, it being made of the like parts.

The *External* Parts are the Skin, the Muscles and Gristles, Vessels of The external Parts of the Nose. all sorts, as also many Bones, and those distinguished or divided by several Sutures.

The *Skin* wherewith the Nose is covered is thin, and without any fat The Skin. under it, for beauty sake; for if there had been any fat naturally in this place, it might have been collected to that quantity or bulk, as to have become a great deformity to the Creature: for which reason Nature hath so ordered it, that in this place the Skin sticketh so fast to the Muscles and Gristles, that it is not easie to part it from them without renting.

The *Bones* which make the Cavities of the Nose are some proper, and Bones and Gristles. some common: of which hereafter in the Fifth Book of *the Bones*. The *Gristles* are five in number, of which we shall also discourse in the same Book.

The *Vessels* of the Nose are, *Veins* from the Jugular Veins, and *Arteries* from the *Carotides*; also *Nerves* from the third pair of the Brain, which send to each side of the Nose one branch, (besides the olfactory Nerves or first pair, called the Mammillary Processes.)

As to the *Internal* Parts of the Nose, we shall begin first with the *Coat* The internal Parts. or Skin which compasseth the whole capacity of the Nostrils. This Coat is said to arise from that Skin of the Brain which is called the *dura mater*; The nervous Membrane. and is not peculiar to this Part alone, but is as well common to the Mouth, Palate, Tongue, Larynx, &c. as to the Nostrils; onely in the Nostrils it is thinner and of exquisite sense; for any thing blown up the Nose that is of a biting nature, so irritates it, as immediately to cause the Horse to sneeze. This Skin hath on its back-side abundance of little Glands or Kernels, in which the Rheum is separated that runs out by the Nose.

There is also another Skin belonging to the inside of the Nose called The muscular Membrane. the *muscular Membrane*, which is said to draw together or contract the Nostrils.

In the upper part of the Nostrils there is a *red fleshy spongy substance*, Spongy Flesh. with which the spongy Bones are filled up.

There are also seated at the upper end of the Nose next to the Brain Sieve-like Bone. over both Nostrils a Bone which from its likeness to a Sieve, (by reason of the innumerable little perforations or holes that are in it) is called *Oscibriforme* or Sieve-like Bone. In the inside of this Bone are seated those two productions of the Brain called *processus mammillares*, which are the true

true Instruments of Smelling, and are therefore better called the Smelling-nerves. There pass from them through the holes of this Sieve-like Bone many little Strings or Fibres, which are dispersed into all the inward capacity of the Nose, serving there to be the immediate Organs of Smelling, but the Scents are communicated to the common Sensory of the Brain by the aforesaid Mammillary Processes.

The uses of
the Nose.

The principal use of the Nose is for Smelling, which is performed in this manner. The Nostrils are adjuvant Instruments of Smelling even as the External Ear is of Hearing. For as the Ear gathereth the sounds that fly in the Air; so when smells exhale out of odoriferous Bodies into the Air, the Horse by taking in his breath at his Nose, (which he for the most part does, and not in at his Mouth as we often do) the scents accompanying the Air ascend up the Nostrils to the top of their Cavity, and so to the before-named Sieve-like Bone, where affecting the little Fibres of the Olfactory Nerves that come, as hath been said, from the Mammillary Processes through those little holes, those Fibres communicate their sensation to the Processes, and these convey it to the original of the Nerves or common Sensory, by which it is distinguished.

Inferiour uses of the Nose are, first, to take in the breath by; and next, to serve as a common Shore or Sink for the discharge and evacuation of the superfluous flegmatick Humours of the Blood.

The Lips.
Their substance.

In the next place we come to treat of the *Lips* (or the external Parts of the Mouth) which are two in number, one upper and the other lower. These are framed of a soft fleshy fungous substance, as also of some proper Muscles covered with the hairy Skin on the outside of them, but on the inside they are covered with a Membrane common to the Mouth and Stomach.

Their use.

The uses of the Lips are first to gather the Hay or Oats or other Food into the Mouth; secondly to retain, or help to retain it, while it is chewing; thirdly, they serve to keep the Gums and Teeth from external Injuries.

The Mouth.

Within the Lips is the *Mouth*, whose Parts are either *containing* or *contained*, that is, either those that make the Mouth, or such as are contained in it.

The Parts
containing.

The Parts whereof the Mouth is made, are of two sorts, some fleshy, others bony. The *fleshy* Parts are the Lips, of which we have already spoken; also the Muscles of the Cheeks and lower Jaw. The *bony* are the upper and nether Jaws, with the Teeth fixed in them.

All these Parts (as also the whole inward capacity of the Mouth) except the Teeth, are lined with a thick Membrane or Skin, which in the Palate is rugged and knotty as it were, by reason of the many little Glands on the back-side of it, by which part of the Slaver is separated into the Mouth; and this Membrane reduplicated maketh the *Uvula*, as some think; though others more probably hold, that it is of a peculiar substance.

The Parts
contained.

The Parts *contained* within the Mouth are divers. As first the Teeth and the Bone *Hyoïdes* at the root of the Tongue; of both which we shall treat in the Book of the Bones.

Besides these there are the Gums, the Palate, the *Uvula*, the Almonds, the Tongue, and the Muscles that serve to move it.

The Gums.

The *Gums* being in number two, are made up of a hard fleshy substance, destitute of motion, that so the Teeth might be better fastned in their Sockets.

The

The *Palate* is the upper part of the Mouth, and is called by that name, ^{The Palate.} from its being as it were fenced or *paled* in with Teeth. It extends from the back-part of the Mouth to the Fore-teeth, but is not so much hollowed in an Horse as in Humane Skulls. It hath in it some eighteen steps or bars which reach from the inside of the Fore-teeth to the very farther end of the Mouth. It consists of Bones, of a peculiar glandulous Flesh, and a thick Coat; which Coat is full of little perforations or holes for the Slaver that is separated in the little Glands (above mentioned) to distill through into the Mouth.

The *Uvula* is a red, fungous and longish kind of a Kernel seated in ^{The Uvula.} the inward or backer-part of the Palate, where the Nostrils open into the Mouth, hanging directly downward with a small but bluntish end just over the chink' of the *Larynx*.

The *use* of this *Uvula* is said to be, first, to moderate the coldness of ^{its use.} the Air drawn in by the Lungs. This is *Bartholin's* opinion, who says further, that from this use of it it comes to pass, that such Persons as want it, die Phthical. Whether that be so or no I cannot tell: but the main use of it in an Horse I take to be, secondly, to hinder the Water, when he drinks, from passing out of his Mouth into his Nostrils.

This Kernel is very necessary to be known by all professed Farriers, ^{The falling of it a Distemper incident to Horses as well as Men.} for such knowledge might have contributed to the preservation of many Horses which for want of it have been lost. Such are those which by reason of Humours too much flowing to this Kernel have had it so much distended, that it hath hung down into the Throat to that degree, that the Horse hath not been able to swallow, there being no passage left for the Meat to go down; but when he has chew'd it and endeavours to swallow it, instead of its going down the Gullet into his Stomach, it comes out at his Nose; whereby it comes to pass that although the Horse have never so good a Stomach, yet for all that he comes to starve to death with hunger.

This my self have been sometimes an Eye witness of, and have oftener heard of it by others; but could never see nor hear of any of them, that had any help for this Distemper; their endeavours proving still unsuccessful by their not well understanding either the Distemper, or the Part affected.

This swelling of the *Uvula* in Men is called by Physicians *Casus Uvulae*; and by the Vulgar, the falling down of the Palate of the Mouth. It is a Distemper that commonly comes upon taking some great cold; but is very ordinarily cured not by Physicians onely, but by every old Woman, who knows that by holding Pepper or Ginger or the like against it, the Rheum is thereby drained out of it, and it contracts it self to its due and natural bulk, whereby the Party is speedily relieved. How far such Medicines might contribute to the cure in Horses, I shall forbear in this place to give my opinion, because as I have already said, I do by God's assistance design to publish a Book of Cures by it self, but was willing in the first place to teach my Practitioner the frame and use of the Parts, and to hint some of those Diseases they are incident to, which we have least understood: and by that time the Ingenious Student is come to understand them, I shall I hope be ready to publish a new and certainer way of curing them than has hitherto been practised.

Next we come to speak of the *Tongue* and its Parts. It is called in Latin, *Lingua*, à *lingendo*, from Licking. It is in figure long, broad and ^{The Tongue.} thick,

Its Membranes.

thick, especially towards the root. It is covered with two Skins; the *outward*, cloathing onely its upper part, which in an Horse is almost as smooth as in Men, though it is much rougher in Oxen, and the like. This Membrane is very porous.

The *inward* Skin covers the whole Tongue, the lower side as well as the upper, and is thin and soft, having many Teat like Protuberances bunching out of it, which are inserted into the pores or holes of the outward Coat.

Its substance.

Concerning the *substance* of the Tongue there is diversity of opinions; for some would have it of a glandulous, others a musculous substance; and some, that it has a peculiar substance: to which opinion I most incline, because I do not find in any Part of the Body a substance like it.

Its Vessels.

It hath *Vessels* of all sorts; *Veins* from an inward branch of the external Jugular; *Arteries* from the Carotid Arteries; and *Nerves* of two kinds, one from the fifth and another from the eighth pair of the Brain.

The Tongue hath at its root several *Muscles*, by which all its motions are performed, of which we will speak in the next Book. And besides the Muscles, there is also at the root of the Tongue a considerable quantity of Fat, with which the Muscles are interlarded as it were.

Its uses.

The *uses* of the Tongue are, first, to taste the Food that is offered, whereby (as well as by the smell) the Horse distinguisheth whether it be good and wholesom for him or not; and in the next place it helpeth the chewing of the Meat, by tossing it to and fro, and after it is chewed, it assisteth in turning it down to the Stomach.

The salival Ducts.

There is to be found out by dissection underneath the root of the Tongue a large Kernel, from whence two Pipes, called salival Ducts, do spring, one from the fore, and the other from the hinder-part of it: These two at a small distance from the Gland unite into one, which runs pretty streight forward under the Tongue toward the Chin: but in the middle way, as Doctor *Wharton* affirms, there are other pretty remarkable Glands (in an Horse) that stand on each side this Duct, and discharge themselves into it. When it is come near the Chin at the Bridle of the Tongue, it ends into other small Glands, through which it pours into the Mouth part of the Slaver that keeps it continually moist.

Besides this Duct there are two others of the same use, which do arise out of the Kernels below the root of the Ear, (called *Parotides*) and run on the outside of the Jaw-bone to the middle of that Muscle of the Cheek that is called *Buccinator*, where they open into the Cavity of the Mouth, into which they discharge the before-named Liquor, which in these and the other Glands of the Mouth is separated from the Bloud.

The use of the Slaver.

Now we must understand, this Slaver (or *Saliva*) is not merely an Humour excrementitious, as that is which is separated in several Kernels in other Parts of the Body, as particularly in the Guts; for this is of great use, not onely in that it continually moistens the Mouth, as also the Hay and Oats whilst they are in chewing; but being swallow'd down with the Meats, it doth further the fermentation and concoction of them in the Stomach, whither part of this Juice also goes with every morsel. It is of the same nature with that which in Men we call the Spittle, and of the same use.

And here it may not be amiss to recite a story I have read of a Person that had one of these external salival Ducts wounded, because I have observed (the last Spring at *Greenwich*) the same accident happen to an Horse, with the same symptom. The Story is thus: A Noble-man being wounded

wounded in the middle of the Cheek with having a Glas thrown at him; the Wound was quickly *almost* closed, but in the middle of it, through a little hole, there leisurely distilled out of it for a long time a watery and clear Liquor, which for all that ever the Surgeon could doe, hindred the intire closing up of the Wound for almost two years. This Liquor did distill out of the salival Duct, which was not then found out; but at last an actual Cautery being applied to the end of the Duct, the Liquor was by that means stopt, and the Wound presently healed. The Horse that I saw had a clear watery Humour running in like manner out of the side of his Cheek, but in that quantity, that in a few hours time (especially in the time next after his drinking) it would make his Manger all a float. A Farrier had him under cure there, and my opinion being ask'd, I advis'd to sear it, but he that had him in hand not knowing the occasion of this flux of Humour, thought rowelling of him would serve; but what he did to him, I had no opportunity since to inform my self.

Now seeing a like case to this may happen, that my Practitioner may understand where to apply his Cautery (or red-hot Iron) for the stanching of the Liquor, I have thought it convenient to annex a Scheme of each of these salival Ducts; *that* under the Tongue being found out by Doctor Wharton, and the *other* arising from the *Parotides* and running on the outside the Gums, by one *Steno*, a Dane.

Table XXXI.

Fig. I. Shews the salival Duct that springs from the Glands under the Ear called *Parotides*, (in a Calves Head.)

- aaaa *The conglomerate Parotis.*
- bb *The conglobate Parotis.*
- c *The lymphatick Vessel tending downwards from the conglobate Gland.*
- dddd *The roots of the salival Duct.*
- eee *The Trunk of the said Duct.*
- ffff *The outer branches of the Jugular Vein.*
- ggg *The Nerves, which as they are inoculated one with another within the Gland and the head, so without these places as in h.*
- ii *The twigs of Nerves accompanying the salival Duct.*

Fig. II. and III. Shew the Gland under the Tongue (called the maxillar Gland) with the Duct that springs from it, (from Dr. Wharton.)

- A *The hinder part of the Gland.*
- aaa *The hinder roots of the salival Duct.*
- B *The fore-part of the Gland.*
- bb *The fore-roots of the said Duct.*
- C *The hinder Trunk of the same Duct, climbing upon the Tendon of the double-belly'd Muscle.*
- D *The return of the same and its union with the Fore-duct.*
- E *The common Trunk of the salival Duct.*
- FG *The double-belly'd Muscle.*
- H *The progress of the said Trunk towards the Fore-teeth of the lower Jaw.*

- I *The opening of the salival Duct under the tip of the Tongue near the Fore-teeth of the said Jaw.*
 K *The round Gland that lies by the Maxillar.*
 L *A row or rank of asperities (or roughnesses) under the side of the Tongue.*
 M *The Tongue thrust to one side out of its place, that the exit of the Vessel may be seen.*
 N *The Tonsil or Almond of the Ear.*

Having now gone through the first division of the Body, which is into three Venters or Regions, wherein I have principally treated of the Parts contained in them; it now remains that I examine the Parts wherewith the Venters themselves are made up, laying each apart by themselves, that their natures, differences and figures may better appear. The Parts of this nature are the Flesh and Bones, of which two it will be most proper to begin with the Flesh, both because it maketh the greatest part of the bulk of the Body, and also because of its quick tendency towards putrefaction, whereas the Bones are of a durable nature, and so no inconvenience will happen upon deferring the examination of them to the last.

The End of the Third Book.

THE

T H E
A N A T O M Y
O F A N
H O R S E.

B O O K I V.

Of the Muscles.

C H A P. I.

*Containeth a description of the several sorts of Flesh, and
an Apology for not expressing the Muscles so particular-
ly in Figures as I have done other Parts of the Body.*

IN the First Book Chap. 6. treating of the Muscles of the Belly, I affirmed that all the *fleshy* Parts of the Body are *muscular*; which must be understood not of all *Flesh* in *general*, but onely of *Flesh* properly so called. For there are four kinds of *Flesh*: First, that which is properly so called, such as is that of the *Muscles*; secondly, that of the Bowels, as of the Liver and Spleen, and the like; thirdly, that of the Glands or Kernels; and fourthly, membranous *Flesh*, such as is that of the Stomach, Guts, &c.

The *Flesh* of the *Muscles* is soft and ruddy, consisting of Fibres and coagulated or curdled Bloud, called a *Parenchyma*. For the Bloud in its circulation as it passeth out of the Arteries into the Veins, is extravasated out of the Arteries into the very fleshy substance, out of which it is not

so clearly imbibed or drunk up by the Veins, but that some particles of it adhere to the fleshy Fibres, and fill up their interstices, that is, the empty spaces between one and another: which Bloud congealing and fixing there, does, I say, together with the Fibres constitute that substance which we properly call Flesh.

As to the other Parts that serve to constitute a Muscle, as also of its use, and the reason of their sundry denominations, I discoursed so fully in the above-mentioned sixth Chapter of the First Book, that I shall not need to add any thing to the same purpose here: onely I think my self in this place obliged to give the Reader the reasons, why I have not represented the Muscles in Figures particularly, as I have done other Parts of the Body, nor dare be so confident of my exactness in the description of them; for

First, The Muscles are so numerous, that to have expressd them all in Figures would have made this Volume at least half as dear again as it is; as may be guessd by the number of Copper-plates (in Folio) that Mr. *Brown* has represented the Muscles of an Humane Body upon; for they are near forty, and these of an Horse must have required rather more than fewer.

Secondly, Though some knowledge of the Muscles, especially the external ones, is necessary that one may know in Tumours which way to make incision (that is, lengthways of the Muscle and not across, for fear of rendring it useles by cutting its nervous Fibres asunder) yet to be so very exact in the knowledg of all of them, is matter rather of commendable curiosity than real usefulness.

But thirdly, The chief reason is (for I will confess it) that I have not had the opportunity my self to raise and inspect every particular Muscle, so that I must have delineated several of them by guess and upon trust, whereby I should both have betrayed my own importune vanity, and have led my Reader 'tis like into several Errors. Neither probably may my verbal description of them be *truly exact* as to those which I have not my self viewed: though seeing in those that I *have* inspected, I have found so great a similitude between the Muscles of an Horse and those of a Man, I hope I shall not be much wide of the truth, if I presume of the same Analogy or likeness in those that I have *not* inspected.

Now as to the likeness of a Man's and an Horse's Muscles the Reader may be pretty well satisfied if he compare those of an Horse's Belly (delineated with the autopsy or self-view of the Graver) expressd at the end of the sixth Chapter of the First Book, with those of a Man's: or take but a prospect of the next following Figure which represents an Horse, several of whose Muscles I have preserved, and after having raised them, plac'd them in their several places again, the Horse standing up in a Press with them on, just in the same posture as he appears in the Figure.

To these reasons I might add the impossibility that most of my Profession should ever attain to an exact knowledge of them; so that this Book being principally designed for their use, I should have been at a great deal of cost and more pains to no great purpose. Now the difficulty lies in this, That most of the names of the Muscles being originally Greek, and several of them such as can no way aptly or intelligibly be rendred into English; and considering the mean education of most Farriers, that few of them understand so much as Latin; I say considering these things, 'tis impossible to describe them to their capacity, and therefore I have contented my self

self with a more superficial and succinct description of them. And though for my own part I may without vain-glory pretend to a more liberal education than most of my Profession, so that the Cramp-names (as we call them) of the Muscles are no such hindrance nor discouragement to me as they will be I fear to most others; yet I hope no curious and ingenious Anatomist, that knows how much time and pains is necessary to be spent upon the exact examination of any one Part, will think me sluggish and supine, that I have not in those few years that I have applied my self to this study, attained as yet to the full knowledge of all the Parts of this Beast that I anatomize. And as on the one hand I hope I may my self attain to greater skill in this Art than I have yet arrived at; so on the other hand I would not be guilty of the vanity of thinking to monopolize it, but shall both desire and hope that others will make up what I shall leave imperfect. But thus much I hope may serve for mine Apology with all ingenuous Men, I shall therefore return from whence I have digressed.

A second sort of Flesh is that of the *Bowels*, as of the Liver, Spleen and Kidneys, whose substance hath been held to be for the greatest part parenchymous, or to consist of an affusion of Blood congealed about the Vessels; though latter Anatomists do affirm them to be for the greatest part glandulous. And to these hath used to be reckoned the Heart; but that is of a substance far different from these, as being truly muscular, and may therefore more properly be ranked with the Muscles, though it be of a more hard and compact frame than them also.

A third kind of Flesh is that of the *Glands*, such as the *Thymus*, which by some is called the Sweet-bread, and is situated near the Collar-bone just within the Chest, of which we have already treated in the Second Book. Of this sort of glandulous Flesh likewise are the *Parotides* or Kernels below the Ears, also the Tonsils (commonly called the Almonds of the Ears) very many Glands in the Mesentery and other Parts of the Body; to which may be added the *Pancreas* seated in the Lower Belly, which is commonly known by the name of the Sweet-bread.

Now the Glands being spermatical Parts, their parenchyma or fleshy substance is not sanguineous or bloody, as that of the two former kinds of Flesh; but spermatical, composed out of the very first rudiments of the embryo or conception. And though the Glands are many times increased in bulk, as particularly in Humane Bodies affected with the King's-Evil, and in Horses which upon taking great Colds have the Tonsils or Almonds of the Ears, and also the *Parotides* or Kernels below the Ears, so swelled and sore, that the Horse will not be able to swallow his Drink, or at least not to hold down his Head to take it, but must be forced to have it given him in a Pail held up as high as the Manger; yet I say, the increase of these Kernels happens not upon any extraordinary afflux of Blood flowing to those Parts, but by a slegmatick Humour falling upon them, and when the Distemper is cured they return again to their former smallness, being according to Nature incapable of that growth that is natural and proper to the Parts called sanguineous. To this sort of Flesh (say some Authours) may the Brain be reduced.

The last sort of Flesh is that which is called *Membranous*, such is that of the middle Coat of the Gullet, Stomach, Guts, Womb and Bladder. For though the inmost and outermost Coats be purely nervous or membranous, yet the middle consists of two ranks of Fibres and a Parenchyma

chyma that adheres to them, which is discoverable particularly in the Guts, when they are scraped by Men that make strings for musical Instruments, for then you may perceive a great deal of slimy stuff to be scraped off them, which is this Parenchyma: For that they lose no part of their membranous or fibrous substance is evident, in that their strength is rather increased than diminished by such scraping. This Coat notwithstanding it is muscular, yet its Parenchyma differs in many regards from that of the sanguineous Muscles, particularly in that it is spermatical as was said before of the Glands.

Now the Parts that consist of these three latter sorts of Flesh are all described in their proper places; but those that consist of the first sort, which as I have said, is most properly so called, I intend to treat of in this Book which containeth the Doctrine of the Muscles.

C H A P. II.

Of the Muscles of the Eye-lids.

HAVING in the sixth Chapter of the First Book spoken of the several Parts of which a Muscle is compounded, and also of the differences and actions of them; as likewise of what use they are in general; (to which Chapter I refer the Reader) My proposed method requires that I should now come to speak to every particular of them, beginning with those of the Lower Belly: but having in the before-cited Chapter of the First Book treated particularly of *them*, I will in this place pass them by, desiring the Reader to consult the said Chapter for his satisfaction; for I love not to be tedious with repetitions.

The Eye-lids
have three
pair of Mus-
cles.
One pair to
open them;
and

The next Muscles then that we come to speak to according to order, are the Muscles of the *Eye-lids*, which are in number three to each Eye.

The first of these is called *Rectus* or *Aperiens*, from its office, which is to lift up or open the Eye lid.

This is seated in the upper part of the orbit of the Eye, and springeth with a slender but fleshy beginning from the same place as the *Elevator* of the Eye doth, (which is at the hole which the Optick Nerve passes through into the orbit) and holds the same course with it, being of the same figure and substance, that is, fleshy; till at last parting from it, with a pretty broad but thin Tendon, it is inserted into the Gristle at the edge of the upper Eye-lid, where it serves (as hath been said) to open the Eye-lid by lifting it up.

Two to shut
them.

The two other Muscles of the Eye-lid are called *Shutters*, and otherwise *semicircular*, because each runs the length of one Eye-lid: though there are some that call them *circular* or *orbicular*, supposing them to be but one Muscle which compasses the Eye-lid round as with a circle. But in Bodies that are very musculous or fleshy, they have by curious Anatomists been plainly discovered to be two, and that the rather, because each receives distinct Nerves from different places. They lie betwixt the carnos Membrane and the inner smooth Skin that lines the Eye-lids.

That

That which draweth down or shutteth the upper Lid is larger, and ariseth from the inner corner of the Eye, from whence it passeth across, though with a kind of an oblique line, towards the outward corner, growing presently fleshy and broad, so that it filleth up all the space betwixt the Eye-brow and the lowest edge of the Eye-lid, and so at last is inserted into the outward corner of the Eye.

The lesser of these two is that which moveth the lower Lid in order to shut it. This is rather membranous than fleshy at its origin, (being also very thin) and takes its rise at the inner corner of the Eye with a sharp beginning as the former did: whence being carried overthwart, it proceeds to the middle of the Eye-lid, where it becomes something fleshy, and continues its course to the outward corner, which it turns about, and ascending a little to the upper Eye-lid, is with an indifferent broad end inserted into it.

There is another pair of Muscles which though not belonging properly to the Eye-lids, yet seem to contribute something to their motion upward or opening, which therefore may reasonably be described in this place, and those are the *musculi frontales*, or Fore-head Muscles. These arise from the Skull near the coronal Suture, and descend with streight Fibres to the Eye-brows, where they terminate. By the help of these Muscles the Skin of the Fore-head to which they closely stick is contracted or wrinkled, and so by consequence the upper Eye-lid's a little drawn upward.

The Fore-head Muscles.

C H A P. III.

Of the Muscles of the Eye.

TO the moving of each Eye of an Horse do belong seven Muscles; though in Humane Bodies there are accounted but six, because the circular or suspending Muscle is said in them to be wanting.

The Eyes have seven pair of Muscles.

Of these seven, four are streight, two oblique or slanting, and the other circular or round. The streight serve to move the Eyes upwards and downwards, to the right hand and to the left. The oblique move them obliquely; and the circular or round one keeps the Eye suspended up in its place.

These Muscles have all their rise from one and the same place; they have also the same progress and structure, and their termination is alike: for they do all arise from the Membrane that invests the Orbit of the Eye near the hole where the Optick Nerve passeth from the Brain into the said Orbit, touching one another at their beginning; but they immediately separate, and in their course become still more and more bulky and fleshy till their middle, which is round and buncheth out with a kind of a belly; but as they grow toward their ends or terminations they degenerate from their fleshy into a thin membranous substance, which is inserted into the horney Coat of the Eye, encompassing it as far as it is white.

Their rise and insertion.

These

Whence they
have their
names.
Attollens
and Depri-
mens.

These Muscles have their several appellations or names from the several motions they perform; as first, The first of the *streight* Muscles, from its office of pulling up the Eye, is called *Attollens*: The second is called *Deprimens*, because it is an Antagonist to the former, for as that pulls the Eye up, so this by a contrary motion pulls it down again. From which offices they have also in Men other two names given them by Anatomists: the first is called *the proud*, because when the Eye is pulled up, a Person looks high and lofty or proud: and on the contrary when the Eye is pulled down by the other Muscle, he looks with a contrary countenance, submissive and humble, for which reason this second Muscle is called *humilis* or *the humble* Muscle.

Adducens.

The next, being the third *streight* Muscle, is called *Adducens*, because it pulleth the Eye towards the Nose. It is otherwise called *Bibitorius*, because it performs that motion of drawing the Eye to the Nose when we drink, for then we commonly look into the Pot or Glass that is before our Nose.

Abducens.

The fourth *streight* Muscle is called *Abducens* or *Indignatorius*, from its office of drawing the Eye to the outer corner, which turn or aspect of the Eye betokens anger or scorn.

Now these four Muscles have these four several motions, when they work severally; but when they all four work together, they have but one action, which is to keep the Eye steady and fixt, which Physicians call a tonick motion: but in Beasts that have the suspending Muscle, the tonick motion is performed mainly, if not altogether, by that Muscle. You have these four, as also the three other lively represented to you in the twenty fifth Table of the Third Book, p. 123.

The upper ob-
lique Muscle.

The next are the *oblique* Muscles, being as hath been said, in number two pair, which from their rolling the Eye about are called *circumagentes*. The *first* of them is called *obliquus major vel superior* (or the uppermost and largest oblique Muscle) being longer than the other, but rather slenderer. It springeth from the upper but inner part of the Orbit of the Eye by the hole where the Optick Nerve comes through, (as do all the rest.) From hence it passeth *streight* to the upper part of the inner corner of the Eye, where it endeth in a small round Tendon, which passeth through a transverse Cartilage or Gristle there placed, called *Trochlea* (or the Pully) and thence continueth its course slantingly along the upper part of the Eye, till at last it is inserted into the outmost Skin of the Eye between the Tendons of the Muscles *Attollens* and *Abducens*. This rolleth the Eye towards its inner corner.

The lower ob-
lique Muscle.

The *second oblique* Muscle is called *obliquus minor sive inferior*, or the less and lower oblique Muscle, being shorter than the other, though rather thicker. This springeth from a chink which is in the lower part of the Orbit of the Eye, beginning with a fleshy head, from whence it ascends with a slanting course towards the outward corner of the Eye, about which it turns, and then ends in a short roundish and nervous Tendon, which meets with the Tendon of the other oblique Muscle, and seeming to unite with it, is inserted in the same place. This rolls the Eye towards its outer corner.

The orbicular
Muscle.

The seventh Muscle is called the *orbicular* or *round*; likewise *Musculus suspensorius*, the suspensory Muscle; and lastly, because it is onely found in Brutes, it hath the name given it of *septimus Brutorum*, the Brute's seventh Muscle. It is short and fleshy, encompassing the Optick Nerve, and

and is inserted into the hinder part of the *Cornea*. You have the figure of it in the afore-mentioned twenty fifth Table of the Third Book, wherein it is removed from one Eye, but in the other it is plainly represented *in situ*. The use of this Muscle, as hath been said, is to sustain the Eye, lest by looking continually down toward the ground, it should hang too much outward; and by it also the tonick motion is performed.

Having discoursed of these several Muscles and of their several actions and uses, I think it very necessary to set down the manner of raising them, that he that will take the pains to examine them in the Creature it self, may the better find them, without violating of them unawares, whereby he will lose his labour, and miss of satisfaction in the inquiry after them.

You must then, after the taking the Eye and all its appurtenances clear out of the Orbit (if you will make your dissection that way; but if you will take the pains to remove the Bones of the Orbit and not cut the Eye out, it will be much better, for then you are sure to see the Muscles in their natural situation: but whether you remove the Bones, or take the Eye out, you must I say) make your dissection on this manner: First, you must with a pair of Scissors cut off the Fat and the Skins before you raise any of the Muscles, making them as clean as you can. Then begin with them in order thus: first raise the larger or upper oblique Muscle, then the lesser or lower oblique; then the four streight Muscles: but you must onely raise the larger oblique Muscle and not remove it, untill you have seen and removed the other five; for when the others are removed, you will the plainer perceive how the Tendon of the said Muscle passeth through the Pully, that is seated in the inner corner of the Eye.

The manner of raising the Muscles of the Eye.

After you have had a full view of these Muscles before-named, then mind the last and seventh Muscle, which still encompasseth the Optick Nerve, reaching from the place where the other Muscles had their rise, quite down to the hinder hemisphere of the Eye.

C H A P. IV.

Of the Muscles of the Nose.

THE *Nose* of an Horse so far as it is gristly, is moved several ways, which motions are performed by these following Muscles. First it is drawn together to shut the Nostrils by the *Adducent* or *Claudent* Muscles: and secondly it is drawn asunder to open the Nostrils by the *Abducent* or *Aperient* Muscles. And to the performing each motion there belong two pair of Muscles; so that in all there are eight Muscles that belong to the Nose. I shall describe the two latter pair first, whereof

The first pair arises from the upper Jaw-bone, near the first proper pair of the Lips, and is inserted partly into the lower part of the *Alæ*, or gristly circumference of the Nostrils, and partly into the upper part of the upper Lip.

The first pair of Abducent Muscles.

The second pair.

The other pair begins at the top of the Nose near the Eye, with an acute and fleshy beginning, whence descending somewhat slantingly, and in its passage lying upon each side of the Nose, it doth at last end at the *Alæ*, as the other pair did, but with a broader and fleshier end. Each of these Muscles being narrow at the beginning, and ending broad, is in shape triangular or three-square, like the Greek Letter Δ *delta*, from whence it is called by some *deltoides*. The use of this pair, as also of the former, is to draw the gristly circumference or wings of the Nostrils upwards, and so to widen and open them.

The first pair of Adducent Muscles.

The other two pair are called the *Adducent* or closing Muscles; the first pair of which is *external*, arising about the root of the Gristle, and ascending cross-ways to the ridge or tip of the Nose, into which it is inserted. This pair is more fleshy than the other, though indeed there is not much Flesh in any of the Muscles of the Nose, and therefore it will require a very accurate Anatomist to raise any of them, and to distinguish them.

The second pair.

The second pair of the closing Muscles are *internal*, and are hid in the Cavity of the Nostrils under the inner Coat that cloaths them. These are not so fleshy as the former. They arise from the end of the Bone of the Nose, and spreading into a kind of membranous substance, they descend to the gristly circumference of the Nostrils where they terminate.

The first pair of these Muscles being contracted depress the *Alæ* or Gristles of the Nose, and the latter pair draw them inwards, and so close the Nostrils; to which motion the orbicular or round Muscle of the upper Lip is assistant, for by its drawing the upper Lip downwards, it doth at the same time constrict or straiten the Nostrils.

C H A P. V.

Of the Muscles of the Lips and Cheeks.

TO the Lips do belong several pair of Muscles, some of which are proper to the Lips alone, and others are common both to the Cheeks and Lips.

The first common Muscle, called the four-square Muscle.

The common are on each side of the Face two. The first of which is called *detractus quadratus*, or the four-square drawers aside of the Cheeks and Lips. This shews more like a Skin than a Muscle, being broad and thin, onely it is interlaced with fleshy Fibres, which makes it to be accounted a Muscle.

It arises from one of the Vertebres of the Neck on its outside, as also from the Shoulder-blade, the Collar-bone and Breast-bone, from whence it ascends with oblique or slanting Fibres up to the Chin, Lips, and root of the Nose; which Parts it draws downwards with a slanting motion.

The second common Muscle, called the Trumpeter.

The second common Muscle of the Cheeks and Lips, is called in Humane Bodies *Buccinator* the Trumpeter, because in blowing a Trumpet the main stress lies upon this Muscle; though others derive that name from *Bucca* the Cheek, because it is the most considerable Muscle of it, and

and on this account it may retain the same name in an Horfe: or it may be called the *Contracter*, from its action, which is to contract the Cheek.

It springs from almost the whole length of the *upper* Jaw-bone, and is inserted into the whole length of the *lower*, at the root of the Gums. It is thin and membranous, and interlaced with divers Fibres running sundry ways; and hath the inner Coat of the Mouth so closely and firmly adhering to it, that it is scarce separable from it. This Muscle is seated under the upper part of the former, and is spread over the whole dimension of the Cheek.

Its use in Horfes and other Brutes is to be as a Hand to help the Mouth in its chewing motion; for as the Meat in chewing falls on the outside of the Teeth, betwixt them and the Cheek, this Muscle helps to turn it over the Teeth again, that it may be sufficiently broken and ground, and made thereby the readier for concoction when it is turned down to the Stomach.

Besides this office of assisting in chewing, it doth serve also at other times upon any occasion to move the Cheeks and Lips.

Next come we to the Muscles that are *proper* to the Lips onely, and those are by Anatomists accounted five pair and one odd one. The first of them is called *par Attollens*, or Lifters up of the Lip. This pair spring from the upper Jaw, where it makes the hollow of the Cheek. At their rise they are broad and fleshy, from thence passing down obliquely along the Cheeks, each of them is inserted into its own side of the upper Lip, near the Nose. The use of these Muscles, if they both of them act together, is to draw the upper Lip directly upwards and outwards; but if onely one acts, then is but one side of the Lip drawn upward obliquely. You may plainly see these Muscles work, if you take notice of a Ston'd Horfe after he hath smelt to a Mare; for then he will most times hold up his Head in the Air, and turn up his upper Lip till he hath almost turned it inside outwards. And the like you may see many Horfes doe, if you onely let them smell to another Horfe's Dung.

The second pair is called *Abducens*, the Drawers of the Lip on one side. This arises at the Cavity that is under the *Os jugale* with a fleshy and round beginning, which is cover'd with some Fat, especially in fat Horfes; from whence they run down on each side to the middle of the upper Lip, into which they are inserted with a strong round Tendon. These jointly move the Lips upwards and outwards as the former did, assisting them in their motion; and when either of them acts singly, then it assists the action of one of the former that is on its own side, and helps to draw the Lip upwards of one side.

The third pair is called by *Riolanus*, *Zugomaticum* or *Jugale*, from its rise, which is outwardly from the process of the *Os jugale*. At their beginning they are fleshy and somewhat round, and running downward a little overthwart the Cheeks they reach at last to the sides of the upper Lip, where they are inserted near the corner of the Mouth. The use of this pair is to draw the Lip upwards sideways.

The fourth pair is called *Deprimens*, or the Drawers down of the lower Lip. These arise fleshy and broad from the lowermost and outwardmost part of the Lower Mandible; from whence each marches obliquely to the under Lip, into which they are inserted about the middle of it. The use of this pair is to draw the under Lip downwards and somewhat outwards.

wards. So that it joineth in the same action with the first pair of the common Muscles called *Detrahens quadratus*.

The fifth pair, called Obliquè detrahens.

The fifth pair is called *Obliquè detrahens*, from their office, which is to draw the lower Lip obliquely downwards and outwards. They take their beginning from the sides of the lower Jaw, where they rise with a fleshy and broad head; from whence they ascend upwards, growing in their passage something narrower, and are each inserted into the corners of the lower Lip. The use of this pair is, as hath been said, to draw the lower Lip obliquely downwards and outwards.

The odd Musclet, called Orbicularis.

In the next place we come to the odd Muscle, called *Orbicularis*, or orbicular, because it goes round the circuit of both the Lips. It is also called *Constringens*, because it serves as it were for a Sphincter Muscle to purse up or contract the Lips. Besides these names it has in Men that of *Osculatorius*, the Kissing Muscle, because it contracts or draws the Lips together in kissing. It sticks very close to the Skin of the Lips, and makes up the greatest part of their substance.

CHAP. VI.

Of the Muscles of the lower Jaw.

THE upper Jaw being immoveable hath no Muscles, there being no occasion for them where there is no motion, which is their onely use. But the lower Jaw which hath motions of divers sorts, doth require divers sorts of Muscles to perform them. Now these Muscles are in number five pair.

The first pair of Muscles called the Temporal.

The first pair of these Muscles is called the *Temporal*, because they are seated upon the Temples. They spring on each side from the Bones of the Brow or Fore-head, the *Synceput*, Temples and Wedge-like Bone. They are the strongest and largest of all the five pair. Their beginning is fleshy, large and semicircular, their inside lying upon the *Periosteum*, and their outside covered with the *Pericranium*. They descend under the *Os jugale* to the acute Process of the lower Jaw, into which they are inserted by a short but very strong Tendon. These Muscles with great force pull up the lower Jaw, and so shut the Mouth.

The second pair, called Deprimens.

The second pair hath the name of *Deprimens*, because they pull down the Jaw. They are also from their shape, having as it were two bellies, called *biventre*. These being assisted by the *quadrati*, which were described in the foregoing Chapter (being one of the pairs that are common to the Cheeks and Lips) pull down the Jaw, and so open the Mouth. They arise with a broad and nervous beginning from the Process of the Temple-bone called *Styloides*, and suddenly becoming round, fleshy and small, they pass downwards, and in their middle where they come to the flexure of the lower Jaw-bone, they lose their fleshy substance and degenerate into a nervous and round Tendon, and then becoming fleshy again they are inserted into the inner side of the lower Jaw at the middle or fore-part of it.

The

The *third* pair is called *Masseteres*, because they are very assistant in the office of *chewing*, by moving the Jaw to the right and left side. Each hath two beginnings: the first is large, strong and nervous, arising from that Suture where the fourth and first Bone of the upper Jaw are joined; the other beginning is fleshy, springing from the *Os jugale*. They are firmly and largely inserted into the outside of the lower Jaw. These Muscles, by reason of their diversity of Fibres, move the nether Jaw both forwards, backwards and to the sides, and so in a manner circularly.

The *fourth* pair are called *Pterygoideum externum*, as if they resembled a pair of *Wings*. These like the former have also a double beginning, partly nervous, and partly fleshy. They spring partly from the upper and outward side of the Wing-like Process of the Wedge like Bone, and partly from the rough and sharp line of the same Bone, from whence they march down with streight Fibres, becoming in their course larger and thicker, till they come to the lateral part of the lower Jaw, into whose inside they are inserted with a strong Tendon. The *use* of this pair of Muscles is to open the Jaw and move it forward, which appeareth when the Teeth of the lower Jaw are stretched farther out than those of the upper.

The *fifth* and last pair of Muscles of the lower Jaw are called *Pterygoideum internum*. These arise with a nervous beginning from the inner side or cavity of the Wedge-like Bone, at its wing-like Process; then becoming fleshy, large and thick, they march down with a streight passage to the inner and hinder part of the lower Jaw, where they are inserted by a nervous, broad and strong Tendon. The *use* of these Muscles is to draw the Jaw towards its head or backwards; and also to help the Temporal Muscle to draw the Jaw up.

CHAP. VII.

Of the Muscles of the Ear.

THE Muscles of the *Ears* in Brutes (especially such as have large Ears, as Horses, Asses, Oxen, Hares, &c.) differ much in magnitude from those of Men, in whom they are so very small, that *Galen* calls them, the lineaments of Muscles. The reason of which is, that in Man the Ears are most commonly immoveable, (though there have been some that could move them) and therefore to have large Muscles were needless; and yet to have none at all, would look like a defect in the most perfect of all Animals. But though Man cannot move his Ears, yet is that no prejudice to his hearing; for the want of that motion is recompenced by the easie and speedy motions of his Head, whereby he can turn it on every side to receive the sounds; whereas four-footed Beasts, that have the motions of their Heads not so nimble, have need to have their Ears always moveable every way, to receive the sounds from every side: and their moveableness has also a further use, to wit, to drive away Flies

Flies and other Insects that are troublesome to the Beast, which Men can doe with their Hands.

The External Ear hath four Muscles.

The Ear we divided, in the former Book, into the *Outward* and *Inward*. The *Outward* (of which we have been discoursing thus far in this Chapter) has four Muscles; and these are those which are so much larger in Brutes than Men. The *Inward* Ear has two, which are of a proportionable largeness in both.

1. The lifter up of the Ear.

The first of these we come to treat of is the *first* of the *Outward* Ear, which goes by the name of *Attollens Aurem*, the lifter or puller up of the Ear. This arises at the outside of the Frontal or Forehead Muscle, and at its rise is thin and membranous; from whence being carried over the Temporal Muscle, and growing in its course something narrower, it doth at last insert it self into the upper part of the Ear, moving it upwards and forwards.

2. The puller back of the Ear.

The *second* is called *Detrahens Aurem*, or the puller back of the Ear. This Muscle arises from the Mammillary Process with a fleshy, broad and fibrous head; and so growing narrower in its progress is at length inserted into the root of the Gristle of the Ear, sometimes by two, sometimes by three Tendons. The *use* of this Muscle is to draw the Ear backwards and somewhat upwards.

3. Adducens Aurem.

The *third* is called *Adducens Aurem*, by which the Ear is drawn forwards and somewhat downwards. This is said to be but a part of the *musculus quadratus* before spoken of in the fifth Chapter of this Book, being one of the common Muscles of the Cheeks and Lips. This Muscle ascending with its Fibres is implanted into the lower side of the root of the Ear.

4. Abducens Aurem.

The *fourth* is called *Abducens Aurem*, because it draws or pulls the Ear backwards. This takes its beginning at the *Occiput* or back-part of the Head from the Coat that cloaths those Muscles that belong to that part, where it is at first something narrow, but afterward waxing broader it is carried transversely to the hinder part of the Ear, into which it is inserted. This assists the second in its action, having sometimes two, and sometimes three Tendons as that has.

The Inward Ear hath two.

1. The External.

The next are the two Muscles of the *Inner* Ear (called *Auris*, as the *Outward* Ear is called *Auricula*) the first of which is called *Externus Tympani Auris*, or the external Muscle of the Drum of the Ear, because it moves the Membrane of the Ear so called upwards and outwards. This is thin but broad at its rise, which is from the upper part of the passage of the Ear; then becoming narrower it grows into a very fine and small Tendon, which is carried on the outside of the *Tympanum* till it arrive at its centre or middle into which it is inserted, where on the inside of this *Tympanum* the little Bone called the Hammer sticketh, which with the Membrane or *Tympanum* this Muscle draweth a little outward and upward. This Muscle as also the next are very small, there being scarce any in the whole Body again so small as they are; and therefore it will require great skill to raise them without violating of them. To prevent which the undertaker is to open with great care the *Os petrosum* which is to be done on that side which is next to the Temples, taking out the pieces of Bones by degrees that these Muscles may receive no prejudice. It is left to the discretion of the Dissector whether he will remove the Bones with a Chisfel, or Saw, or by filing, so he doe it carefully.

The second is called *Internus*, and hath its origination from the bottom of the *Os cuneiforme* or Wedge-like Bone, there where it is joined with the *Processus petrosus*. It is seated inwardly in the Cavity of the *Os petrosus*, being fleshy at its beginning, yet thin and small: at its middle it is divided into two very small and very thin Tendons, whereof one is inserted into the upper Process of the *Malleus* or Hammer, and the other into the neck of it. The use of this Muscle, alone, is to draw the head of the Hammer obliquely forwards, and also to draw it somewhat inwards: but when these two act both together, they move the *Tympanum* with its small Bones upwards and downwards, which is done when the Horse would carefully listen or harken to any approaching noise.

C H A P. VIII.

Of the Muscles of the Tongue.

THE Tongue in Brutes hath but two principal uses, viz. to taste the Food, and to rowl it up and down the Mouth: but in Men it has a third use, which is to be the main instrument of Speech. Yet notwithstanding there are as many Muscles that belong to it in Brutes as there do in Men; for in some regard it has a further use in them than in Men, seeing it does not onely taste and rowl about the Meat, but it serves also to gather it into the Mouth; for that they doe with their Tongue, because they have not the help of Hands as we have. Wherefore that the Tongue might perform all these offices, it was necessary it should be furnished with variety of Muscles, to make it capable of being moved every way, outward and inward, upward and downward, and sideways. And lest in undergoing these motions it should be made to reach farther than is necessary, Nature hath restrained it with a strong Ligament underneath, which in Men is called the *Frænum* or Bridle of the Tongue.

The Tongue therefore hath five pair of Muscles proper to it self, besides those that are common to it and the *Os hyoides*, of which in the following Chapter.

The first pair proper to it is called *Genioglossum* (or the Chin-tongue pair) so called because their rise is from the Chin, and their insertion into the Tongue. This name is proper enough in Men who have Chins, but agrees not so well with them in Horses (or other Brutes) in whom we call all that part below the Teeth, the lower Jaw, not distinguishing any part of it by the name of the Chin. But notwithstanding I shall describe them by that name, because it would be too tedious and too bold an undertaking for me to invent new names for this as well as for others that are in Brutes as improperly called by such names as this pair is; leaving such an attempt to those that have both more leisure, and that make a greater figure in the Anatomical Province.

This pair arise from the ruggedness which is in the middle of the lower Jaw before, in the inner and lower part of it. In their progress they are said to have several such inscriptions as the streight Muscles of the Paunch

The Tongue hath five pair of proper Muscles.

1. Genioglossum.

Paunch have, as if each consisted of several Muscles; however that be, they reach to the middle of the Tongue where they are inserted into its lower side. Their use is to move the Tongue forwards, towards the Fore-teeth, and many times out of the Mouth, that is, when the Beast gathers in his Meat.

2. Hypsilo-
glossum.

The second pair is called *Hypsiloglossum*, (which word should be writ without an H, seeing they have this name because they rise from the bottom of the *Os hyoides*, which is otherwise called *Ipsiloides*;) from its resembling in shape the Greek Letter ν (*Ipsilon*.) They end in the middle of the Tongue, and have an action contrary to the former; for as those mov'd the Tongue outward, so these move it streight inward or backward.

3. Myloglof-
sum.

The third pair is called *Myloglossum*, from the places of its rise and insertion; for they arise from the inner part of the lower Jaw, at the roots of the farthest grinding Teeth, and are inserted into the Ligament by which the Tongue is tied to the fauces or Jaws. If this pair work together, they draw the Tongue downwards; but if onely one of them work, then it draws the Tongue obliquely to its own side.

4. Cerato-
glossum.

The fourth pair is called *Ceratoglossum*, because they arise from the horns of the *Os hyoides*, and reaching from thence to the sides of the Tongue are there inserted into it. If one of these work alone, it draws the Tongue aslant to either the right or left side; but if both work together, they draw the Tongue downwards and inwards.

5. Styloglof-
sum.

The fifth and last pair of Muscles proper to the Tongue are called *Styloglossum*, because they arise from the *Styloides* (or Pen-like) Process of the Temple-bones, being fleshy at their beginning, though very small and sharp; but afterwards becoming broader and thicker, they run to the sides of the Tongue, into which they are inserted about the middle of its length. If either of these Muscles move singly, the Tongue is drawn to the right, or left side; but if both act together, they pull the Tongue upwards and inwards.

C H A P. IX.

Of the Muscles of the Bone of the Tongue, called Os hyoides.

THE Muscles of the Cheeks and Tongue serving to toss the Meat to and again in the Mouth, and those of the lower Jaw helping to chew or grind it; after it is sufficiently minced, it wants afterward to be swallowed and to be transmitted into the Stomach. Now none of the fore-said Muscles contribute any thing thereto, therefore it was necessary there should be others appropriated thereto, which by moving diversly the root of the Tongue might make way for the morsel to descend into the Gullet. Such are those that are common to the Tongue and the Bone called *hyoides* that is fasten'd to its root or basis, which are in number four pair.

The Os hyoides hath four pair.

The first pair is called *Sternohyoideum*, because they spring from the upper but inner part of the *Sternum* or Breast-bone (with a broad and fleshy beginning) and ascending under the Skin of the Neck by the Wind-pipe (still keeping the same largeness and substance) are at length inserted into the root or bottom of the *Os hyoides*, which they move downward and backward.

1. Sternohyoideum.

The second pair is opposite to the former, and is called *Geniohyoideum*. These are large, short and fleshy all over, and arise with Fibres of a divers course, from the inside of the fore-part of the lower Jaw (called in Men the *Chin*) and are inserted into the middle part of the Bone *hyoides*, which they draw streight upwards and a little forwards.

2. Geniohyoideum.

The third pair is called *Coracohyoideum*. These are slender, but strong, and long; yea considering the slenderness of them, they are the longest Muscles of the whole Body. They arise out of the Process called *Coracoïdes* at the upper end of the Shoulder-blade near the Neck, and run obliquely upward under the first pair of Muscles of the Head called *Mastoi-deum*, where they lose their fleshy substance, as giving way to the other that are more worthy and considerable than themselves, and degenerate each into a nervous and round Tendon for some time; but so soon as they are past these Muscles, they become musculous again, and so continue till they reach to the *Os hyoides*, into whose horns they are inserted. These because of their two bellies are by some called *Digastricks*. Their use is to pull the *Os hyoides* obliquely downwards.

3. Coracohyoideum.

The fourth and last pair of Muscles of the *Os hyoides* is called *Stylocoracohyoideum*. These arise from the root of the Appendix or Process called *Styloides*, and end in the horns of *Os hyoides*. They move the Bone obliquely upwards.

4. Stylocoracohyoideum.

I hope the English Reader will pardon me for not translating the names of these Muscles, for it is impossible for any Man to doe it, seeing our English Tongue is not capable of such compositions as the Greek admits of, from whence these names are borrowed: but he will see the reasons of the names, if he observe but the parts from whence the Muscles are said to rise, and into which they are inserted, in the description of them.

C H A P. X.

Of the Muscles of the Larynx or Throttle.

THE Larynx in Mankind is the main instrument in modulating or forming the Voice, so as to make the tone high or low, &c. And though few Beasts can alter their tones with that variety that a Man can, yet have they the same number of Muscles to move the several Gristles whereof the Larynx is composed. Now its Muscles are either *proper*, or *common*. The *common* are those that are implanted into the Larynx, but arise not therefrom; and the *proper* are those that both arise and end in the Larynx. The *common* are four, and the *proper* nine.

The *first* of the *common* pair is called *Sternothyreoideum*, and by some *Bronchium*, or the Weazand-muscles. These arise with a fleshy and broad beginning from the upper and inner part of the *Sternum* or Breast-bone at the very Throat, ascending with right or streight Fibres up by the sides of the Wind-pipe, continuing the same largeness and substance till they reach to the *Cartilago thyreoides*, or Shield-fashioned Gristle, into which they are inserted. Their *use* is to draw down the said Gristle, and so to widen the Chink as some Authours think; though others are of opinion that such drawing of it down, serves to straiten the Chink.

The *second* pair is called *Hyothyreoideum*. These arise from the lower side of the Bone *hyoides*, having a broad and fleshy beginning; from whence descending with streight Fibres they are inserted into the *Cartilago thyreoides*; by lifting which upwards they are said to straiten the Chink of the Larynx; though some on the contrary affirm that they widen it.

Next come we to the *proper* Muscles of the Larynx, the *first* pair of which is called *Cricothyreoideum anticum*, because they take their beginning from the *fore-part* of the Ring-fashioned Gristle called *Cricoides*, and proceed obliquely to the Shield-fashioned Gristle or *Thyreoides*, into whose sides they are implanted. The *use* of this pair of Muscles is to move the Shield-fashioned Gristle or *Thyreoides* obliquely downwards, and by that means to open the *glottis* or Chink of the Larynx.

The *second* of the *proper* pairs of Muscles of the Larynx are called *Cricoarytænoideum posticum*. These contrary to the former arise from the lower and *back-part* of the Ring-fashioned Gristle, and running upward with streight Fibres are inserted with a nervous end into the lower side of the *Arytænoides* or Ewer-like Gristle, which it pulls upward and backward, and thereby opens and widens the Larynx.

The *third* pair is called *Cricoarytænoideum laterale*, because they are seated at the *sides* of the former pair. They arise from the sides of the Anulary or Ring-fashioned Cartilage somewhat slender; from whence proceeding directly upwards, and becoming more large and fleshy, they come to the *Arytænoides*, into the sides of which they are implanted in that part that the foregoing pair did not cover. The *use* of this pair is to open the Larynx by drawing the Gristles obliquely aside.

The Larynx
hath two pair
of common
Muscles, viz.

1. Sterno-
thyreoide-
um.

2. Hyothy-
reoideum.

and four pair
proper ones
and an odd
one, viz.

1. Cricothy-
reoideum.

2. Cricoary-
tænoideum
posticum.

3. Cricoary-
tænoideum
laterale.

The *fourth* pair is called *Thyreoaerytænoideum*. These are the largest and strongest of all the proper Muscles of the *Larynx*, yea almost equal to all the rest put together. They arise close one to the other from the inner hollow and middle part of the *Thyreoides* or Shield-fashioned Gristle, whose inner Cavity they fill through the whole length of it, and with oblique Fibres they ascend upward, growing narrower in their ascent, till they come to their insertion into the sides of the Ewer-like Gristle. These are the Muscles that are principally affected in Humane Bodies when they are in the greatest danger from that Disease called the Squinancy or Quinsie. For when these Muscles are inflamed, they swell inwards into the Throttle, and make the Cavity thereof so strait, that the Patient cannot fetch his breath, but is strangled.

4. Thyreoaerytænoideum.

The *fifth* and last is reckoned but for one single Muscle, and is called *Arytænoides*, also *Claudens secundum*, or the second Shutting-muscle. They take their rise from the hinder line of the Ewer-like Gristle or *Arytænoides* from whence it hath its name. It is very small but fleshy, and running with transverse Fibres, it is inserted into the sides of the same Gristle, which it helps to constrict or draw both its sides together, and so straitens the Throttle.

5. The Muscle Arytænoides.

The *Epiglottis* or Throat-flap, that covers the Chink of the *Larynx* has no discernible Muscles in Man, nor I believe in an Horse: but in Cattle, Sheep, &c. that chew the Cud, it is said to have evident ones; some of which spring from the *Os hyoides*, and are inserted into the basis of the *Epiglottis*, which they lift up; and others are placed between the Coat and Gristle of the *Epiglottis*, helping it to shut the *Larynx*.

C H A P. XI.

Of the Muscles of the Uvula and Throat.

THE *Uvula* is said to have two Muscles to hold it up, one of which is called *Pterygostaphilinus externus*. This springeth from the upper Jaw a little beyond the furthestmost Grinder, and is inserted into the *Uvula*.

The Uvula hath two Muscles.

1. Pterygostaphilinus externus.
2. Pterygostaphilinus internus.

The *second* is called *Pterygostaphilinus internus*. This proceeds from the lower part of the inner Wing of the Process *Pterygoides* (or Wing-like) and is inserted in like manner as the former into the *Uvula*.

This is the description that Anatomists commonly give of these two Muscles; but it may be question'd whether they are any more than imaginary ones; for seeing the *Uvula* has no apparent voluntary motion, it seems to have no occasion for any Muscles.

Next to the Muscles of the *Uvula* come those of the *Throat* (or the beginning of the Gullet called *Pharynx*) to be treated of, to which belong seven Muscles, that is, three pair and a Sphincter. The *first* of the pairs is called *Sphenopharyngæum*. These arise thin and nervous from the Appendix of the Wedgelike-bone, descending by the inward Cavity of its

The Pharynx hath seven Muscles.

1. Par Sphenopharyngæum.

Wing-like Processes, and are inserted into the lateral parts of the Palate and *Pharynx*, which they widen in swallowing.

2. Cephalo-pharyngæum.

The next pair is called *Cephalopharyngæum*. These spring from that part where the *Head* is joined to the first *Vertebra* of the Neck, from whence they descend to the *Pharynx*, into which they are spread with a large *plexus* of Fibres, which seemeth to make its Membrane. The action of this pair is contrary to the former; for as those widen the *Pharynx* to let the nourishment descend into the Gullet, so these straiten it when the Food is past by it, and thereby squeeze the Food down the Gullet.

3. Stylopharyngæum.

The third pair is called *Stylopharyngæum*. These arise with a small beginning from the inner part of the *Styloides* Process of the Temple-bone, and descending with a thin body are inserted into the sides of the *Pharynx* which they dilate or widen.

4. The Muscle Oesophagiæus.

The last of these Muscles is that which hath no fellow, and is called *Oesophagiæus*, or the Sphincter of the Gullet. This arises at one side of the *Thyreoides*, or Shield-fashioned Gristle, and is inserted into the other side of the same, wholly encompassing in its course both the fore and back part of the Gullet, in the same manner as the Sphincters of the *Anus* and Bladder do those Parts, serving here for the same use, *viz.* to draw or purse in the mouth of the Gullet, as those do the Arse and Bladder. Now though I have the warrant of several Authours in describing of this Muscle last of the seven, yet there be others that treat first of it, and reckon it the first Muscle of the Throat, saying, that if you first raise this, the two next before-mentioned pairs, namely, the *Stylopharyngæum* and the *Cephalopharyngæum*, may be the better found.

Two pair of Muscles lately found out by Doctor Croune, *viz.*

Having done with the Muscles of the *Uvula* and Throat, as also with all the Muscles of the inward and outward Parts of the Mouth and Chaps, according as they are treated of by the Ancient and Modern Anatomizers of these Parts; it remains now that I should descend to the Muscles of the Head and Neck, and so to the inferiour Parts; but before I depart quite from hence, I think it necessary to give the Reader an account of two pair of Muscles more, which belong to the Palate of the Mouth, never treated of by any Anatomist yet, save Mr. *Brown*, who in his Book of the Muscles lately set forth, gives the first account of them, at the desire of the discoverer of them, which was the most ingenious Doctor *Croune* now living, and at this time Lecturer at Chirurgeons Hall in *London*.

This worthy and learned Discoverer hath given them these names following; the first he calls *Musculi Pterygo-palatini*, and the other *Spheno-palatini*.

Pterygo-palatini, and

This description hath he also given of them, *viz.* The first or *Pterygo-palatini* are seated in the lower part of the Cavity of the Wing-like Processes of the Wedge-like Bone, and terminate about the *Glandula palati* with their Tendons, which run upon part of the fore-mentioned Processes, as on two *Trochleæ* or Pullies. The use of this pair is to depress the before-named Gland of the Palate and the *Uvula*.

Spheno-palatini.

The latter of them, which he calls *Spheno-palatini*, have an use contrary to the former, *viz.* to lift up the fore-mentioned Gland and *Uvula*. Their rise is from the *Os sphenooides* or Wedge-like Bone, and their insertion (with a broader Tendon than the former) into the sides of the before-mentioned Gland and *Uvula*. It is believed from the situation and action of this last pair of Muscles, that when the Rheum that had swelled the Gland

Gland and relax the *Uvula*, is drained away, these Muscles help to reduce the *Uvula* to its proper and natural situation; though to me it seems, that its own contracting of it self is sufficient.

CHAP. XII.

Of the Muscles of the Head.

THE Muscles of the *Head* are either *proper* or *common*. The *common* are those which primarily move the Neck, and the Head only secondarily, of which in the next Chapter; for according to order the *proper* are first to be spoken to, and these are they that move the Head onely, the Neck at that time remaining unmoved, the number of which are sixteen, or eight pair.

The *first* pair is called *Mastoidium* (which pair some Authours indeed reckon for the eighth or last pair, and the *Splenium* for the first; but being willing to follow the more modern Writers I will begin with the *Mastoidium* and reckon them for the first pair.)

These are seated in the fore-part of the Neck, having each a double beginning; one of which is from the Breast-bone, being altogether nervous, and the other from the Collar-bone, which is fleshy. From these originals they ascend obliquely upwards by the Neck, till they come to the hinder part of the Head, *viz.* to the Mammillary Process of the Temple-bone, into which each is inserted by a round and fleshy Tendon. If both these Muscles work together, then they bend the Head right forward or downward; but if one onely works, then that draws the Head a little to one side. Of all the eight pair there are onely this that bend the Head streight forward, and that are placed in the fore-part of the Neck; for all the rest are seated behind towards the Mane, and do either pull the Head back, or else to one side.

The *second* pair (or first pullers back of the Head) is called *Splenium*. These are long and thick, arising from the five uppermost *Vertebrae* of the Chest and five lowermost of the Neck, with a nervous beginning; from whence ascending to the hinder part of the Head, they there end with a broad and fleshy Tendon. The use of these, if both of them act together, is to draw the Head directly backward; but if either of them act singly, then it draws the Head a little to one side.

The *third* pair, (being the second puller back of the Head) is called *Complexum* or *Trigeminum*, because each Muscle seems to consist of three, for it arises with three heads; one of which is from the transverse Process of the fourth and fifth *Vertebrae* of the Chest; the second from the first and second of the same, and the third from the ridge of the seventh *Vertebra* of the Neck: all which uniting into one body, the Muscles ascend upward as far as to the *Occiput* or Noll-bone, (in their course becoming fleshy and broad) and are inserted into the said Noll-bone, at the root of the Mammillary Process, sometimes by one, and sometimes by a triple Tendon.

The

4. Parvum
& crassum.

The third puller back of the Head, or *fourth* pair, is called *parvum & crassum*, because they are small and thick. These are situated under the former, arising from the transverse Processes of the six uppermost *Vertebrae* of the Neck, with a nervous beginning; but afterward becoming fleshy, they are carried obliquely upward, and are inserted into the hindermost root of the *Processus Mammillaris*. Their *use* is, if they act both together, to bring the Head lightly backwards; and if but one act, then to bring it backward to one side.

5. Rectum
majus.

The *fifth* pair is called *Rectum majus* or the greater right pair, being small, fleshy and slender, and arising from the tip of the Spine or ridge of the second *Vertebra* of the Neck, where they touch one another; but presently part, and ascending both upward, end with a round Tendon in the middle of the Noll-bone or *Occiput*. The action of this pair is the same as of the former.

6. Rectum
minus.

The *sixth* pair (being the fifth of the pullers back) is called *Rectum minus*, or the lesser right pair. Their situation is just under the former pair, as it were concealed, and are of the like substance, form and progress. They arise close together from the back-part of the first *Vertebra* of the Neck where the Bone should have ended in a Spine, but that Spine is wanting because it would have offended the former pair of Muscles that spring from the second *Vertebra* and march over this. Presently after their original they part, and ascend upwards, and on either side are implanted into the Noll-bone. The *use* of these is to assist the motion of the two foregoing pair. Now the reason why there are so many Muscles appointed to move the Head backward, and but one pair forward, is because the Head by reason of its great bulk and weight, is prone enough of it self to incline forward or downward; but it requireth a great force to move it upward or backward.

7. Obliquum
superius.

The *seventh* pair is called *Obliquum superius*, or the upper Oblique pair. These are seated under the right or streight pairs, and are like them in form and substance. They are small, arising out of the middle of the *Occiput* at the outside of the streight pairs, from whence they descend downwards, and are inserted into the tips of the transverse Processes of the first *Vertebra* of the Neck, the right-hand Muscle into the right Process, and the left into the left. The *use* of these, if they both act together, is to nodd the Head gently directly backwards.

8. Obliquum
inferius.

The *eighth* pair is called *Obliquum inferius*, or the lower Oblique pair. These arise from the Spine or ridge of the second *Vertebra* of the Neck, from whence running obliquely upwards, they end at the transverse Processes of the first *Vertebra* of the Neck. They are longish, round and fleshy, and make (as do also the former) a Triangle of equal sides.

The *use* of this pair is to move the Head as it were semicircularly, (for it cannot be moved quite round) the first *Vertebra* turning upon the Tooth-like Process of the second: but this motion is performed, when one of them onely acts at a time; for if both of them move or act together, then they either keep the Head steady (as some Authours conceive) or else draw it a very little backwards.

C H A P. XIII.

Of the Muscles of the Neck.

THE Head is not onely moved by its *proper* Muscles mentioned in the last Chapter, primarily; but secondarily also by other Muscles belonging to the *Neck*, which are in number eight, on each side four, by the help of which the Neck is sometimes bent forward, other times extended backward; it is also sometimes drawn to one side, and sometimes to the other: but there are more Muscles to draw it backwards than either forwards or to one side, because the labour is greater by reason of the weight of the Head and Neck (as was said in the former Chapter.) There are therefore two pair of Muscles to bend the Neck backward, namely the first and second, which do also draw it a little obliquely; and the third and fourth pair draw it both forward and to one side, as both act together, or but one of each pair at a time.

The Muscles common to the Head and Neck are four pair.

The *first* pair of these is called *Spinatum*, because they are seated amongst the Spines of the *Vertebrae*. They arise from the roots of the Spines of the seven uppermost *Vertebrae* of the Chest, and five lowermost of the Neck, being separated from one another onely by the tips of the Spines, and are inserted into the whole lower side of the Spine of the second *Vertebra* of the Neck. They bend the Neck backward, or a little obliquely. Some think that they have no original from the Spines of the Neck, but that they onely adhere to them in their passage.

1. *Spinatum.*

The *next* pair is called *Transversale*, because they both rise from and are inserted into the transverse Processes of the *Vertebrae*. They take their beginning from the roots of the transverse Processes of the six uppermost *Vertebrae* of the Chest; from whence ascending by degrees they become stronger and thicker, and are inserted into the outsides of all the transverse Processes of the Neck-bones. The *use* of this pair, as also of the former, is as hath been said, to pull or draw the Neck directly backwards; but if one Muscle of either pair work alone, it pulls the Neck with an oblique motion.

2. *Transversale.*

The *third* is called *Longum*, or the Long pair. These lie hid under the *Oesophagus* or Gullet, wherefore they are by some called the Undergullet-lurkers. They arise with a thin and sharp but fleshy beginning from the body of the fifth and sixth *Vertebrae* of the Back, and as they ascend upwards, are knit to the sides of all the *Vertebrae*, till they come to the first or highest of the Neck, where each touching other they are both inserted into its Process. The *use* of this pair, when they work together, is to bend the Neck directly forward, and withall to incline the Head; but if one of them act alone, then is the Neck drawn towards that side on which the Muscle moveth.

3. *Longum.*

The *fourth* and last pair of the Muscles of the Neck is called *Scalenum* or *Triangulare*. These by some Authours are accounted as the eighth pair of the Chest. They are seated on the sides of the Neck inclining rather to the fore than hinder part of it. They take their beginning from the first Rib, arising fleshy and large, and are inserted into the inside of all the

4. *Scalenum.*

the transverse Processes of the *Vertebrae* of the Neck. Their use is the same with the foregoing pair. They are observed to be perforated or to have holes through them, by which Veins, Arteries and Nerves do pass out of the Body into the Fore-legs.

Table XXXII.

Representeth an Horse standing with his Face towards us, that one may have the fuller view of some of the Muscles of the Head and Neck. It sheweth also several other Muscles, less perfectly.

- AA *Shew the par Mastoideum.*
 BB *The Muscles of the Shoulder-blade.*
 CC *The par Trigeminum or Complexum.*
 DD *That pair of Muscles of the Neck called Scalenum or Triangulare.*
 E *The Wind-pipe in its natural situation.*
 FF *That pair of Muscles of the Neck called Longum, removed from under the Gullet.*
 GG *The pair of the Nose called Philtrum.*
 HH *The Adducent or closing Muscles of the Nostrils.*
 II *The Muscles of the Eye-lids.*
 KK *The Temporal Muscles.*
 LL *The Muscles of the Ears.*
 M *The Frontal or Fore-head Muscle.*
 N *The Cucullaris or Monk's hood.*
 O *The Deltoides of the Shoulder.*
 P *The Serratus major Anticus (shrunk up, for naturally their Teeth reach to those of the obliquely descending pair of the Abdomen.)*
 QQ *The Pectorales.*
 R *The Obliquè descendens of the Abdomen, a little shrunk up from the Serratus major.*
 S *The Deltoides of the Thigh, (which I presume to call so, for it is just of the same figure with that of the Shoulder.)*
 T *The Serratus posticus.*
 VVV *The external Intercostal Muscles.*
 WXY *The three Buttock Muscles.*
 Z *The Vastus externus.*
 a *The Sacrolumbus.*
 b *The Longissimus dorfi.*
 c *The Semispinatus.*

CHAP.

C H A P. XIV.

Of the Muscles of the Breast.

HAVING dispatched the Muscles of the Head and Neck, we come in the next place to speak to those of the Chest or *Thorax*, in which are contained the principal Instruments of Life, the Heart and Lungs. Now the Lungs being the principal organs of Respiration, and wanting Muscles whereby to dilate or contract themselves, it was necessary they should receive assistance from the Chest in which they are included, by the dilatation or contraction whereof, they might be also dilated and contracted. To which end the Chest is furnished with several Muscles, some of which contract it in Expiration, that is, when the Horse lets forth his breath, and others dilate it in Inspiration, when he receives in his breath.

Of the Dilaters or those that widen the Chest there are four pair, besides the sixteen pair of the External Intercostals, there being (as is already said in Chap. 2. of the Second Book where I largely treated of them) between each Rib two Muscles, an External and an Internal one. Now there being in number seventeen Ribs, reckoning a Rib for the extreme part both toward the Neck and toward the Flank, there must be one pair of Muscles fewer than there are Ribs, of which those that are seated externally, serve all as one Muscle to assist in the widening or dilating the Chest, and those that are seated internally (lying under the former) assist in the contraction of it. For a more full description of these Muscles you may please to turn back to the afore-cited Chapter.

The first pair of the dilating or widening Muscles is called *Subclavium*, from their situation, which is under the Collar-bone called *Clavicula*, for they fill up that space that is between the Clavicle and the first Rib. These arise fleshy from the inner and lower part of the Clavicle or Collar-bone, which is next to the Rib, and running obliquely or slanting forward, are implanted into the first Rib near the Breast-bone with a fleshy end. The action of this pair of Muscles is to draw the first Rib upwards and outwards, by which motion the cavity of the Chest is widened.

The next or second pair of the Dilaters is called *Serratum majus Anticum*, or the greater and foremost Saw-like pair, so called partly from their situation and magnitude, and partly from the figure of their Tendons which resemble the teeth of a Saw. They arise from the inside of the Shoulder-blade and the two upper Ribs, and are inserted into the lower five True-ribs and two upper bastard or Short-ribs, before they end into Gristles; so that its breadth takes up a great part of the side of the Chest, and it is also very fleshy. The use of this pair of Muscles is to draw the Ribs outwards and upwards, and so to dilate or widen the Chest, which it doth more especially in great and violent strainings.

The third proper pair of the Muscles of the Chest is called the upper backward Saw-pair, or *Serratum posticum superius*. They are seated on the Back under the Muscle called *Rhomboides* or the fourth Muscle of the Shoulder-blade, betwixt both the Blades, and above the first pair of the

There are four pair of Muscles that widen the Chest.

1. Subclavium.

2. Serratum majus Anticum.

3. Serratum posticum superius.

Head. They spring membranous from the Spines of the three lower Rack-bones of the Neck and the first of the Back, and are inserted into the Interstices of three or four of the upper Ribs. Their *use* is the same as of the former, *viz.* to draw the Ribs upward, whereby the Chest is dilated, and the inner Cavity thereof enlarged.

4. Serratum
posticum in-
ferius.

The *fourth* is called *Serratum posticum inferius*, the lower backward Saw-pair. These are seated almost in the middle of the Back, under the broad Muscle that is the first of the Depressors of the Shoulder. They arise from the Spines of the three lowest *Vertebræ* of the Back and of the first of the Loins, with a membranous, nervous and broad beginning; afterwards they pass with an overthwart line cross the Muscles of the Back, and being increased with fleshy Fibres are inserted into three or four of the lower short Ribs before they turn into Gristles. Their *use* is to draw the three or four lowest Ribs outwards, and so to dilate or widen the lower part of the Chest.

Besides the four pair already named there is yet another Muscle that assists these in the motion of widening the Chest in Inspiration, which is the *Diaphragma* or Midriff, of which I have already spoken in its proper place, namely in the fourth Chapter of the Second Book; I shall therefore omit speaking of it any farther here.

Two pair that
contract the
Breast.
1. Par Tri-
angulare.

Next come we to treat of the Muscles that *contract* or straiten the Chest in Expiration or letting forth the breath. The first pair of these is called *par Triangulare*, or triangled pair, though they make not a perfect triangle, because they consist of two long sides and one short one. These arise from the middle line of the Breast-bone on the inside of it, (for their seat is within the Cavity of the Chest, under the Breast-bone) being little and slender, and are inserted into the bony ends of the third, fourth, fifth and sixth True-ribs (where they are fastned to the Gristles.) The use of this pair is to draw the Ribs toward the Breast-bone, and thereby to straiten the Chest in Expiration.

2. Sacro-
lumbum.

The next is called *Sacrolumbum* from their rise, which is from the *Os sacrum* and from the Spine or ridge of the *Lumbi* or Loins. They are seated under the *Serratum posticum inferius*, and creeping upwards mix themselves with the long Muscle of the Back, and also fasten themselves to the transverse Processes of the Racks of the Loins as far as to the lowest Rack of the Chest, from whence ascending up to the Ribs, they are inserted into the lower side of them all by a particular Tendon about three or four fingers breadth from the ridge of the Back. The *use* of this pair according to *Veslingius*, is to contract the Chest; but *Spigelius* and also *Bartholinus* do believe that because it grows out of the same beginning with the long Muscle of the Back, therefore it extends and raises up the Chest as that doth.

Cervicale
descendens.

There is another pair opposite to this described by *Diemerbroeck*, a diligent Anatomist, who hath given them the name of *Cervicale descendens*. These, says he, do spring from the third, fourth, fifth, sixth and seventh *Vertebræ* of the Neck, and are inserted into the upper side of each Rib, as the *Sacrolumbum* is into the Lower; and says, that this pair by pulling the Ribs upwards in Inspiration widen the Chest, as the other by drawing them down in Expiration straiten it.

To the Muscles already spoken of, which do contract the Chest, do belong the sixteen *Internal Intercostal* Muscles: For as the *External* ones assist the Wideners or Dilaters of the Chest in their motions, so do the

Internal

Internal also assist these contracting Muscles in the drawing together of the Chest, and do all act together as one Muscle, as the others do; for they pass obliquely from the lower to the upper Ribs, as the others did from the upper to the lower, their Fibres running contrary to or across the former. All these Muscles are said, secondarily, to be assisted in their motion by the Abdominal Muscles, as also by the Muscles of the Shoulder-blade and Fore-legs.

C H A P. XV.

Of the Muscles of the Back and Loins.

THE Muscles of the *Back*, as also of the whole Spine, are so diversly and intricately intermixed and knit together, that some Anatomists have divided them into more, others into fewer, and that by reason of the infinite originals of the Fibres and the multitude of their insertions, all which the admirable wisdom of Nature thought fit to mingle and knit one within another, that they might the better and with the more strength sustain and accomplish those strong and violent actions to which they are design'd, and also with more ease and safety bear such extraordinary heavy weights, as this noble Animal, the subject of my Discourse, doth continually undergo. For if *power united be the stronger*, (as the common saying is) then certainly if many Muscles conspire together unto one motion, they will be better able to perform it.

Now that there are not more than one apparent motion performed by the Muscles of the Back of an Horse is plain, which motion is by the help of the Back-bones to raise up and suspend as it were the whole bulk of the Body, and to bear also great weights many times upon it: I say this is the main, if not the onely motion performed by these Muscles; for the Bodies of Horses cannot be turned backwards and forwards, to the sides, and almost semicircularly, as the Backs of Men are, as may be seen in Dancers, Tumblers and the like.

Again, these Muscles though they are by later Anatomists divided into several pairs, yet the Ancients (as *Galen* for one) were of opinion, that seeing they cannot be by any means truly separated, either there must be so many pair as there are Rack-bones, or else (which is more likely) that there is but one onely pair, offering tendinous distributions to all the *Vertebrae* of the Back. And says *Galen*, If one of this pair work alone, the Spine is inclined towards that side, be it the right or left; but if they both work together, the Spine is bended to neither hand, but pulled streight backward, or rather the Spines are held in their several proper places. And, adds he, whereas almost all Muscles have their Antagonists, that are the Authours of a contrary action to theirs, yet these Muscles of the Spine (if you except the bending Muscles of the Neck) have no Antagonists or Opposites.

Neither are these Muscles of the Back proper to the Back alone, but common to the *Loins* also, being reckoned their second pair, of which I will

1. Musculi longissimi.

will first treat though it be contrary to the custom of Anatomists to doe so. This pair then goes by the name of *Musculi longissimi*, so called from their extraordinary length, as being the longest Muscles (and also the strongest) in the whole Body: For they arise from the *Os sacrum*, and *Ileum* or Haunch-bone, and passing along by the Spine or ridge of the Loins, Back and Neck, they reach as far as to the *Processus Mammillares*, or Mammillary Processes of the Temple-bones. They are almost confounded with the *Sacrolumbum* and *Semispinatum* in their march through the Loins, whence by some those are taken to be parts of this pair: but as soon as this pair arrives at the Back, it parts with those, and appears to be distinct from them. Their use is (if they act together) directly to extend the Back and Loins; but if one onely work, then is the Spine inclined on one side, for their Fibres are oblique or slanting.

2. Par Quadratum.

The next pair goes by the name of *Quadratum* or the Square pair, from their Figure; for whilst they are in their natural situation they both of them together make a four-square figure, though when they are separated they are each of a triangular shape. They arise broad, thick and fleshy from the backward and upper Cavity of the Haunch-bone, and from the inner and upper side of *Os sacrum*, and remaining fleshy in their whole course, they are inserted into all the transverse Processes of the *Vertebrae* of the Loins as far as the lowest Rib. Their use is to bend the Racks of the Loins with a right motion forward or downward; but if one of them work alone, it draws the Loins to one side a little downward.

3. Sacri.

The next are the Muscles called *Sacri*, or holy Muscles, from their rise, which is from the *Os sacrum*. They spring with an acute original from that part of the said Bone where the Spine is fastned to the Haunch-bones. After their original they grow broad by degrees, and though they end not till they come to the Spine of the lowest *Vertebra* of the *Thorax*, yet in their progress they are inserted into several of the Spines and oblique Processes of the *Vertebrae* of the Loins, their Fibres running obliquely or with a slanting line upwards and inwards. The use of this pair, if one work alone, is to pull the Body a little on one side, but if both act or work together, they extend that part of the Spine to which they are fastned.

4. Par Semispinatum.

The last pair is called *Semispinatum*. These arise with a nervous original or beginning from all the Spines or Ridges of the *Os sacrum* and the Loins, and are inserted into the transverse Processes of the *Vertebrae* of the Loins and some of the lowermost of the Chest. These with the former pair do fill up the distances between the Spines, where they touch one another, nothing coming between them to separate them from one another, but a membranous Ligament issuing from the upper Spine. The use of this pair is to join the Spines together, and to extend or erect that part of the Back to which they grow. Now if all these Muscles of the Back and Loins work together, the whole Back is extended, or in a manner drawn backwards: but if the Muscles of one side work alone, the Body is inclined to that side.

The distemper called a sway'd Back is oftner an affection of these Muscles,

These Muscles are apt to have their tone and strength violated by several accidents, as by over-great Loads, by a sudden Cold taken by pulling off the Saddle after hard riding before the Horse be quite cold, and the like; whereby the Muscles become benumbed and relaxed, and so are in a manner deprived of both sense and motion; by which means the Horse

Horse becomes useles, being so far from being able to carry Burthens or to perform any other service for his Master, that when he is up he can hardly serve himself, I mean, stand to eat his Meat; or if down, not able to rise without help. This also often happens to old and lean Horses, in whom by reason of the weakness of their Bodies, as also because they abound with flegmatick Humours, these Muscles are so relaxt that they are scarce able to support the weight of their own Bodies, much less other Burthens. And in this case I think nothing more proper than good store of strengthening Food, to support and nourish their inside, whereby they may gain strength, and withall to apply some strengthening Plaster to the outside at the same time.

than any dis-
location in
the Verte-
brae.

But to recover those that come by this affection by great Colds taken as is above-mentioned, it will be the best way to give them warm, strengthening and comfortable Medicines inwardly, and also to apply first some warm Sheep-skins pretty often renewed, and at the same time to anoint the Loins with some sovereign Ointments or Oyles outwardly; or if this will not doe, then to sweat him in a Dunghill, and after he comes out, to apply to the Loins a strengthening Charge or Plaster.

I thought my self a little obliged in this place to enlarge upon this account, to undeceive many of our Professors, who take all Distempers in this kind to be as one, concluding still that all Horses thus affected, are either strained in the Kidneys or swayed, as we call it, in the Back; when indeed these Muscles are either benumbed by cold as aforesaid, or by strains gotten by carrying over-great weights or burthens, they are distended to that degree, that for some time they lose the strength and vigor they used to perform their motions with; this, I say, is often the true cause of the debility and weakness of the Back.

Not that I will deny that there is any such malady as a swayed Back, for I have my self by dissection seen in a Horse that was knocked on the Head, (being not curable of this Distemper) not onely all the muscular Parts as it were bruised, and many of their interspaces filled with a kind of a congealed Humour or Matter, but also found a kind of dislocation in that part where the *Os sacrum* or lowest *Vertebra* of the Loins are joined, and a deal of congealed Matter settled about those Parts. But such a strain is seldom curable, or if ever, not without great charge and long keeping. What I have therefore said upon this account is to let our Professors know, that most of those affections which they call sway'd Backs are onely distempers of the Muscles, and therefore easily cured if soon taken in hand: but those which have broken Backs, (which we commonly understand by swayed Backs) are seldom curable. And thus much shall suffice as to this sort of discourse in this place; it remains now that I return to my former discourse, and describe the remaining part of the Muscles, of which those of the *Anus*, Bladder, and Genitals both in Horses and Mares come next to be spoken to.

C H A P. XVI.

Of the Muscles of the Fundament, the Bladder, the Testicles, Yard and Clitoris.

A Horse being a Creature made for service, it was fit that he should void his Excrements at his own conveniency and choice, and not perpetually; As therefore Nature hath provided Muscles about the Mouth and Chaps for the receiving, chewing and swallowing of the Food, so at the end of the Guts and at the outlet of the Urine there are Muscles set as Porters to interclude the passage, that nothing might go out but by the Horse's own accord; whereas were it not for these Muscles, his Excrements would come from him continually and involuntarily, as I have seen to happen in such Horses whose Sphincter Muscle hath by some accident or extraordinary weakness been violated. Neither hath Nature onely provided Muscles for the keeping of the Excrements in, I mean till such time as it is necessary they should be let forth; but others also as instruments to assist in the voiding or letting of them forth. For the former purpose is appointed one Muscle at the *Anus* called the Sphincter, and for the latter, two, called Levators.

The Sphincter Muscle of the Anus.

The *Sphincter* is a fleshy Muscle seated at the very end of the Arse-gut, the which it incompasseth round like a Ring, to which it may fitly be resembled. It is rather knit to than arises from the lower *Vertebrae* of the *Os sacrum*, being round and broad, and furnished with transverse or overthwart Fibres, or indeed orbicular ones. This Muscle is much thicker above or inwards, than below or at the Fundament, where it adheres so firmly to the Skin, that it is not easie to separate it from it. Its *use* we have mentioned in the former Paragraph.

Two Levators.

The other two are called the *Levators* or lifters up of the Fundament. These are small, broad and nervous, arising from the Ligaments of the Hip-bones and *Os sacrum*, from whence passing by the sides of the streight or Arse-gut they adhere to it, and are inserted into the upper part of the Sphincter. A portion of them also grows to the root of the Yard, and in Mares to the neck of the Matrix. Their *use* is to assist the Abdominal Muscles in the expulsion of the Excrements, which they doe by lifting up the Fundament. They also help to keep the Fundament from falling out, which sometimes happens when they are too much relaxt.

The Sphincter of the Bladder.

To the *Bladder* doth also belong a Muscle called a *Sphincter*, which is seated in the beginning of its neck, the which it compasseth round. It is furnished with orbicular Fibres as the Sphincter of the Fundament is, and is of the same use; for it constringes or purses up the neck of the Bladder (as that doth the *Anus*) that the Urine may not pass out without a spontaneous relaxing of this Muscle. In Mares it is seated at the very end of the Bladder, *viz.* at the hole where the neck of the Bladder opens into the *Vagina*.

The Muscles of the *Yard* are in number four (or two pair) of which we have already treated in the First Book at Chapter 20. of which the first pair are called the *Erectores* or Lifters up of the Yard, and the other *Dilatantes*,

Dilatantes, Wideners, and by some they are called *Acceleratores* or Hasteners. I thought fit in this place onely to name them, referring the Reader to the above-named Chapter for his farther satisfaction; as also to the said Book at Chap. 22. for the description of the Muscles of the *Testicles* called the *Cremaster* Muscles, by which the Testicles are suspended. The Reader may also be satisfied in the same Book at Chap. 27. concerning the Muscles of the *Clitoris* in Mares, which are two pair, as the Yard of a Horse, to which it is resembled, hath; for I shall not insist upon them in this place neither.

C H A P. XVII.

Of the Muscles of the Scapula or Shoulder-blade.

HAVING sufficiently treated of the Muscles of the three *Venters*, it remains that I descend now to treat of those of the *Limbs*, beginning first with the formost of them, the first of which shall be those that move the *Shoulder-blade*.

The *Shoulder-blade* is observed to have four motions, *viz.* forward, backward, upward and downward, which motions are performed by four pair of proper Muscles. The *first* pair are seated betwixt the two *Shoulder-blades*, covering the top of the *Withers*. They are called *Cucullares* from the resemblance they have with a Monk's Hood or Cowl. Their first original is fleshy and thin, which they take from the *Occiput* or hinder part of the Head; but as they descend down the Neck they have other membranous beginnings from five of the Spines thereof, yea and from eight or nine of the uppermost of the Chest: but they presently begin to be straitned as they descend towards the *Shoulder-blades*, into whose whole spine or ridge they are implanted, as likewise into the *Shoulder-bone* and broader part of the *Collar-bone*. This pair of Muscles, because of their divers originals, from whence they have several sorts of Fibres, are said to perform several motions; as when the upper part of the Muscle that arises from the *Occiput* is contracted, then is the *Shoulder-blade* lifted obliquely upward, that part being furnished with oblique Fibres; and when that part which springs from the *Withers* is contracted, then it is pull'd streight thitherward.

The *second* pair are called *Levatores*, the Lifters or Heavers; and by some (in Men) *Patientiæ Musculi*. These are situated above the *Collar-bone*, taking their beginning from the transverse Processes of the first, second, third and fourth *Vertebræ* of the Neck; which beginnings being united in the middle (or thereabouts) of the length of the Muscles, they are at last inserted into the *Shoulder-blades* at their fore corner. The use of these Muscles is to draw the *Blades* upward and forward.

The *third* pair is called *Serratim minus Anticum* or the lesser fore Saw-pair. These lie under the *Pectoral* Muscles, and spring from the four uppermost *Ribs* before they become gristly, by four fleshy portions representing the

The *Shoulder-blade* hath four pair.

1. *Cucullares*.

2. *Levatores*.

3. *Serratim minus Anticum*.

the teeth of a Saw; from whence they pass somewhat slantingly to the Shoulder-blade, into whose Process (called its Anchor-like Process) it is inserted with a broad (partly fleshy and partly nervous) Tendon. The use of this pair is to move the Shoulder-blades forward to the Chest.

4. Rhomboides.

The fourth and last pair is called *Rhomboides*. These are seated under the *Cucullares*, being thin, broad and four-square. They spring fleshy from the hinder Processes or Spines of the three lowest Rack-bones of the Neck, and as many of the uppermost of the Chest, and continuing fleshy to their very insertion they are implanted into the basis of the Blades. Their use is to draw the Blade somewhat upward and backward, couching it to the Back.

Note, that seeing a Horse and all four-footed Beasts go prone, whereas Man walks erect or upright, the motions of the Muscles might, and ought in strictness, to be explained diversly in *them* from what they are in *him*: As for example, Those which are said in Man to move the Part upward, viz. toward the Head, ought in a four-footed Beast to be said to move it forward; and those which move it backward in Man, move it upward in the other, because of the different posture of their Bodies: and the same might be said as to their motions forward and backward. But seeing many of the Muscles have their names from their offices in *Men*, it would make but a confusion and a great impropriety in their appellations to explain their motions by other termes in *Brutes*. And therefore the Reader is desired to observe, That when we say a Part is moved upward, we mean towards the Head; when downward, toward the Tail; when backward, toward the Back; and when forward, we understand it toward the Breast or Belly.

C H A P. XVIII.

Of the Muscles of the Shoulder.

THAT which I call the *Shoulder* is that Part or Bone that reaches from the top or pitch of the Shoulder (and is joynted into the Shoulder-blade) to the next Joint which we call the Elbow; which it is necessary to intimate for distinction sake, because the Shoulder-blade and this part are commonly both understood by the name of the Shoulder. Having advertised this, pass we now to its Muscles.

Each Shoulder hath nine Muscles, viz. first, two Extensors.

Deltoides.

The motions of the Shoulders are five, viz. backwards, forwards, upwards, downwards and circularly. To perform which each hath nine Muscles, of which there are two that move it upward, namely the *Deltoides* and *Supraspinatus*; and of these we shall treat in the first place.

The first is called *Deltoides* from its figure, which resembles the shape of the Greek Letter Δ *delta*. It is fleshy and (as you may see) triangular, arising from the midst of the Clavicle or Collar-bone, the top of the Shoulder, and the whole ridge of the Shoulder-blade, and is extended as far as to the middle of the Shoulder-bone, where it is inserted. This Muscle is observed to have divers sorts of Fibres; some of which run obliquely

liquely downwards, such are those on the fore-part; others run obliquely forward, which are those on the back-part of it; and a third sort, which are placed in the middle, run directly toward the Fore-leg: Wherefore (says my Authour) when the Fibres of the fore-part are contracted, the Shoulder is lifted upward and forward towards the Horse's Nose; if the middle Fibres be contracted, the Shoulder is lifted directly towards his Back; and if the hinder Fibres be contracted, then is the Shoulder carried obliquely backward: so that this Muscle is said not onely to raise up the Shoulder (which is indeed its chiefest use) but helps also to perform other motions as well as that.

The *second Erector* or Lifter up of the Shoulder is called *Supraspinatus* Supraspinatus by some, but by others *Superescapularis superior*, or the upper Blade-rider, because it is seated uppermost upon the Shoulder-blade, and filleth up all that cavity which is between its spine and upper edge. It arises from the spine of the Blade with a long and fleshy beginning, and passing over the jointing of the *Scapula* with the Shoulder-bone by a broad and strong Tendon, is inserted into the neck of the said Shoulder-bone. This Muscle is by some Authours thought not onely to lift up the Shoulder (which is its principal use, as being one of the Erectors) but also to help to turn it a little round.

The *Depressors* or Pullers down of the Shoulder are also two, namely *Latissimus* and *Rotundus major*. The *Latissimus* is so called from its breadth and largeness, for with its fellow it covereth almost the whole Back. It goeth also by the name of *Ani-scalptor*, or Scratch-arse Muscle (in Men.) It rises with a membranous and broad beginning from the tops of all the spines of the Rack-bones that are betwixt the sixth *Vertebra* of the Chest and the middle of *Os sacrum*, as also from the upper part of *Os ileum* or Haunch-bone: from thence ascending upward untill it come to that part of the Back where the Ribs begin to bend backward, there it becomes more fleshy, and is carried over the lower or hinder corner of the Shoulder-blade, at which place it begins to grow narrower but continues fleshy: and at length by a broad and strong Tendon it is inserted below the upper head of the Shoulder-bone lengthways, on the inside, betwixt the Pectoral and Round Muscles, there being a space left betwixt them for that purpose. This draws the Shoulder downward or toward the Tail, though a little obliquely backward.

The *second Puller* down of the Shoulder (or its fourth Muscle) is called *Rotundus major*, or the greater Round Muscle. It takes its beginning from the whole lower *Costa* or Rib of the Shoulder-blade, and is inserted into the upper and inner part of the Shoulder-bone with a short but broad, strong and nervous Tendon. The use of this is the same with the former, viz. to pull the Shoulder downward.

The two pair of Muscles that pull the Shoulder forward are called, the one by the name of *Pectoralis*, and the other *Coracoideus*. The *Pectoralis* is so called from its situation, which is upon the fore-side of the Breast. It hath a very large and for the greatest part membranous beginning, which it takes from divers parts: for its upper part arises from the middle of the Collar-bone on that side next the Breast; its middle, from the whole length of the Breast-bone and the ends of the Gristles of the Ribs that end in it; and its lower part springs from the Gristles of the sixth, seventh and eighth Ribs. After it hath taken these beginnings, it presently becomes fleshy and thick, and running towards the Shoulder is at

length inserted into the Shoulder-bone with a short, but broad, sinewy and strong Tendon a little below its head, betwixt the Muscle *Deltoides*, and that which is called *Biceps*. The office of this Muscle is, when it contracteth it self equally, to move the Shoulder equally and directly forward or toward the Breast, inclining to neither hand: but if all its Fibres be not equally contracted, (for by reason of its divers beginnings it hath also divers sorts of Fibres, some running with a slanting line from above downwards, others with the like slanting line from below upward, and those betwixt these running streight; wherefore I say, if all these Fibres be not equally contracted, but some work, and others not) then are other motions performed by this Muscle, as the Shoulder drawn more upward or downward, as the different Fibres work.

Coracoideus. *Coracoideus* is by *Bartholin* accounted the ninth Muscle of the Shoulder (which, says he, was first observed by *Arantius* and *Placentinus*) but we do after the more modern Authours reckon it for the sixth, and second drawer forward of it. It hath its name *Coracoideus* from its beginning, which is from the *Processus Coracoides* of the *Scapula*; from whence it reaches to the middle of the Shoulder-bone where it terminates. Its use is (as say the discoverers of it) to draw the Shoulder to the Process of the Blade-bone, or forward upon the Breast.

Fourthly,
three Pullers
backward.
Infraspinatus.

The Shoulder is moved also backward by three Muscles, which are *Infraspinatus*, *Subscapularis* or *Immersus*, and *Rotundus minor*.

That which is reckoned the first of these, is the *Infraspinatus*, by some called *Suprascapularis inferior*. It is seated upon the Shoulder-blade and fills up all that space which is betwixt the ridge or spine of the *Scapula* and its lower edge, even as the *Suprascapularis superior* fills up the upper space. It arises fleshy from the basis of the Blade below the ridge of it, becoming narrower in its progress as the Blade-bone grows narrower, and is inserted by a broad and short Tendon into the fourth Ligament of the Shoulder-bone.

Subscapularis.

The second Puller or Drawer back of the Shoulder is the *Subscapularis*, the Under-blade-lurker, or *Immersus* the drowned Muscle, because it is seated under the Blade-bone betwixt the Ribs and it. Very fleshy it is, arising so from the inner part of the basis of the Blade; in figure it is triangular, like the Bone, growing narrower or straiter by degrees as it descends, and is inserted into one of the Ligaments of the Shoulder.

Rotundus minor.

The next being the third and last of the Drawers back of the Shoulder is called *Rotundus minor*, the lesser Round Muscle, from its figure. It arises from the lowest corner of the *Scapula*, and is implanted into the neck of the Shoulder-bone.

As for the circular motion of the Shoulder, that is not performed by any one Muscle, but by several of these already named, acting successively one after another.

CHAP.

C H A P. XIX.

Of the Muscles that move the Fore-leg and Foot.

THAT part of the Leg which reaches from the Elbow to that which we call the Knee, answers to that part in Humane Bodies which reaches from the Elbow to the Wrist. Onely in an Horse there is but one Bone in this space (which we shall call the Cubit-bone) whereas in Men there are two going by two distinct names, one of which being the greater is called *Cubitus* or the Cubit, and the other *Ulna* or the Ell. But as for that part which we call the Knee, it agrees more exactly with the Wrist in Men, and might more properly be called so: For examining the Part to see of what it is compounded, I find it made up of two ranges of little Bones as the Wrist of a Man is, and not like the Knee of a Man, which consists of one little round Bone (called the Knee-pan) fastned between the Jointings of the lower head of the Thigh-bone and the heads of the *tibia* and *fibula*: for that Bone is exactly found in the Hind-leg of a Horse in that Joint we call the Stifle, which is indeed the Knee, as shall be proved in a convenient place. And as the Knee of a Horse is like the Wrist of a Man, so is that Bone below it, (or indeed three Bones, for the Bone which we call the Shank or Shin, hath two small Bones fastned to it running by its sides down almost all its length till within two or three inches of the great Pastern; I say that as the Knee is that part which is the Wrist in Man, so is this part between the Knee and great Pastern) answerable to the *Metacarpium*, that is, to that space which reaches from the Wrist to the setting on of the Fingers. Onely in Man there are five Bones, and in an Horse but three. So likewise does the great Pastern correspond to the first Joint of the Finger; the little Pastern to the second Joint; and the Coffin-joint on which the Hoof grows, to that Joint of the Finger on which the Nail grows.

By this you may see that these Parts of an Horse come very near the like Parts of a Man, the number of Bones and Muscles of the Fingers onely excepted. For a Horse is *solidipes*, or whole-footed, so that the whole of it is necessarily moved at one time, and therefore has no need of that variety of Muscles that a Man's Hand is endowed withall. An Horse's Fore-feet are of no other use than to go upon, any more than his Hinder-feet; whereas the Hand of a Man is ordained for other uses, and is therefore accordingly shaped, and divided into more Parts, to wit four Fingers and a Thumb, all which have their peculiar Muscles to enable them to perform those motions to which they are designed. Whence the number of the Muscles come to differ greatly. Now we shall take no notice of those that a Man has more than an Horse, but shall onely treat of those that are to be found to move the Joints of an Horse already mentioned, *viz.* the Cubit-bone, the Shank, the two Pasterns, and the Coffin-joint.

First, the *Cubit* is either *bended*, or *extended*. Of the *Benders* there are two; the *first* of which is called *Biceps*, from its double beginning; for it hath two heads, the first being outward, tendinous and round, the

How far the Fore-leg of an Horse answers in its Parts to the Arm of a Man.

Two Muscles bend the Cubit.

1. Biceps.

seth

feth from the upper brim of the hollowness of the Shoulder-blade; the second head is broader, and is framed partly of a Tendon and partly of Flesh: this arises from the *Processus Anchoriformis* or Anchor-like Process of the *Scapula*; then descending by the inner head of the Shoulder-bone, it meeteth with the former head, and becometh a strong fleshy Muscle, running down the inside of the Cubit-bone to the Knee, where it is inserted. This bends the Cubit forwards and somewhat inwards.

2. *Brachiaeus internus.*

The *second Bender* is from its situation in Humane Bodies (being placed as the former is, upon the inside of the Arm in them, and of the Leg in Horses; I say from its situation it is) called *Brachiaeus Internus*. This lies inwardly under the *Biceps*, and is something shorter than it, but of a fleshy substance like it. It takes its beginning near the end of that Muscle of the Shoulder called *Deltoides*, about the middle of the Shoulder-bone, to which it is firmly fastned: after which it runs its course as the former, and is inserted into the foreside of the Cubit-bone a little above the Knee, assisting the motion of the former.

Two also extend it.

1. *Longus.*

There are also two Muscles to *extend* the Cubit, which lie on its outer and hinder side. The first of them from its length is called *Longus*. This arises with a strong and broad original, partly nervous and partly fleshy (which some make to be two heads) from the lower Rib of the Blade-bone, after which it descends on the hinder side of the Shoulder-bone, and also of the Cubit-bone, and is inserted into its outside just at the Knee. This draws the Cubit backwards and somewhat outwards, and thereby extends it or stretches it out streight.

2. *Brevis.*

The *second Extender* of the Cubit is called *Brevis* from its shortness. It arises from the hinder-part of the neck of the Shoulder-bone, and holding the same course as the former, is inserted into the lower end of the Cubit-bone at the same place with the former, and assists its motion.

Besides these there are said by some Anatomists to be two more *Extending* Muscles, *viz.* one called *Brachiaeus Externus* from its being placed on the *outside* of the Arm in Men. But this is by *Spigelius* looked upon to be the second head of the *Long* Muscle, because it grows into one Muscle with it, and has the same insertion with both it and the *Short* one.

The other is called *Anconæus*, being a small-bodied Muscle, arising from the lower and back-part of the Shoulder-bone, and is inserted into the Cubit an inch or two below the Elbow. But some make this to be but a part of the *Short* Muscle.

As for the other Bone of this Joint in Men, called *Radius*, that also has its Muscles, which serve to turn the Arm and Hand round: But seeing there is no such Bone in an Horse, as neither any such motion of an Horse's Leg, it cannot be expected there should be found any Muscles in him answerable to the other, as to this part.

Pass we on therefore to the next Joint commonly called the Shank, but which truly answers to the Metacarp, or back of the hand in Men. And this like the Cubit is either *bended* or *extended*.

Two Muscles bend the Shank.

1. *Cubitæus internus.*

To *bend* it there are two Muscles; of which the *first* is called *Cubitæus internus*. This arises from the inner knob of the Shoulder-bone, and descending along the inside of the Cubit, is implanted into the inner and hinder sides of the top of the Shank.

2. *Radiaeus internus.*

The *second* is called *Radiaeus internus* in Men, though very improperly in an Horse, seeing he has no *Radius*. This has the same rise, progress and insertion with the former.

There

There are also two Muscles to *extend* it; the first of which is called *Cubitus externus*. This springs from the outer knob of the Shoulder-bone, and descending down the Cubit, is inserted into the outer and fore-side of the head of the Shank. Two also extend it.
1. Cubitus externus.

The *second* of the *Extenders* is called *Radius externus* (improperly as to an Horse, as was noted before.) This has the same rise, progress and insertion with its fellow. 2. Radius externus.

The next Joint is the *great Pastern* which answers to the first Joint of the Finger in a Man's Hand, as the *little Pastern* answers to the second Joint, and the *Coffin-joint* to the last on which the Nail grows. All these are either bended or extended as the former Joints were. But before we describe those Muscles that perform these actions, there is one other to be treated of that is called in Man *Palmaris*, from its being spread over the Palm of the Hand; but in an Horse its Tendon is spread over the Sole of the Foot, whence the name of *Plantaris* would better agree to it. This springs fleshy from the inner knob of the Shoulder-bone, but presently grows into a slender Tendon which descends to the Sole of the Foot as aforesaid.

The *Pasterns* and *Coffin-joint* are bended by two Muscles; the *first* of which is called *Sublimis*, (I suppose because it rises *high* up.) It springs from the inner knob of the Shoulder-bone, and is inserted into the *Pasterns*. The Pasterns and Coffin-joint are bended by two Muscles.
1. Sublimis.

The *second* is named *Profundus*. This arises from the upper part of the Cubit-bone, and is inserted into the *Coffin-joint*. 2. Profundus.

They are extended by *one* very considerable Muscle, called *Extensor magnus*. This springs from the outer knob of the Shoulder-bone, and its Tendon is inserted into the fore and outer side of the *Pasterns* and *Coffin-joint*. Some reckon this to be two Muscles. They are extended by one, viz. Extensor magnus.

There are several other proper Muscles that belong to the Fingers in Men, some to one and some to another, as also others that move them laterally, or to and from one another, which it were from our purpose here to mention, as not being to be found in 'an Horse. Though I dare not affirm positively that there are no more than I have here described; for I am apt to suspect the contrary from the multitude of Tendons that descend into the *Coffin-joint*: however these that I have mention'd are the most considerable and plainly discoverable; and rather than encrease their number at a *venture*, I will be content that this Chapter be reputed imperfect.

Table XXXIII.

Represents an Horse with the Side towards you, that you may have a sight of as many of his Muscles at one view as is possible.

- AA Shew the oblique descendent Muscle of the Abdomen or Paunch.
- B The oblique ascendent Muscle of the same part, at its original from the Hip-bone.
- C Its membranous Tendon reaching to the White-line.
- D The transverse Muscle of the Paunch.
- E The right or streight Muscle of the same part.
- F The Pectoral Muscle.
- G The Serratus major Anticus.
- H The Deltoides of the Shoulder.

- H *The Serratus Posticus.*
 K *The Cucullaris.*
 L *The Sacrolumbus.*
 M *The Longissimus Dorfi.*
 N *The Semispinatus.*
 OOOOO *The Intercostal Muscles.*
 PPP *The Ribs laid bare.*
 Q *The end or gristly part of the Shoulder-blade.*
 R *Glutæus minor or lesser Buttock-muscle.*
 S *Glutæus medius or middle Buttock-muscle.*
 T *Glutæus major or greater Buttock-muscle.*
 V *The Deltoides of the Thigh, having its Tendon broken off it.*
 XX *The Musculus Biceps.*
 Y *The Vastus Externus.*
 Z *The Musculus Rectus.*
- a *One of the proper Muscles of the Cheek called Lateralis.*
 b *A Muscle of the Nostrils called Philtrum.*
 c *The external Adducent Muscle or closing Muscle of the Nose.*
 d *The orbicularis or constringens, which draws the Lips together, being common to both Lips.*
 e *The Muscles of the Eye-lids.*
 f *The Temporal Muscle.*
 g *The Buccinator or Trumpeter.*
 h *One of the Muscles of the Neck called Longus, seated under the Gullet, but to be seen in this Figure by reason of the posture of it.*
 ii *One of the proper Muscles of the Head called Mastoides.*
 k *The Muscle of the Head called Splenius or Triangularis.*
 l *The Frontal or Fore-head Muscle.*
 m *The Spinatus, being one of the Muscles that move the Neck.*
 n *The Complexus or Trigemini so called from its threefold beginning.*
 o *The Subclavius pulled a little outward from under the other Muscles.*
 p *The Infraspinatus or Subscapularis inferior.*
 q *The Supraspinatus or Superscapularis superior.*
 r *The Scalenus.*
 f *The Rotundus major or Humerum deprimens a little out of its place at its lower end.*
 t *Musculus Biceps.*
 u *Longus.*
 w *Brachiaeus externus.*
 x *Cubitaeus externus.*
 y *Radiaeus externus.*
 z *Extensor magnus.*
 α *Radiaeus internus.*
 β *Cubitaeus internus.*
- 11 *The Gastrocnemius internus of both the Hind-legs.*
 22 *The Gastrocnemius externus of the like.*
 3 *The Tendon of the Muscle Plantaris coming out as out of a Pulley.*
 4 *The Tibiaeus Anticus.*
 55 *The Extensor tertii internodii digitorum aut Longus, so called by Mr. Brown.*

C H A P. XX.

Of the Muscles of the Thigh.

BY the *Thigh* we mean that part which is betwixt the Joint of the *Huckle* or *Whirle-bone*, and that which is called the *Stifle*; which consisteth of one large and long Bone, going by the name of the *Thigh-bone*, or *Femur*. This Bone hath a round head which is jointed into the round Cavity of the *Hip-bone*, so that it admits of all kinds of motions, whence it hath a multitude of Muscles to perform these motions; some of which move the *Thigh* forwards, whereby it is bended; some move it backwards, and thereby extend it: a third sort bend it inward, as when a *Horse* rubs the contrary *Leg* with his *Foot*, which is often seen upon any itching or pricking humour affecting that Part: a fourth sort move it outwards; and a fifth obliquely about. But first of the *Benders forwards*, which are accounted to be three in number.

The *first* of which is called *Psoas* or *Lumbaris*. This is almost round, thick and livid, and lieth in the inner part of the *Abdomen*, upon the *Vertebrae* of the *Loins*. It arises fleshy from the transverse Processes of the two lowest *Vertebrae* of the *Chest* and two or three uppermost of the *Loins*; from whence descending by the inside of *Os ileum*, at length it ends in a strong and round Tendon, which is inserted on the fore-side of the upper part of the lesser head of the *Thigh-bone*. The use of this is, strongly to draw the *Thigh* upward, and somewhat inward. Upon this Muscle the *Kidneys* are placed, near that part of it where its Nerve enters into it; which in *Men* is the cause of that stupor or numbness that is felt in the *Thigh* by those that are troubled with the *Stone* in the *Kidneys*, on that side that the *Stone* is on.

The Benders
of the Thigh
are three.
1. Psoas.

The *second Bender forward* is called *Iliacus internus*, or the inward *Haunch Muscle*. It springeth with a slender and fleshy beginning from the inside of the *Haunch-bone*, and being joined by its Tendon to the former Muscle, is inserted with a round Tendon into the lesser head or *Rotator* of the *Thigh-bone*. The use of this is the same with the first, which is, to lift the *Thigh* up and so to bend it forward; yet it doth not move it so much inward as the *Psoas* doth.

2. Iliacus in-
ternus.

The *third* is called *Pectineus*, arising broad and fleshy from the line of the *Share-bone* near its *Gristle*, and is implanted into the inside of the lower end of the *Thigh-bone* with a broad and large Tendon. Its use is to draw the *Thigh* upward and inward. This is the Muscle that in *Men* helps to lay one *Thigh* over the other in sitting.

3. Pectineus.

Note, that both this last foregoing, and all the following Muscles save the two last, are inserted at the lower end of the *Thigh-bone*, just above the *Stifle*; whereas in *Men* they are most of them if not all inserted into its upper part, viz. either into its neck, or into one or other of the two knobs jetting out at the lower end of the neck, (called the great and little *Trochanters*.) What may be the reason of this different insertion is not easie to guess, unless it be the shortness of the *Thigh-bone*, which in an *Horse* is not half so long as it is in a tall *Man*: so that an *Horse's* Muscles

cles

cles being so plump and bulky upon his Buttocks, it was necessary they should have some considerable space to grow slenderer in and to become tendinous; and therefore they are extended as far as the *Stifle* which answers to the *Knee* in Man.

The Extenders are also three.
1. *Glutæus major.*

Next come we to the Muscles that bend *back* and so *extend* the Thigh, (as when an Horse stretches himself) which motion is also performed by three Muscles. The *first* of which is called *Glutæus externus*, or the outwardmost Buttock Muscle; in Men it is also called *Glutæus major*, the greatest Buttock Muscle; but in an Horse it is not so, for in them the middlemost is the largest. This springeth with a very fleshy beginning from the Crupper, from the Spine or ridge of the Haunch-bone, and from the *Os sacrum*. Afterward descending a little obliquely and riding over the Joint of the Huckle-bone, it at length grows narrower and more slender, and so endeth into a strong and broad Tendon, which is inserted into the inner part of the Thigh-bone just above the *Stifle*, yea it seems to reach as far as to the top of the *Tibia*. Its *use* is to draw the Thigh backward and so to extend it, as also to enable the Horse to go backward.

2. *Glutæus medius.*

The next or *second* is called *Glutæus medius*, or the middle Buttock Muscle. This in Man (because of his going erect) lieth quite under the former, and is so hid by it, that unless the former be first removed, it cannot be seen. But in Horses it is larger than the former, and lieth side by side with it, as doth the next also, and they are both to be seen without removing the first, as may be plainly observed by the following Figure. It arises with a fleshy and broad beginning, a little higher than the first, from the Spine of the Haunch-bone on the fore-part of it, and from thence descends somewhat obliquely over the Joint of the Hip as far as to the lower end of the Thigh-bone, into the outer side of which it is inserted with a broad, strong and membranous Tendon. Its *use* is to extend the Thigh and to draw it outward and backward, as when the Horse stands to *stale*.

3. *Glutæus minor.*

The *third* and last of the *Extenders* is called *Glutæus minor*, or lesser Buttock Muscle. This in a Horse arises equal in height with the former at the Spine of the Haunch-bone. At its beginning it is round, sharp and fleshy; but in its course it becomes more broad, descending with an oblique line by the side of the second Muscle, and is inserted at the lower end of the Thigh-bone, rather towards its fore-side. This assists the action of the former, drawing the Thigh outward and backward.

One Mover of the Thigh inward, viz. *Triceps* or *Quadriceps.*

The Thigh is drawn to the *inside* by the Muscle *Triceps*, or *Quadriceps*, for it goes by both names, because some affirm it to have four, and others but three beginnings. This Muscle is looked upon to be the thickest of all the Muscles of the whole Body, being furnished with great variety of Fibres.

The first of its beginnings is from the upper part of the Share-bone, where it arises with a nervous head, and descending is inserted into the inside of the lower end of the Thigh-bone.

The second part of it arises from the lower side of the same Bone, being fleshy and broad, and is inserted into the inside of the Thigh-bone, a little higher up than the former.

The third head of this Muscle arises with a fleshy and sometimes nervous beginning from the whole lower part of the *Coxendix*, round about the circumference of its wide hole; and is inserted near the last.

The

The fourth head springs with a nervous and fleshy beginning from the tip of the *Coxendix*, and afterward running along the inside of the Thigh, endeth into a round Tendon, which joining with the Tendon of the first part of this Muscle is inserted into the lower end of the Thigh-bone with it.

The Thigh is also turned *outward*, which motion is performed by four Four Muscles move the Thigh outward, called *Quadrigemini*, all which are placed one by another upon the outside of the articulation of the Thigh. The first of them is from its situation called *Iliacus externus*, and from its figure, *Pyramiformis* or Pear-like Muscle. This is longer than any of the rest of them, arising round from the lower and outer part of *Os sacrum*; thence it runneth downward upon the backside of the great *Rotator*, and is implanted into the outside of the lower end of the Thigh-bone.

The second and third of these Muscles do want particular names; but both of them arise from the knob of *Os ischium*, near one another, and are inserted with the first.

The fourth and last is called *Quadrigenus quadratus*. It is more fleshy and broad than the rest, arising from the inner part of the knob of the *Ischium*, lying some two or three inches distant from the third, and endeth with the former.

To these must be added that Muscle which we have named the *Del-* Also the Del- *toides* of the Thigh, not finding any in Humane Bodies to answer to it, roides of the so as to borrow a name from thence. It springs (as you may see plain in the foregoing Figure) from the outside of the tip of the *Ileum*, with a sharp beginning; but presently enlarging it self, becomes three-square, and is inserted with a broad membranous Tendon into the outside of the Thigh-bone, from which insertion it appears torn off in the Figure. By its situation it seems to assist the action of the *Quadrigemini*.

The Thigh is turned about obliquely by two Muscles called *Obturato-* The Thigh is *res*, or Stoppers, because they fill up the wide hole between the *Os pubis* turned a lit- and Hip-bone. The first is called *Obturator internus*. This ariseth from tle about by the inner circumference of the hole before spoken of, and passing over two Muscles. viz. 1. Ob- thwart the end of the Hip-bone, is inserted into the Cavity of the great turator in- *Rotator*.

The other is called *Obturator externus*, the outward Filler. This arises out of the external circumference of the above-named hole with a 2. Obturator fleshy and broad beginning, and winding about the neck of the Thigh-bone turneth into a strong and large Tendon which is implanted into the Cavity of the great *Rotator* with the former. externus.

And thus much for the Muscles of the *Thigh*, which for order sake I have according to the custom of Anatomists first treated of; but it is necessary that we make our dissection in the Leg first, to remove those Muscles; for we cannot so easily nor conveniently raise nor shew these of the Thigh, untill those of the Leg be removed, because the heads of some of them lie upon the Muscles of the Thigh.

C H A P. XXI.

Of the Muscles of the Tibia or Leg.

THE Muscles of the *Tibia* or Leg are of the same number in Horses as in Men, (like as the Muscles of most other Parts are) the insertion of some of them onely excepted. Which difference springs from hence, that this Bone of the Leg which in a Horse is but one main Bone supported on each side with another slender immoveable one for strength, as also for the safer passage of the Tendons of the Muscles between them, (which I suppose to be the onely use of them, as not being moveable; I say this Bone which in a Horse is but one) is in a Man two, going by two different names, *viz.* the one by that of *Tibia*, and the other, by that of *Fibula*, and some of the Tendons of the Muscles are inserted into one of them, and some into the other. But otherwise so far as I have had opportunity to examine them, I have found them to have the same original, substance, figure and course in a Horse as in Man; and therefore I shall proceed to treat of them after the same method as I have done of all the rest, forbearing to speak any further of the difference (in a Man and an Horse) between the Parts that are moved by the Muscles to be treated of in this and the following Chapter, untill I come to the Book of the Bones, where I shall shew at large the similitude between them, and that the difference is not so much as it may be believed to be.

The Leg is
extended by
five Muscles.
1. Membranosus.

The Leg hath three motions allowed it, *viz.* bended, extended, and moved obliquely outwards. All the *Extenders* are placed on the fore-part of the Thigh, of which the first is called *Membranosus*. This Muscle is by *Bartholin* called the *Abductor*, as if its use were to move the Leg obliquely outwards; but that office is by other Anatomists since him ascribed to the *Popliteus*, and this said to extend the Leg. It ariseth fleshy from the upper part of *Os ileum* on the outside, and near the great Process of the Thigh-bone it becomes broad and nervously membranous, wherefore it is called *Fascia lata*, the broad Swadling-band, for it enwrappeth almost all the Muscles of the Thigh within it self; and being come as low as the Knee in Humane Bodies, and that Joint we call the Stifle in Horses, (which exactly answers to the other, even as far as to the little round Bone between the two Bones of the *Femur* and *Tibia*, called the *Patella* or Knee-pan) I say when it is come as low as the Stifle (over which it crosses) it is at last inserted into the *fore-side* of the *Tibia* or Bone of the Leg. Its use is, as hath been said, to extend the Leg directly; or as some Authours will have it, somewhat to abduce it or draw it obliquely outwards.

2. Longus.

The *second Extender* is called *Longus*, and *Sartorius* or *Sutorius*, from its use in those Men that sit cross-legg'd at work, as *Shoemakers* and *Tailors*. It ariseth sharp and nervous from the upper and fore-part of the appendix of *Os ileum*, and as it passes obliquely down the inside of the Thigh, it becomes more fleshy and broad, continuing so till it come to the inside of the Leg a little below the Stifle, where it ends in a broad Tendon, and is inserted into the Bone of the Leg or *Tibia*. The use of this Muscle

Muscle is not onely to extend the Leg, but also to draw it inwards, wherefore it is by some Authours reckoned for one of the *Benders* of the Leg.

The *third*, from its *streight* course, is called *Rectus*, the Streight Mus^{3.} *Rectus* cle. This takes its beginning from the lower brim of the Haunch-bone, and passing with a fleshy and round belly streight down the fore-side of the Thigh untill it come to the Stifle, it there turns into a strong and broad Tendon, which adhering to the *Patella* descends over it, and is implanted into the fore-side of the upper part of the Shank.

The *fourth* is called *Vastus externus*, because of its great fleshy bulk,^{4.} *Vastus externus*. and because it descends on the *outside* of the Streight Muscle. It arises broad and nervous from the root of the great *Rotator* or *Trochanter*, cleaving close to the outward part of the Thigh-bone all along its course, untill it come to the Stifle, where it becomes membranous and broad, and uniting with the Tendon of the Streight Muscle or *Rectus*, is inserted into the same place with it, but on its outside.

The *fifth* is called *Vastus internus*, running on the *inside* of the *Rectus*.^{5.} *Vastus internus*. It arises from the root of the lesser *Trochanter* and from the neck of the Thigh-bone with a nervous beginning, and afterwards growing fleshy descends down the Thigh-bone, sticking close to it, till it come to the Stifle, over which it passeth, and afterward unites its self with the former two, and takes its insertion in the same place of the *Tibia* as they do.

It is worth the Dissectour's taking notice of these three last Muscles, how they be joined all in one just at their crossing the Stifle, where they make one broad and very strong Tendon, which spreads over and involves the *Patella* or little Bone of the Stifle, and ties it so fast in its place upon the jointing of the Thigh-bone with the *Tibia*, that it is very seldom displaced, or indeed never. For although by distentions or strains we often have this Part affected; yet never did I see an absolute dislocation in it. The *Patella* indeed may be (and often is) wrenched either to one side or the other as the accident may happen, but it is immediately reduced to its place again by this compound ligamentous Tendon, which like a *Spring* retracts it self into its former Station, and the Bone to which it is knit, also. So that, that malady which is commonly taken for a dislocation of this Bone, seems rather to be from Blood extravasated out of the Capillary Vessels, which by great distentions many times may be broken; which Blood lieth congealing and putrifying in the spaces between the Membranes and Muscles, affecting the sensible neighbouring Parts, which puts the Horse to that great pain we observe him to have on such accidents. Now the means we use to remove this pain is by chafing the Part with penetrating Oils, which commonly effect the cure, if they be used presently before the Blood be too much congealed: But if the pain be not removed by this means, we are fain to open the Skin by way of an Issue, blowing in wind to separate the several Skins one from another, and so make way for the congealed Matter the better to come forth; which done, the pain is removed, and the affection quite taken away, and the Horse most times goes again as well as ever. Whereas should this Bone be displac'd, as it is by many Farriers thought to be, this way of proceeding seems so far from contributing to the cure, that by laying the Skins open there is rather given more liberty for the Bone to remove out of its place, than any assistance afforded toward the restoring it again. But

ſo much by way of digreſſion to inform our Profeſſours in this point; I ſhall now proceed to deſcribe the remaining Muſcles, the next of which are the *Benders* of the Leg.

Four Muſcles bend the Leg.
1. *Biceps.* Theſe are in number four; the firſt of which (according to *Bartholin*) is called *Biceps*, though by other Authours it is reckoned the laſt and fifth, ſuppoſing that there are five of theſe Muſcles. It ariſes ſharp and nervous from the appendix of the *Coxendix*, and being carried on the outside of the Thigh, it doth about its middle become fleſhy, as if it begun there with a ſecond head; from whence deſcending it groweth in its courſe more thick and outwardly nervous, untill it becomes a ſtrong Tendon, which is inſerted into the outer ſide, (but ſomewhat backward) of the appendix of the *Tibia*. The *uſe* of this Muſcle is to bend the Leg by pulling it backward.

2. *Semimembranoſus.* The *next*, according to the before-named *Bartholin*, is the *Semimembranoſus*, which by others is reputed the fourth Bender. It takes its beginning from the knob of the *Coxendix* as the former doth, with a ſmall, membranous head, from whence it runneth down the back-part of the Thigh, till it come to the Leg-bone, into which it is inſerted with a round Tendon behind, in that place which in Man is called the Ham.

3. *Seminervofus.* The *third* (according to the ſame Authour) is the *Seminervofus*, ſo called from its ſubſtance, it being partly nervous and partly fleſhy, as the former was partly fleſhy and partly membranous. This ariſes ſmall and nervous from the ſame knob of the *Coxendix* as the former two did; from whence deſcending obliquely by the back and inner part of the Thigh (in which courſe it becomes fleſhy) its Tendon reaches towards the middle of the Leg-bone, into whoſe inner and backer part it is inſerted.

4. *Gracilis.* The *fourth* is called *Gracilis*, the ſlender Muſcle. This by ſome Authours is accounted for the *ſecond* Bender of the Leg, but I ſhall after the method of the before-named Authour rank it for the fourth and laſt. It ariſes with a large and nervous beginning from the middle of the Share-bone juſt at its jointing, from whence it runs down the inſide of the Thigh untill it comes to the *Tibia* or Leg-bone, into whoſe inſide it is inſerted with a round Tendon near the former.

Note, that ſome of theſe Muſcles being placed more outward and others more inward; if they all work together, they draw the Leg directly backward; but if one be contracted alone, then it doth bend the Leg a little either to this or that ſide, according as the Muſcle is placed, as well as draw it backward.

One moves it obliquely, viz. Poplitæus. There is another Muſcle whoſe uſe is to move the Leg *obliquely*; its name is *Poplitæus*. It takes its riſe broad and nervous from the outer head of the Thigh-bone, and afterward becoming fleſhy runs with a ſlanting line down the Thigh to the back and inward part of the upper knob of the *Tibia*, where it is inſerted.

C H A P. XXII.

Of the Muscles that move the lower part of the Leg, and the Foot.

BY the *lower part* of the Leg is to be understood that Bone which is below the Hock or Hough, reaching from thence to the great Pastern; which Bone answers to those five in Humane Bodies that make the Instep. Likewise the great Pastern and little Pastern answer to the first and second Joints of the Toes in Men; and lastly that which is called the Coffin-joint on which the Hoof grows, is answerable to the last joint of the Toes on which the Nails are placed. Onely the difference is, that a Man because of his going upright, treadeth upon the whole space from the Heel to the Toes; and his Foot is also divided into five Toes, each consisting of several Joints, that by spreading themselves and grasping closely on what he treads upon, they may keep him the more firmly erect. Whereas a Horse and other four-footed Beasts having four Feet upon the ground, have no need of so broad nor large a Foot, and do therefore go as it were upon Tip-toes, their Heels reaching as high up the Leg as to the Hock, which indeed is the Heel of the Horse, as a very eminent and learned Physician who did me the honour to take a view of my Skeleton, intimated to me. For make but any Quadruped, as a Dog or the like, stand upright, lifting up his Fore-feet, and you may observe all that part of his *Leg* from the Hough downwards to lie upon the ground as a Man's Foot does; yea some, as Coneys, &c. in their ordinary gate tread upon all that space: onely such Creatures have their Feet cleft into Toes, whereas a Horse is whole-footed, and thence arises a difference as to the number of the Muscles of the Foot.

Note, that the Muscles which move each Bone have onely their *Insertions* into that Bone they are to move, and that they take their *rise* from the Bone or some other Part (immediately or mediately) above it, as may be observed by the foregoing discourse of the Muscles of the Thigh and Leg. Thus those Muscles that move the Thigh, take their original from either the Hip-bone, Share-bone, or *Os sacrum*, all of which are above it; likewise those that move the Leg, arise from the Hip or Share-bones, or else from the Head or some other part of the Thigh-bone which is the Joint above it; and thus lastly do the Muscles that are to move all that part of the Leg or Foot which is below the Hock, spring from and lie upon the Parts above the Hock, save the *Flexor brevis* and *Tensor brevis*, and the *Plantaris* which is at the Sole of the Foot (which cannot properly be called a Muscle neither, for it is very little or not at all carnosus, but rather ligamentous) for otherwise onely the Tendons of the Muscles reach hither, and are inserted some into one Joint, some into another.

The *Foot* is bended, extended, and moved (a little) to either side, according to the motion of the *Instep-bone* (for so we shall call it for distinction sake.) First, it is *bended* when it is drawn upwards and forward. To perform which motion there are two Muscles assisting: the first of which is called *Tibiaeus anticus* or the forward Leg-muscle, so

The Instep-bone is bended by two Muscles.

1. *Tibiaeus anticus.*

named

named from the situation of it, which is upon the fore-part of the Leg-bone towards its outer side. It arises sharp and fleshy from the upper appendix of the Leg-bone, cleaving close to it all along as it descends, and towards the bottom of it, it turneth by degrees to a Tendon, which passing under the Gristle that compasseth about the next Joint or Hock, is divided into two or more Tendons that are inserted into the fore-side of the Instep-bone, which (together with the rest of the Foot) it moves forward and upward.

2. *Peronæus anticus.*

The next is called *Peronæus anticus*, because it arises in Man from that Bone of the Leg that is called *Perone* or *Fibula*, and therefore it is improperly so called in an Horse that wants that Bone, and in whom it springs from the upper appendix of the *Tibia*, and descending downwards with a fleshy body till it come almost to the bottom of this Bone, it turneth into a Tendon as the former did, which Tendon passeth down by the outside of the Hock, and is inserted into the outside of the Instep-bone, which with the rest of the Foot it moves forward and somewhat outward.

It is extended by three.

1. *Gastrocnemius externus.*

The Foot is also *Extended*, that is, when the Instep-bone is drawn backwards, which motion is performed by three Muscles: of which the first is called *Gemellus externus*, or *Gastrocnemius externus*. This in Men makes the greatest part of the Calf of the Leg. It takes its rise broad and fleshy from the inner head of the Thigh-bone at the lower end of it, and also from the outward head of the same Bone, for it hath a double beginning; which two heads descending for a while apart, they begin to be united into one about the middle of the Leg-bone, after which they both turn into one entire, broad, strong and nervous Tendon, which unites with the Tendon of the following Muscle called *Gastrocnemius internus*, and both are inserted into the Heel-bone.

2. *Gastrocnemius internus.*

The *second Extender* of the Foot is called *Gastrocnemius internus*. This Muscle lieth something under the former, arising from the hinder-part of the upper end of the Leg-bone with a strong, nervous beginning, and growing tendinous toward the lower end of the Bone unites with the Tendon of the foregoing, and is inserted into the Heel-bone with it as aforesaid.

3. *Plantaris.*

The *third* and last is called *Plantaris*, or the Muscle of the Soal or Tread. This arises fleshy, round and slender between the former two, taking its beginning from the back-part of the lower head of the Thigh-bone. After it hath descended a little way down the Leg-bone it becomes a slender round Tendon, which running between the Tendons of the former two and joining very closely with them descends down to the Heel-bone, where it leaves them and proceeds along the back-part of the Instep-bone and the two Pasterns, and terminates within the Foot, spreading all about the bottom of it, making that Part which is called the Soal of the Foot in Men, and in Horses that Part that lieth next under the Soal, and is plain to be seen when we have drawn the Soal of the Foot out.

The Tendons of these three Muscles make the magna Chorda.

It is the Tendons of these three Muscles that make that strong and thick Tendon by which Butchers hang up their Meat, which by reason of its greatness and singular strength is called *Chorda magna*. It is also this Tendon running down the back-part of the Leg, which we call the back Sinew, which being affected either by a strain or bruise or other accident, causes so great a pain, by reason of the sensibleness of the Tendon. When it is hurt, the Horse many times falls exceeding lame, though such acci-

accidents are not so dangerous to life in Horses as they are said to be in Men; for we make no difficulty in curing them, especially if presently taken in hand, but Chirurgeons do most times conclude Wounds of this Part in Men to be very dangerous by reason of their frequent falling into convulsions thereupon.

The Foot is also moved somewhat sideways, viz. inward and outward, It is moved sideways by two. by two Muscles. The *first* of which is called *Tibialis posticus*. This springeth from the upper end of the Leg-bone, from whence it descends among the before-named hinder Muscles till it come to the Instep-joint, where it becomes tendinous, and from thence runs down the inner side of the Instep-bone and Pasterns, till it come to the Soal of the Foot, into which it is inserted. Its *use* is to move the Foot obliquely inward. 1. Tibialis posticus.

The *second* is called *Peronæus posticus* (improperly in an Horse.) It arises from the upper and hinder-part of the Leg-bone by a nervous and strong beginning, from whence it descends all along the outside of the Bone cleaving firmly to it, untill it reach its middle, where it becomes tendinous, and descends with the Tendon of the *Peronæus anticus* on the outside of the Instep-joint or Hock, but is not joined with it; for it continues its course further untill it reach the Foot, into the bottom of which it is implanted. This moves the Foot contrary to the former, viz. obliquely outward. 2. Peronæus posticus.

The Pasterns and Coffin-joint are likewise *bended*, or *extended* by their proper Muscles. The *Benders* are two, of which the *first* is called *Flexor longus*, or the Long Bender. This arises from the upper and hinder-part of the Leg-bone, about the middle whereof it becometh tendinous, and descends on the inner side of the Hough down the Instep-bone and Pasterns into the Coffin-joint. The Pasterns and Coffin-joint are bended by two Muscles. 1. Flexor longus.

The *second* is called *Flexor brevis*, the Short Bender. It springs from the inside of the Heel-bone a little below the Hock, and has the same insertion with the former. These bend the Pasterns and Coffin-joint by drawing them backward. 2. Flexor brevis.

The *Extenders* are also two. The *first* is called *Longus Tensor*, or the Long Extender. It arises from the fore and inner side of the Shank just under the Stifle, and descends on the fore-side of that Bone, the Instep-bone and the Pasterns, and is inserted into the fore and upper part of the Coffin-joint. They are extended also by two. 1. Extensor longus.

The *second* ariseth from the fore-part of the annular Ligament that binds about the Instep-joint, and descending under the former has the same insertion. These two extend the Pasterns and Coffin-joint by drawing them forward. 2. Extensor brevis.

Thus I am come to the end of the Treatise of the Muscles, in describing of any of which if I have erred, I hope the Apology with which I prefaced this fourth Book will obtain my excuse with all ingenuous Men: and as for the morose and carping, I shall take it as a favour from them, if instead of railing at random, they will take the pains to demonstrate my mistakes.

Table XXXIV.

Represents an Horse with his hinder-part toward you, that the Muscles of his Buttocks, &c. may be the plainer seen.

AA Shew the Cucullaris or Monk's Hood.
B The edge of the Deltoides of the Thigh.

C The

- C** *The Glutæus minor or lesser Buttock Muscle.*
DDD *The Glutæus medius or middle Buttock Muscle.*
EE *The Glutæus major or greater Buttock Muscle.*
F *The Biceps.*
GG *The Seminervofus of both Legs.*
HHH *The Lividus or Pectinalis of both Hind-legs.*
I *The Semimembranofus.*
K *The Orbicularis or orbicular Muscle of the Lips.*
L *A portion of the Longiffimus dorsi.*
M *The circular Muscle of the Nose.*
N *The fphincter Muscle of the Fundament.*
O *The Maftoides on the other fide the Neck.*
P *The Mufculus lateralis or Manforius, being one of the Mufcles of the Cheeks.*
Q *The Mufculus scalenus or Triangularis.*
R *The Complexus or Trigemini.*
S *The Transverfalis Colli or tranfverfe Muscle of the Neck.*
T *The Spinatus Colli being one of the Extenders of the Neck.*
V *Vaftus externus.*
WW *Gaftrocnemius externus.*
X *Peronæus anticus.*
Y *Peronæus pofticus.*

The End of the Fourth Book.

T H E

THE
ANATOMY
OF AN
HORSE.

BOOK V.

Of the Bones.

CHAP. I.

Of the nature, definition, differences and parts of Bones.

THE *Bones* are by a learned and ancient Philosopher compared to the Carkase of a Ship, to which the rest of the Parts are fastned and whereupon they are sustained. These afford stability, streightness and form to each Part and to the whole. The knowledge of them is most necessary; for without it we must needs be ignorant of the originals and insertions of the Muscles; and upon fractures or dislocations of them, it were very unlikely that any should set them right again without the knowledge of their shapes, and the manner of their jointing one with another.

A *Bone* is said to be a *similar Part, the driest and coldest of all the* The definition
rest, made of the most earthy and tartareous part of the Seed in the of a Bone.
Womb, (i. e. of the Humour in the Ovum or Conception) and is nourished with the like particles of Bloud after the birth, and moistned with the Marrow contained in it.

The material
and efficient
causes of a
Bone.

In which description the word [*Seed*] is to be interpreted as we have intimated, and not of the Male and Female's Seed mixed together in the Womb, as the Ancients conceived; for it is certain that the Female hath no true Seed, and that the Male's being onely an active principle of generation, affords nothing of matter to the Parts of the *Fætus*, but onely impregnates the *Ovum*, as shall be shewed more at large when I come to speak to the *Generation of Animals*. Thus the Male's Seed is no material cause at all of the Bones, but onely a *remote* efficient cause of them as it is of other Parts of the Body; of all which the plastick or formative power that is seated in the *Ovum* it self, is the *immediate* efficient.

Their differ-
ences.

As to the *differences* of Bones, they are many, as being divided or distinguished several ways. And first from their hardness, or softness: thus the lower parts of the Temple-bones are called *Petrosa*, stony Bones, and such are also the Bones of the Teeth. Others are in respect to these, soft; such are the spongy Bones of the Nose, and those which are called *appendices* to any Bone. And lastly of a mean substance between these may be reckoned all the rest of the Bones.

They are again divided or distinguished by their magnitude; thus some are esteemed great, some little, and some of a moderate size betwixt both.

Also they are divided by their figure; some being plain, some round; some have three sides, others four; some are like a Boat, some a Cup; some like a Hammer, an Anvil, or a Stirrop, such are the Auditory Bones.

They are also distinguished from their situation, connexion, cavity, sense, and upon several other considerations, which it would be tedious further to prosecute.

Their Parts.

Again, the Bones are many of them divided into three *parts*; first, that part whereof the body of the Bone consisteth; secondly, the part that groweth to the Bone; thirdly, the bunching part of the Bone: of which the first hath no proper name belonging to it, but is called by the name of the whole Bone; the second being that part that groweth to the Bone is properly called *Epiphysis*, the Appendage; and that part that bunches out beyond the plain surface, is called *Apophysis*, or the Process.

How many
Bones of the
Head.

In relation to this discourse of the Bones we shall divide the Body into three Parts, *viz.* the Head, the Trunk and the Limbs. By the *Head* is implied both Head and Neck. The first and uppermost Part of the Head is the Skull, called *Cranium*, because it is as it were *Cranos* an Helmet to the Brain. It is compounded of several Bones to the number of fifteen or seventeen in Humane Bodies, say most Anatomists, that is, in all, as well little as big; for of the large ones there are but nine, three of which are common to the Skull with the upper Jaw-bone, which are the Wedge-like Bone or *cuneiforme*, the Yoke-bone, and *spongiosum*, the spongy or Sieve-like Bone. The other six are proper Bones and make up the Skull it self; and those are the Fore-head Bone, the Noll-bone, the two Bones of the *Synciput*, and the two Temple-bones, in which last are contained (in each of them) three small Bones, of which we have already treated where we spoke of the Parts of the Ear in the third Book at Chap. 14. namely the Hammer, the Anvil and the Stirrup, all which make up the said number of fifteen Bones of the Skull; to which if we add the lately found-out Bone of the Ear, called the orbicular Bone, there will be seventeen. Now the larger Bones are divided or distinguished by
several

several Seams called Sutures, and both Bones and Sutures are of the same number in this Animal we are treating of as in Men, as may be seen by the following Figure.

Table XXXV.

Represents the Sutures or Seams of the Skull of a young Foal newly foaled, which in a grown Horse are not so discernible.

Figure I.

Shews the Sutures of the top and sides of the Skull.

- AAA** The first Suture called *Coronalis*, or the *Coronal Suture*.
BB The second proper Suture called the *Lambdoidal* or *Lambdoides*.
CCC The third proper and true Suture called the *Sagittal* or *Sagittalis*.
DD The first counterfeit proper Suture, so called because it is not *Saw-like* as the other three are; it is also called *Squamosa*.
EE The first common Suture by which the lower Process of *Os frontis* is joined with the first Bone of the upper Jaw.
F The second common Suture by which the *Wedge-like Bone* is joined with the said first Bone of the upper Jaw. This is called *Cuneiformis*.
G The third common Suture called *Cribrosa*, which is common to the *Wedge-like Bone* and the *septum of the Nose*.
H The common Suture that divides the *Os jugale* into two, or by which it is joined together.

Figure II.

Shews the Sutures of the bottom of the Skull.

- AA** The common Suture that joins the bottom of *Os occipitis* to the *Os sphenoides*.
BBBB Some other Sutures that belong to the bottom of the Skull.

C H A P. II.

Of the Sutures or Seams of the Head.

A Suture
what, and of
how many
kinds.

A Suture is the connexion of one Bone of the Head to another, of which there are two sorts: the one is plain and linear, like two boards glewed or stones cemented together; the other indented like the teeth of two Saws put tooth within tooth.

The Sutures
are proper or
common.
The proper
are true or
false.

Of these Sutures some are *proper* to the Skull alone, and some are *common* to it with the upper Jaw. The *proper* Sutures are again double, that is to say, *true* or *false*. Of the former sort are those Saw-like ones before-named, which are three in number, *viz.* Coronal, Lambdoidal and Sagittal; and of the latter are the plain ones, which some reckon to be more, some fewer.

True Sutures
are
1. The Coro-
nal.

The *first* of the Saw-like ones is called in Humane Skulls *Coronalis* or the Crown-Suture, because the Ancients were wont to wear their Crowns or Garlands in that place. This Suture, as in Men, so likewise in a Horse runs overthwart the Skull above the Fore-head, reaching from the Temple-bone of one side to the Temple-bone on the other, joining the *Os frontis* or Fore-head-bone to the *Synciput* or Bone of the fore-part of the Head.

2. The Lamb-
doidal.

The *second* is called *Lambdoides* or Lambdoidal Suture, as resembling in its dimension the Greek letter Λ *lambda*. This is seated on the back-part of the Head, being opposite to the former, beginning at the bottom of the *Occiput*, from whence it ascends obliquely to either Ear in Men, but in a Horse something above the Ear, running with a more slanting line. It joins the Bone of the *Occiput* to the Bones of the *Synciput* and Temples.

3. The Sa-
gittal.

The *third* runs not overthwart the Head as the two former, but lengthways of it, reaching in Humane Skulls from the top or middle of the Lambdoidal to the middle of the Coronal Suture onely; but in Horses it reaches further (as it does in Children) crossing the Coronal Suture, and runs afterward down the Fore-head-bone to the Nose. This is not so Saw-like in Horses Skulls as the other two are, as may be seen by the foregoing Figure. It is the last of the true or Saw-like Sutures, and hath the name of Sagittal, from its streightness, its course being streight like an *Arrow*.

The false Su-
tures are
two.

Next come we to the *false*, counterfeit or bastard proper Sutures, which are those that resemble a Line onely, and are not Saw-like at all. These are in number two; the first of which passeth from the Root of the *Processus mammillaris* upwards with a circular Duct, and passeth downwards again towards the bottom of the Ear, after it hath compassed in the Temple-bone. By this Seam are the Bones of the *Synciput*, *Occiput* and *Sphenoides* joined with the Temple-bones.

The second of the bastard proper Sutures runs obliquely downwards, arising from the side or rather top of the former, and runs down toward the Socket of the Eye, to the beginning of the first common Suture.

The

The *common* Sutures are those that belong not to the Skull alone, but The common Sutures are are common to it with the Wedge-like Bone and the upper Jaw. Of which these that follow are the most remarkable.

First, the *Frontalis*, by which the outer Process of the Fore-head-bone 1. Frontalis. is joined with the first Bone of the upper Jaw.

The *second* is that which is called *Cuneiformis* or Wedge-like, by 2. Cuneiformis. which the Wedge-like-bone is joined with the first Bone of the upper

Jaw.

The *third* is called *Cribrifosa*, which is common to the Wedge-like- 3. Cribrifosa. bone, and the *septum* or partition of the Nose.

Now the *uses* of these Sutures or Seams are, first, to be vents of the The use of the Sutures. Brain, through which the impure and footy excrements might exhale or evaporate; secondly, to help to stay the Brain from tottering, and its parts from being misplaced in violent motions, by giving way to the Fibres that pass through them from the *Dura mater* within, to the *Pericranium* without the Skull, by which Fibres the said *dura mater* and also the Brain it self (which is wrapt within it) is kept suspended as it were, that so the hardness of the Skull might not offend it by pressing against it, nor the Brains own weight bear too hard upon the bottom of the Skull, which it would be apt to do were it not for its being thus born up or suspended by these Fibres that tie the *Dura mater* to the outside of the Skull.

These Sutures were also made for the ingress and egress of the Vessels, for the life and nourishment of the Parts contained within the Skull.

Lastly, that if at any time the Head should happen to be broken, the fracture might not run through the whole Skull, but stay at the end of the fractured Bone; whereas were it not for these Seams, it would like an earthen Pot with one knock or fall be in danger of being shivered all in pieces, which it is not now so apt to do, for the crack will not so easily pass over a Seam as it would run along an intire bone.

CHAP. III.

Of the proper Bones of the Skull.

THE Bones of the Skull are of two sorts, *proper* and *common*. Of The Bones of the Skull are proper or common. the first in this Chapter; and of the latter in the next.

The *proper* are in number six; one of the Fore-head, another of the hinder-part of the Head or *Occiput*, two of the Crown, and two of the Temples, all which are divided or distinguished from one another by the before-named Sutures. The proper are six.

The Fore-head-bone, called *Os frontis*, is seated before, and maketh the fore-part of the Skull, both above and a little below the Orbit of the Eyes. It is bounded before by the Coronal and first common Suture, on the sides by the Temporal Bones, and on the inside by the spongy Bones. 1. The Fore-head-bone.

Betwixt

Its Cavities. Betwixt the *Laminae* or Scales of this Bone at the top of the Nose there is a large (or rather double) *Cavity*, from whence two holes pass to the Nostrils, distinguished by many bony Fibres and small Scales, which are encompassed with a green Membrane, and contain a soft medullar, or as it were an oylie body.

The *uses* ascribed to these Cavities are various: as first, to prepare the air that is drawn in by the Nostrils, for the generation of animal Spirits; secondly, to keep for some time the odoriferous air whereby smells may be more leisurely perceived; thirdly, some think that they serve for the collection of flegmatick Excrements; and others, lastly, that they assist or promote the shrillness or echo of the Voice. I will not determine of the truth of any of these opinions; but shall onely observe this further, that these Cavities are much larger in an Horse than they are in a Man, even the difference of the bulk of their Bodies considered.

Besides these Cavities there is also a Den or *Sinus* made of a double Scale; one of which being outermost maketh the upper (inward) part of the Orbit of the Eye, and is plain; the other maketh the Cavity above the Eyes on either side, and is not plain, but hath inscriptions answerable to the winding convolutions of the Brain, whose bunching-out portions it receives.

Its Holes. This Fore-head-bone hath also two *Holes* in the middle part of the Eye-brow, which go to the Orbit of the Eye, by which the first branch of the Nerve of the fifth conjugation of the Brain goeth to the Muscle of the Fore-head.

Its Processes. It hath also four *Processes*, two of which are seated at the greater corner of the Eye, and other two at its lesser, all helping to make the upper part of the Orbit.

The Bones of the Synciput. Their connexion. Next come we to the Bones of the *Synciput* or fore-part of the Head, which are in number two, being joined before with the Bone of the Fore-head by the Coronal Suture, with the *Os occipitis* behind, by the Lambdoidal Suture, on each side to the Temple-bones by the scaly Sutures, and to the Wedge-like-bone by one of the common Sutures. They are also joyned together, or one to another, in the middle or top of the Head (lengthways) by a Suture common to them both, called the Sagittal Suture.

Their shape, substance, surface and holes. Their *figure* is almost four-square; their *substance* thinner than that of the other Bones, yet consist of two plates, save in their lower edges, where they are joined to the Temple-bones. On the outside they are smooth, but on the inside uneven, having several shallow Cavities or Dens by the sides of the Sagittal Suture, to which the *Dura mater* firmly grows; as also many long and winding inscriptions or furrows for the Vessels which run from the internal Jugulars through the said *Dura mater* to the Brain. They have likewise several perforations or little *holes*, some of which indeed penetrate but one Plate, which are for the entrance and exit of the Vessels that run between the Plates; but most run quite through them, and are made for small Veins and Arteries to pass both from within outwards, and from without inwards.

The Os occipitis. Next is the *Os occipitis*, or Noll-bone, which makes the hinder and lower part of the Head, and the middle part also of the basis of the Skull. It is of a very hard substance, harder than any Bone of the Skull besides, (except the *Os petrosum* of the Temple-bones) being thicker at the bottom where it is without flesh, and where the two *Sinus* of the *Dura mater*.

mater are joined. At the sides of the great perforation (through which the Spinal Marrow descends) it is somewhat thin and without any Cavities or small Dens in it; but that its thinness here might be no prejudice to it, from the edge of this perforation there ascends on the inside a large Process or Prominence running along to its top, to strengthen it and arm it against any accidents that might happen by blows, &c. This Prominence it is that distinguishes the two Protuberances of the *Cerebellum*.

This Bone is in shape five-corner'd, by two of which corners it is joined in its upper part to the Bones of the *Synsiphut* by the Lambdoidal Suture; by two other in its fore-sides to the Temple-bones by one of the counterfeit Sutures; and by its fifth corner to the *Os cuneiforme*, or Wedge-like Bone. *Its shape and connexion.*

It hath in it several *Sinus's* or Channels, of which some are on the inside, and others on the outside of it. Of those on the *inside* there are two which are pretty large, ordained for the receiving the protuberances or bunchings out of the *Cerebellum* or After-brain. The others on the inside are some to receive the protuberances of the Brain it self; others to receive the two *Sinus's* of the *Dura mater*, that they might not be compressed by the Bones of the Skull; and the rest are for the like uses. The two that are on the *outside* of this Bone, are in its lower part by the sides of the great perforation, of a semicircular shape. *Its Sinus.*

This Bone hath also several *Processes*, four of which being clad with a glib Gristle are received into so many *Sinus's* of the first *Vertebra* of the Neck. But that is the most considerable which I mentioned before, and serves to strengthen the Bone. It has *Holes* to the number of five; the first is in the midst of the bottom of the Noll, which is the largest of all the inward holes of the Head, being in shape round and somewhat long, through which the *Medulla oblongata* or Spinal Marrow passeth out of the Skull into the Cavity of the *Vertebrae* of the Neck. The other four are less by far, and are made for the transition of several Vessels. *Its Processes and Holes.*

The *Temple-bones* come next to be treated of, which are seated on the sides of the Skull and reach to the bottom of the Ears. They are joynd on their upper part to the outside of the Bones of the Crown by the Suture called *Squamosa*, or Scale-like. In their fore-part they are joined to the first Bone of the upper Jaw, by its first Process; and their hinder-part is joined to the *Os occipitis*, by one of the counterfeit Sutures. *The Temple-bones. Their connexion.*

The *figure* of the Temple-bone is in its upper part ample, equal and semicircular; but below, it is very shapeless, like to a rude, rugged and unequal Rock, from whence as also from its hardness it hath its name of *Petrosum*, or the Rocky-bone. *Their figure.*

The *substance* of this Bone is also full of variety; for at its bottom it is thick and rugged; but as it ascends, by degrees it grows much thinner, and at its top is so thin that it is almost transparent, (especially where it gives way to the Temporal Muscle) and like a Scale lies upon the lower edge of the Bone of the *Synsiphut*, which Bone in its descent under the Temple-bone is also attenuated. *Their substance.*

The Temple-bones have each of them two *Sinus* or Cavities. The *outer* of these is much larger than the other, being lined with a Cartilage or Gristle, seated betwixt the Auditory passage and the Process of the Yoke-bone. It is of an indifferent length, running as it were transversly or overthwart, and has the longer Process or the head of the lower Jaw inserted or articulated into it. The other Cavity is *inward* at the back-side *Their Sinus.*

side of the Process of the Yoke-bone, and is common to the Temple-bone with the Noll-bone.

By these *Sinus* or Cavities there stands a sharp and longish, and (in Horses) pretty thick (but in Men far more long and slender) Appendix, from its shape in Humane Bodies called *Os styloides*, the Pen-like Bone. Besides which there are also three *Processes*; two of which are external, and one internal.

Their Processes.

The *first external* is blunt, thick and short, (said to be somewhat hollow within) tending downwards, in shape something like to the Nipple of a Cow, from whence it is called *Mammillaris*.

The *second* of the *outward* Processes runs forward from the hole of the Ear to the Process of the first Bone of the upper Jaw, both of them framing the *Os jugale*, or Yoke-bone. For these two Processes, one of the Temple-bone and the other of the first Bone of the upper Jaw, being joined by an oblong Suture do make the fashion (as it were) of a Bridge, or of an Oxes Yoke, from whence that Bone hath its name, and of which we shall treat further in the next Chapter.

Os petrosum.
Its Holes,
and Cavities.

The *third* Process, which is *internal*, is that which is called the Rocky-bone. It is pretty long, jetting out to the inside of the bottom of the Skull, within which it hath two *holes*, through one of which an Artery, and through the other the Auditory Nerve pass to the inner Cavities of the Ear, which are three in number, namely the *Tympanum* or Drum, the *Labyrinthus* or Labyrinth, and the *Cochlea*, or Snail-shell. On the outside of the Skull this Process has three perforations or holes. The first and largest of which is called *meatus Auditorius*, or the hole of hearing. The second is narrow, short and oblique, near to the first, by the first hole of the Wedge-like Bone. Through this the Jugular Vein enters into the inner Cavities of the Skull. The third hole is seated betwixt the *Processus mammillaris* and the *Styloides* or Pen-like Appendix, ending into that passage that goes from the Ear to the Mouth. As to the little Bones that lie hid in the Cavities of this Process, by ancient Anatomists they were reckoned to be but three, but there is by modern Authors added a fourth; and they are commonly known by these following names, *viz. Incus, Malleus, Stapes*, and *Os orbiculare*, of all which I have already treated in the fourteenth Chapter of the Third Book, where they are also lively represented in Figures, to which place I refer the Reader for his further satisfaction; having not mentioned them in this place, but that they make up the number of the *proper* Bones of the Skull.

Table XXXVI.

Shews the severall Bones of the Skull both proper and common, together with the severall perforations for the outgate and ingate of the Vessels, as many as can be shewed in two Figures, one shewing the top and the other the bottom of the Skull.

Figure I.

Shews the uppermost Bones of the Skull, of the Nose, and of the upper Jaw.

- AA *The Bones of the Synciput or fore-part of the Head.*
 BB *The Temple-bones, on which the Temporal Muscles rest.*
 MM *The Os jugale.*
 OO *The common Suture that joins the Fore-head-bone and the Bones of the upper Jaw together.*
 DDD *The six Fore-teeth of the upper Jaw.*
 X *A hole a little above the upper Gumm, through which do pass the Palate-vein and Artery, which branch afterward about the upper Lip.*

Figure II.

Shews the hinder and lower Bones of the Head, with their perforations.

- AA *The Os occipitis or Noll-bone.*
 BB *The holes through which the sixth pair of Nerves (formerly so reckoned) do pass out of the Skull.*
 CC *The two holes through which the seventh conjugation of Nerves (of the same reckoning) do pass out of the Skull.*
 DD *The holes through which the tasting Nerves do pass, which are dispersed about the Tongue, the Muscles of the Os hyoides and several other parts within the Mouth.*
 EE *The holes by which the external Jugular Veins and Arteries pass into the Skull.*
 FF *A hole in the Process of the Wedge-like Bone called Pterygoides, seated at the bottom of the Skull.*
 HH *Two holes in the Bones of the Palate.*
 M *The hole of the Palate through which the Palate-vein and Artery pass out of the Mouth to the upper Lip.*
 OO *The holes through which do pass the Veins, Arteries and Nerves to the roots of all the Teeth.*
 PP *The holes through which the Optick Nerves do pass to the Orbit of the Eyes.*
 YY *The Six Fore-teeth or Shearing-teeth of the upper Jaw.*
 XX *The Tusshes, or Dog-teeth.*
 ÆÆ *The holes through which the fifth pair of Nerves do pass forth of the Skull.*

C H A P. IV.

Of the Bones common to the Skull and upper Jaw.

HAVING hitherto treated of the Bones *proper* to the Skull onely, I come now to treat of those which are *common* to it with the upper Jaw; and these are in number three, namely, the *Os sphenoides* or *cuneiforme*, the *Os cribriforme*, and the *Os jugale*.

The Wedge-like Bone.
Its situation.

The first of these is the *Sphenoides*, or Wedge-like Bone, so called from its situation, which is betwixt the Bones of the Skull and the upper Jaw, and not from the likeness of its figure to that of a Wedge, as some do believe. It is joined before to the Fore-head-bone, and behind to the *Os occipitis*. At the sides it doth a good part of it join to the *Os petrosum*. Above, it is joined to the first, fourth and sixth Bones of the upper Jaw; and below, to the Bones of the Palate of the Mouth.

Its Processes.

It hath several *Processes*, of which some are external, and some internal. The *internal* are four, standing out like four feet of a Table or Chair, which (taking in the space between them) form the *Sella Turcica*. The *external* are also four, of which the two *formost* are contiguous to the upper Jaw, and are called the Wing-like Processes, from the resemblance they have to Bats-wings; for they are thick in some places, and yet end into a notable thinness, almost as thin and sharp as the edge of a Knife. The two *hinder* are stretched out toward the *Styloides* Processes of the Temple-bones.

Its Cavities.

This Bone hath several *Cavities* or hollownesses; two of which are common with it and the Temple-bones, and the Bones of the *Synceput*.

Its Holes.

It hath also many perforations or little *Holes* to the number of seven on each side. One of which being round gives a passage to the Optick Nerve toward the Eye. The rest are penetrated some by one, some by several pairs of Nerves; others by the Carotid Arteries and Jugular Veins; and others again by both Nerves and Bloud-vessels.

The Sieve-like Bone.
Its situation and connexion.

The next common Bone of the Head and upper Jaw is the *Os cribriforme*, so called from the several or indeed innumerable little holes in it, which make it like a *Sieve*, through which holes the smells do pass to the Mammillary Processes, or Olfactory Nerves. It is situated in the fore-part of the Skull, between or a little below the Sockets of the Eyes, under the middle basis of the Fore-head-bone, and at the upper part of the Nostrils. It is joined by a plain or simple line to the Fore-head-bone, the second Bone of the upper Jaw, and to the *Os cuneiforme*.

Its Parts.

This Bone is by some divided into *four parts*; of which the *first* is a Process in the upper and middle part of it, which is long and triangular, ending in a sharp point, whence it is called *Crista galli*, or the Cock's Comb. This runs in betwixt the Mammillary Processes dividing them one from the other. To its sharp point the *Sinus* of the *Falx* adhereth.

The *second* part of this Bone is that which most properly is called *Os cribriforme*, being perforated all over like a Sieve, some of which holes are streight and some oblique. They are observed to be much larger in Dogs

Dogs than in any other Animal (allowing for the proportion of their Bodies) which is supposed the reason why their smell is more exquisite than that of any other Creature.

The *third* part is a Process in its lower or under side opposite to the upper Process; which part divideth the upper part of the Nose into two Nostrils, whence it is called *septum Nasi*, the Partition-bone of the Nose.

The *fourth* and last part of this Bone is compared to a Sponge or Pumice-stone, being porous and full of small cavities, which are filled with a spongie flesh; and from this part the whole Bone is by some called *Os spongiosum*. For the names of *cribriforme* and *spongiosum* are confounded one with the other, being either of them given indifferently to the whole Bone. But if we will consider the *spongiosum* onely as a part of the *cribriforme*, then we must say, that it is that part of it that is seated just at the top of the Nostrils. Some make two Bones of it, affixing one at the top of each Nostril, and call them in the plural number *Ossa spongiosa*.

The use ascribed to the *Os cribriforme* by most Anatomists hath been *its Use* to discharge through its pores or holes flegmatick excrements from the Brain into the Nose, but he that shall examine them, will find that its holes are so filled either with the spongie flesh before-named, or else with the Fibres of the smelling Nerves passing through them to the inside of the Nostrils, that there is no passage left for any humour by them. What we therefore account their true use to be, the Reader may be informed, if he please to turn back to the fifteenth Chapter of the Third Book, where we treated of the Nose, and described its uses: adding to what is there said of it, that it makes up the inner corner of the Orbit of the Eye.

The *third* and last Bone common to the Skull and upper Jaw is called *Os jugale*, or the Yoke-bone. This is seated on each side of the Horse's Face between the *meatus* of the Ear or Auditory passage, and the first Bone of the upper Jaw; being framed of two Bones, one of which is a Process of the Temple-bone that is carried from the *meatus Auditorius*, and is the hinder of them; and the other Bone being the foremore is a Process of the first Bone of the upper Jaw, and which maketh the lower side of the lesser or outer corner of the Eye. These two are joined by a slanting or oblique Suture, and being so joined do constitute this Bone called *Os jugale*. Over this Bone runs the Tendon of the Temporal-muscle, and also the Tendon of the *Masseter* or Chewing-muscle, as they pass to the lower Jaw.

Some make but two common Bones of the Skull and upper Jaw, not reckoning this for any particular Bone, seeing (as has been said) it is formed onely of the two Processes of the Temple and upper Jaw-bone. But seeing it is distinguished from the others by a particular name (though not of any peculiar substance) I thought it not absurd to reckon it for a *third* common Bone.

C H A P. V.

Of the Jaw-bones and their Parts.

THE Bones of the *upper* and *lower Jaws* come next to be spoken to, with the first of which we will begin.

The Bones of
the upper
Jaw.

This Jaw hath Bones of two sorts, the one proper to it self, and the other common to it and the Skull. The *common* Bones are the Wedge-like and Sieve-like Bones, and the *Os jugale*, of which we have already treated in the foregoing Chapter. I shall therefore proceed to treat of the Bones *proper* to the upper Jaw onely, which make the lower side of the Orbit of the Eye, the Nose, Cheeks and Roof of the Mouth.

1. Zygomaticum.

The Bones that constitute all these Parts are twelve in number, on each side of the Face six; the *first* of which is called *Zygomaticum*, because by its Process it makes up the greatest part of the *Os jugale*. This is seated at, and maketh, the lower part of the outer corner of the Eye.

2. Lachrymale.

The *next* is a round, little, brittle and thin Bone, seated in the inner corner of the Eye, called *Os lachrymale*, because it has a hole in it through which the serous humour that makes the tears in Men doth issue. Upon this hole the little Kernel called *caruncula Lachrymalis* resteth, that hindreth the continual gleeing of the foresaid humour. There is also in the lower part of this Bone another hole which goes to the cavity of the Nostril, through which doth pass a branch of the fifth pair of Nerves to the inner Skin of the Nose.

3. Innominatum.

The *third* is seated in the inner side of the Eye, and within is continued with the fungous Bones of the Nostrils. It is broad, and somewhat quadrangular or four-corner'd, also thin and transparent, like the Scale of a Fish. On its outside it is smooth, but within rugged and unequal, because of the Scales that cleave unto it. It is joined to four Bones, *viz.* to the Fore-head-bone, to the Wedge-like Bone, to the second Bone of the Jaw, (*viz.* the next foregoing) and also to the fourth, or next following. It is not known by any peculiar name; I have therefore made bold to call it *Os innominatum*.

4. Os malæ,
or Cheek-
bone.

Its connexion.

The *fourth* Bone is called *Os malæ*, the Cheek-bone, because it maketh up the greatest part of the *Cheek*, as also of the *Palate*. It likewise contains the upper Teeth in its cavities or caverns. It is much larger than any other Bone of the upper Jaw, and is circumscribed with many Sutures; for not to mention the Teeth that are inarticulated into it, it abuteth upon or is joined to several Bones. In the first place it is joined above, on the side next the Nose, to the Bone of the Fore-head; below, to the Wedge-like Bone, and the Bone of the *Palate* of the Mouth; before, to the *Os lachrymale*, and to the fifth Bone that makes the upper part of the Nose, (which is next to be described;) and lastly to its own companion, *viz.* the Cheek-bone of one side to that of the other.

Its Holes.

This Bone hath three perforations or *holes*, two of which are under the Orbit of the Eye; that is, on each side one, running from the lower part of the Eye outward. Their *use* is to transmit or let pass two branches of the fifth pair of Nerves out of the Orbit of the Eye to the Face, on the Parts whereof they are bestowed.

The

The *third* of these holes is in the Palate, at the backside of the Grinding-teeth where both Bones of the Jaw meet. It is presently divided into two, one of which runneth on one side of the *septum* of the Nose, and the other on the other, to the Nostrils, to which there pass through these holes a small Vein and a small Artery.

It hath also a den or cavity on each side, by the side of the Nose under the Orbit of the Eye, which is covered with a very fine Membrane. This is often full of a mucous or slimy phlegm.

The *fifth* Bone of the upper Jaw doth with his companion make the bony prominence of the Nose. It is a small Bone, in figure almost four-square. It is hard, solid, and reasonable thick, having sundry small perforations in it. It is joined above to the Fore-head-bone, *viz.* to its internal Process. In the sides above it is joined to the first Bone, and a little lower to the fourth Bone of this Jaw. In the middle it is joined to its companion, and below to the Gristles that make the lower part of the Nose. 5. The Nose-bone.
Its connexion.

The *sixth* is that which makes up the Roof of the Mouth, with its companion; for you must reckon every one of these Bones double, one on one side of the Face, and another on the other. It is a broad Bone, thin and solid, and in the end, where it is rough, it resembleth a semicircle. It is joined behind to the Wing-like Processes of the Wedge-like Bone, and on the inside, to the Partition-bone of the Nostrils. It is likewise joined to the fourth Bone of this Jaw or Cheek-bone, and lastly to his companion or fellow in its back-part. 6. The Palate-bone.

This Bone hath also two perforations, on either side one, running upward and backward to two of the holes of the Wedge-like Bone.

The *lower* Jaw comes next to be treated of, which makes the lower part of the capacity of the Mouth. This differs from the former in that it is moveable, whereas the upper is not. In shape it is long and prominent. At both the ends of it, there are two *Processes*, which are by some called *Horns*. The *foremost* of them runs upward, and from a broad basis grows sharp, ending into a cone or point. This point receives the Tendon of the Temporal Muscle, which Tendon compasseth it round about, and is strongly implanted into it: from whence it is that a luxation of the lower Jaw, because of the distention of this Tendon that happens thereupon, is very dangerous, and hard to cure.

The other being the *backward* Process, is called *Articularis*, because it serves for articulation. This hath a neck and a longish head, (called *Condylus*) that is covered with a Cartilage for its easier motion: By this head it is articulated into the *Sinus* of *Os petrosum*, that is also lined with a Cartilage, and is knit thereto strongly by a membranous Ligament. At the sides and roots of these Processes it hath shallow *Sinus's* or Cavities in its surface, but they are deeper on the inside than on the outside. The principal use of both seemeth to be for the passage or insertion of the Muscles.

This Bone of the lower Jaw is very hard, and for the most part very solid, to make it the stronger. Yet on each side (more backward than in Men) it hath a Cavity within it, which contains a marrowy juice for its nourishment. It hath also four perforations or holes, of which two are at the roots of the Processes, by which a branch of the fifth pair of Nerves, as also a Vein and Artery do pass to the Teeth. The two other holes Its Cavities and Holes.

holes are in its fore-part by the sides of the Chin, through which two twigs of the said fifth branch of Nerves do pass out again to the lower Lip, and its Muscles and Skin.

*The Sockets
of the Teeth.*

This lower Jaw as well as the upper hath Sockets for the Teeth to stand in, in number equall to the Teeth, which Sockets are called by the Latins *Alveoli* or little Pits. These are digged deep, that the Teeth like so many Nails might be the firmler fastned in them. When any of the Teeth fall out of them, (as the Foal-teeth, &c.) in a short time they are obliterated, the Jaw becoming smooth without any pit in it in that place.

Table XXXVII.

Represents an Horse's Head and Jaws as much of them as can be seen by the Head standing with one side towards us; and shews those Bones which could not so well be seen in the foregoing Table, where the Head is represented in one Figure with the top, and in the other, with the bottom of it towards us.

Figure I.

- A *The Temple-bone on which the Temporal Muscle is placed.*
- B *A hole in the Skull through which doth pass forth from the Brain a small Nerve, which is dispersed about the top of the Skull.*
- DD *The Bones which make the top of the Nose.*
- HH *The Os jugale.*
- F *The hole through which doth pass a branch of the Nerve of the fifth conjugation, which furnisheth the Muscles of the upper Lip and also the Muscles of the Nostrils with Nerves.*
- L *The round production of the upper Jaw, which production is called cervix.*
- M *The Auditory Passage or hole of the Ear.*
- N *The Mammillary Proceß of the Temple-bone.*
- OOO *The lower Jaw-bone.*
- P *The hole where the Nerve of the fifth pair comes forth, which Nerve furnisheth the Muscles of the lower Lips with twigs from it.*
- Q *The Production of the lower Jaw, which doth articulate into the upper.*
- K *The Noll-bone.*

Figure II.

Represents the Skull and upper Jaw onely, the lower Jaw being removed, the better to shew the several perforations in the side of the bottom of the Skull, which perforations or holes in the other Figure are hid by the articulation of the lower Jaw.

- A *The hole by which the Nerve passes from the Brain to the upper Jaw.*
- E *A hole whereby a small Nerve doth pass from the Brain, which is distributed upon the bottom of the Occiput, and other Parts at the bottom of the Skull.*

- F A hole by which a branch of the external Jugular Vein and Artery doth pass to the Brain.
- G A hole through which do pass the sixth pair of Nerves, according to Doctor Willis.
- H The hole through which the Optick Nerves do pass from the Brain to the Eyes.
- I A hole through which do pass another pair of Nerves, which branch into the Muscles of the Tongue, and also send twigs to the Muscles of the Ears.
- K The hole where the Palate-vein comes forth.
- M Another hole through which doth pass a small twig of the external Jugular Vein and Artery up to the Brain.
- O The Auditory Passage.
- Q A hole through which a small Nerve doth pass from the Brain to be distributed about the top of the Skull.
- S The hole where the Nerve of the fifth pair comes forth of the upper Jaw after it hath furnished the roots of the Grinding-teeth with Nerves, from whence it marches towards the lower Lip, where it is dispersed amongst the Muscles thereof.
- XX Two other holes in the bottom of the Skull through which do pass other conjugations of Nerves, which are dispersed about the Head, Face and Mouth.

C H A P. VI.

Of the Figure, Magnitude, Number and Articulation of the Teeth.

THE Teeth are called in Latin *Dentes, quasi Edentes*, from eating. The Teeth. Their substance and Vessels. They are of a very hard substance, yea, harder than any of the other Bones in the whole Body. That part of them that stands out above the Gumm, is smooth and free from any covering; but that part that is within the Sockets of the Jaws is more rough and covered with a thin Membrane or *Periosteum*, which Membrane is of exquisite sense. Those sort of them which we call the Grinding-teeth, have a manifest Cavity within, but the *Incisores* (or Fore-teeth) and Dog-teeth have but very obscure ones. Into these Cavities by the very small holes that are in the roots of the Teeth, are received (into each Tooth) a Capillary Artery from the *Carotides*, also a small Vein from the Jugulars, and a twig of a Nerve from the fifth pair; which Nerve being expanded through the thin Membrane that invests the said Cavity, gives it a most acute sense; whereas the bony part of the Tooth is of it self insensible. These Vessels before-mentioned, namely, the Vein, Artery and Nerve, are united together and cloathed with a common Coat when they enter the Jaw, within which they have a proper chanel to run along in under the roots of the Teeth, to each of which roots they send small twigs as they pass by, as afore said.

As

Three sorts of
them.

1. Incisores.

As in Men, so in Horses, there are three kinds of Teeth, namely, *Incisores*, *Canini* and *Molares*. The *Incisores*, Cutters or Shredders are those we call the Fore-teeth from their being seated in the fore-part of the Jaw. They are sharp-edged like a Knife, and broad also, that they may the better bite off or crop the Grass, &c. They are in number twelve, that is to say, in each Jaw six. They have each but one root or phang, though that root is indifferent large, most times larger than any one of the phangs of the great or Grinding-teeth.

2. Canini.

The next to these are those which in Horses we call the *Tushes*, but in Men they are called the Dog-teeth or *Canini*, not onely because in figure they are like the Teeth of a Dog, and stand out of the Gums as Dog's-teeth do; but from their use also, which is to gnaw upon and break (with their sharp points) what is too hard for the Fore-teeth to cut or shear in funder. The roots of these as of the former are single, having but one phang.

3. Molares.

Those of the third rank, are the double Teeth, which are called *Molares*, or Grinders, because the Meat is broken or ground by them, even as Corn is ground by the Mill-stone. These are in Horses twenty four in number, in each Jaw twelve. Their seat is in the inner part of the Mouth, being environed in their outside by the Cheeks, lest the broken or shredded Meat, being rowled by the Tongue upon the Teeth, should slip over them out of the Mouth, before it be sufficiently ground.

How to know
the age of an
Horse by his
Teeth.

The two foremost of these Teeth, standing next to the Dog-teeth or Tushes, are those by which the age of an Horse is known till after seven years old, and that by their unevenness at the top, having several little thin shells or scales as it were sticking up round the outside of the top of them, whereby their middle part is made to appear hollow; which hollowness where it is found, is a certain sign of the Horse's being under seven years of age. And it is also to be observed, that the nearer the Horse comes to that age, the more doth that hollowness grow out by degrees: so that when he comes to be full seven years old it is quite obliterated, and so the Horse's age to be no more known by that sign, being past the mark in the Mouth as we say: for by the perpetual use that the Horse makes of his Teeth, the before-mentioned Shells at the top of them, which cause their hollowness, are worn down even with the other parts of the Teeth, so that the whole top of the Tooth becomes even, smooth and plain.

Neither are the rest of the Grinding-teeth without some hollowness or at least roughness in their tops; but this is of a different nature from the other: which roughness or unevenness is very necessary, for by it they are made more fit for the comminution of the Meat: For as Millers when their Millstones are grown smooth, do pick them anew, to make them grind the better; so hath Nature made the upper part of these Grinding-teeth, elegantly to imitate the rough superficies of a Millstone, having here and there formed little pits in them. We shall not need to shew the uses of these, or of either the foregoing sorts of Teeth, that being intimated sufficiently in the description of them.

Table XXXVIII.

Shews the upper and lower Jaw separated from one another and placed sideways, with so much of each Jaw broken off as till one come to the roots of the Teeth, to shew how the Nerves branch into the ends of the roots of each Tooth.

Figure I.

AA The Shearers or Fore-teeth.

BB The two Productions of the lower Jaw which articulate into the upper Jaw.

CC The Proceß into which the Temporal Muscle is inserted.

D A hole through which doth pass a branch of the external Jugular Vein and Artery.

E A hole through which doth pass the Nerve that furnisheth the Teeth with twigs from it as it passeth along, (being a branch of the fifth pair) which trunk doth afterwards lose it self about the Lips, furnishing all the Muscles of the Lips and Nose with Nerves.

(Note that this Nerve in the upper Lip is that which Farriers do improperly (and by a mistake) call the Cord, which they many times take up with a Cornet and cut insunder to prevent a Horse from stumbling; believing that the said Cord reaches from the tip of the Nose where they cut it, down to the Fore-legs and so to the Feet, by which they imagine that the Horse's Head is so bound down, that he cannot have the freedom of it, which causes him to stumble. This fancy how ridiculous soever, is common amongst Farriers, and is owing merely to their ignorance of the Parts; for it reaches no farther than from the Brain to the Lips: so that the cutting of it is likelier to hinder the motion of the Lips than to remedy stumbling.)

R A little hole through which doth pass a Nerve from the Brain to the Pericranium.

T The same hole in the upper Jaw, as the letter E points to in the lower, through which the Nerve which they call the Cord, doth pass to the Lips.

S The Tusshes or Dog-teeth of the lower Jaw.

V The Auditory Passage or hole of the Ear.

Y One of the Tusshes of the upper Jaw.

1 2 3 4 5 6 The Grinding-teeth.

OOOO The Nerve that sends twigs to the roots of the Teeth of the lower Jaw, being the first branch of Doctour Willis his fifth pair.

CHAP.

C H A P. VII.

Of the Bone of the Tongue called *Os hyoides*.

Os hyoides.
Its figure and
parts.

THAT Bone which is called *Os hyoides*, is of the shape of a Greek υ (*ypsilon*) and is seated under (or at the root of) the Tongue, being as it were the foundation and supporter of it. It is compounded of three Bones, *viz.* one in the middle, (being larger than the other two) which is gibbous forwards (or outwards) and somewhat hollowed inwards; by its gibbous side it is joined to the basis or bottom of the Tongue: The other two Bones are lateral, and are called *Cornua*, or Horns. To the first Bone there are affixed two Gristles, and to each of these one. They are all tied to the adjacent parts, partly by a fleshy, partly by a nervous substance. It hath three *Sinus* or Cavities; above, a transverse depressed *Sinus*, to admit the second pair of Muscles proper to it; and in the sides of this *Sinus* there are two other, which give way unto the first pair of Muscles that are implanted into the sides of this Bone.

Its Use.

The *use* of this Bone (although it be but a little one) is very great; for most if not all the Muscles that move the Tongue either are inserted into it or arise from it. It serves also to keep the Throat open, admitting the *Epiglottis* or Throat-flap into its bosom, when it is lifted up in breathing. And lastly some of the Muscles of the *Larynx* or Throttle arise from it.

C H A P. VIII.

Of the Bones of the Neck.

HAVING treated of the Bones of the *Head*, we come in the next place to speak to those of the *Neck*, which, in dividing the Body into three Parts at the beginning of this Fifth Book, (*viz.* the Head, Trunk and Limbs) we considered as annexed to the Head. Its Bones are of two sorts, *viz.* the Collar or Chanel-bones, and the *Vertebrae*. But first of the *Collar-bones*.

The Collar-
bones, their
substance and
use.

These are in number two, one on each side. They are called *Claviculae*, either from their resembling the shape of old-fashioned Keys, which were of the shape of an Italick *s*; or because they lock up as it were and close the Chest; for by some they are accounted as belonging to it. Their substance is spongy and thick, especially about their heads; but in their middle they are thin and flat. By one end they are joined to the top of the Breast-bone, and by the other to the first Rack-bone of the Back, wherein they differ from those in Man, which are jointed into the

the Process of the Shoulder-bone. Their use is to uphold the Shoulder-blades, that they should not slide down upon the Breast together with the Shoulder-bone, which upon a dislocation or fracture of these Collar-bones doth often come to pass.

The number of the *Vertebræ* or Rack-bones of the Neck is seven, and they are reckoned from the Head downward; that next the Head being the first. They have in each of them a large Cavity as those of the Back and Loins have, to give way to the Spinal Marrow to descend by. Besides this large hole which is common to these with those others, they have also each of them two other smaller holes in their transverse Processes, through which the Cervical Veins and Arteries do pass to the Head. And betwixt their jointing one with another there is a third hole, or rather half of one, for one half is formed out of the lower side of the upper, and the other out of the upper side of the lower *Vertebra*: By these the Nerves pass out from the Spinal Marrow.

The Vertebra of the Neck, their number and holes.

The first of these Bones is called *Atlas*, because in Men the Head stands upon it like the Globe of the World, as the Poets feigned *Atlas* to bear the Celestial Globe upon his Shoulders. The body of this Bone is more slender, but solidier than the rest, and it wanteth its hinder Process or Spine, having onely a kind of a semicircular knob jetting out instead of it: the reason of which seems to be, lest the greater streight pair of Muscles of the Head that spring from the second *Vertebra* of the Neck, and march over the back-side of this, should be hurt in bending the Head forwards. But it has all its other Processes, viz. ascending, descending and transverse. Within on the fore-side of its great *Foramen*, it has a *Sinus*, in shape semicircular, which is lined with a Cartilage or Gristle, and which receiveth the Tooth-like Process of the second *Vertebra*.

The first described.

The second *Vertebra* is called *Dentata*, because out of its upper side, between its two ascending Processes, there springs an Appendix or Process, round and long, like the Dog-tooth in Man (or Tush in a Horse.) This Tooth is covered with a Cartilage, and is jointed into the foresaid *Sinus* of the first *Vertebra*, and upon it, as upon an Axle-tree, the head turns round, from whence the whole Bone is called by some *Axis*. That part of the Tooth which enters not into the said *Sinus* (viz. its basis) is encompassed with a Ligament, which knits it to the *Occiput*. This and the four following have Spines or hinder Processes, each of which are divided into two for the better connexion of the Ligaments and Muscles to them. We shall not need to describe particularly any more of them, seeing they are in all things like to the second, saving that their lateral Processes are larger, and divided into two as well as the hinder: yea the seventh it self differs not from the rest, though in Man it do.

The second, Sec. described.

The bodies of these *Vertebræ* of the Neck are longer than those of the Back or Loins; for though the Neck of an Horse be of so considerable length, yet as hath been said its *Vertebræ* are but seven (as they are in Man) whereas those of the Back and Loins are twenty four in all, which space notwithstanding is not so long again as the Neck is; whereas were the *Vertebræ* of a proportionable length, it should be more than three times the length.

Table XXXIX.

Represents the seven *Vertebræ* of the Neck all joined together in one Figure. They are placed so, as that the first Figure shews their sides, the second their back-parts, and the third their fore-parts.

Figure I.

- A** Shews a hole through which a branch of the internal *Jugular Vein* and *Carotid Artery* comes forth of the first *Vertebra*, having entred the same *Vertebra* at the hole marked with the letter **F**.
- B** A hole in the said *Vertebra* out of which doth pass the first *Nerve* from the *Spinal Marrow* without the *Skull*, which *Nerve* marches streight to the before said *Vein* and *Artery* and joins it self with them, and runs their course both up to the *Head* and down to the *Body*, there being an ascending and a descending branch of it for that purpose.
- CDE** The ends of the said *Vein*, *Artery* and *Nerve* where they were cut off with the seventh *Vertebra* from the *Trunk* of the *Body*.
- F** The hole in the first *Vertebra* by which the *Vein* and *Artery* entred the said *Bone*, and come out again at the letter **A**.
- P** The hole betwixt the first and second *Vertebra* through which doth pass the second pair of *Nerves* of the *Spinal Marrow*.
- HHQRST** The rest of the holes in the other six *Vertebræ*, through which the *Jugular Vein* and *Artery*, and the *Spinal Nerves* do pass in and out.
- 1. 2. 3. 4. 5. 6. 7.** The seven *Vertebræ* of the *Neck*.

Figure II. Shews the back-side, and Figure III. the fore-side of the said *Vertebræ*.

C H A P. IX.

Of the Vertebrae of the Back and Loins; and of the Ribs.

THE *Back* consisteth of seventeen *Vertebrae* or Rack-bones, just so many as there be Ribs on a side, for on each side of every Rack-bone is there a Rib articulated. But seeing, as we have said, the Collar-bone is inserted into the first *Vertebra* of the Back, it will so fall out that the last Rib will be articulated into that *Vertebra* which we reckon for the first of the Loins: into which the Rib indeed is so jointed, that it is not easy to say whether it be into the top of this, or into the lower end of the seventeenth of the Back. The *Bodies* of the Racks as well as their *Processes* do differ somewhat from the *Bodies* and *Processes* of the Racks of the Neck; for the *Bodies* of the Racks of the Neck are longer than these, and more flat on their inside, that the Gullet might rest the more securely on them: and as for their *Processes*, the hinder are not cleft into two as those of the Neck are, and the transverse ones are more short and blunt, having (instead of the holes that are in those of the Neck) each a shallow *Sinus*, into which the Ribs are partly articulated. But the *Processes* are in both of an equal number, namely four oblique ones, (that is, two tending obliquely upwards, and two obliquely downwards) two transverse or lateral ones, and one acute or hinder one, which is called the Spine.

The Back hath seventeen Vertebrae.

Their Bodies and Processes described.

The *Bodies* of these *Vertebrae* are not so solid as those of the Neck, but they are more bulky or thicker about, and are full of small perforations for the admission of the Bloud-vessels to the Spinal Marrow, and besides have two at each Joint for the egress of the Nerves from the Spinal Marrow. They have each of them on each side a *Sinus* or Cavity for the inarticulation of the head of the Rib, which *Sinus* those of the Neck want, as having no Bones to joint into them.

Note that the transverse *Processes* of two or three of the lowest of these Racks begin to grow shorter and shorter, and their Spines are more blunt, and stand evener out, declining not so much downwards as those before-going. As for the great Cavity or Perforation in the middle of the *Bodies*, it is proportionable to the Marrow which it contains.

Next to the Bones of the Neck we come to those of the *Loins*, which make the third part of the Spine. They are in number seven, and are bigger than any of the fore-going either of the Neck or Back. Their hinder *Processes* or Spines are shorter, but broader and thicker than those of the Back, somewhat bending upwards as most of those decline downwards; but as for the lateral or transverse *Processes*, they exceed those of the Back in length. These *Vertebrae* are joined one to another by a clammy Gristle, and likewise the uppermost of them to the last of the Back, and the lowest to the first of *Os sacrum* in like manner.

The Loins have seven. Their Bodies, Processes and connexion.

Besides their lateral Perforations betwixt their jointings for the transmission or letting forth of the Nerves, they have also several other little holes for the intromission of the Bloud-vessels. As for their middle Perforation, nothing need be said particularly of it, seeing it differs not from that

that of those of the Back, being of capacity equal to the thickness of the Marrow that it contains.

The Ribs are
seventeen.

The *Ribs* (in Latin *Costæ*) are in number thirty four, that is to say, on each side seventeen. Their substance is partly bony, and partly cartilaginous or gristly; the first serving for firmness, and the latter for articulation, that upon occasion they might yield a little without breaking. They are divided into two sorts, the one called *true*, and the other the *Bastard-ribs*. The *true* are the nine uppermost, so called because each with its fellow makes a compleat circle, being joined together by the mediation of the Spondyls of the Back behind, and the Breast-bone before. I say the Ribs are articulated into the Back-bones behind, something of a cartilaginous substance coming between: (the manner whereof is well exprest in the following Figure.) At this articulation into the *Vertebræ* each Rib has two knobs, one of which is received into the *Sinus* of the Body of the *Vertebra*, and the other which is less, into that of the transverse Process. And they are joined before to the Breast-bone by way of articulation also; for their Cartilages end into little heads which are received into the smooth *Sinus's* of the Breast-bone.

Nine true.

Eight ba-
stard.

The *Bastard-ribs* are the eight lower, being of a more soft and gristly substance than the other; because being articulated onely at one end, it was necessary they should be of a more yielding and pliable nature, otherwise they would have been very apt to break. Yea their yielding is not onely a security to themselves, but very convenient in respect to the parts that are contained under or within them. For seeing the Stomach lies in this region which uses to be distended with Meat or Water, these Ribs ought to give way to it when it or the intermediate parts, as the Liver and Spleen, bear against them.

Their figure.

The *figure* of the Ribs is (as you may also see in the following Figure) semicircular, like a Bow when it is drawn; which Nature hath so ordered to make the Chest stronger and more capacious.

Their surface.

They are on the outside rough and unequal, especially near the *Vertebræ*, that the Ligaments might take the firmer hold on them, by which they are tied to the Rack-bones: but on their inside they are smoother (being covered with the *Pleura*) lest they should hurt the Lungs and other Parts that bear against them. They are all of them narrower and roundish toward the Back, and broader and flatter toward the Breast. In their lower and inner part they have a furrow that runs along them, in which a Nerve and the Bloud-vessels are conducted.

Their uses.

The *uses* of the Ribs are, first, to be a defence to the Bowels within the Breast, and to the Stomach, Liver and Spleen in the Lower Belly; and secondly, to support the Muscles which serve for respiration, and to be moved by them: for which cause the Breast ought not to consist of one Bone, for then it would have been immoveable; whereas now it easily admits of dilatation and contraction.

C H A P. X.

Of the Sternum or Breast-bone, and of the Scapula or Shoulder-blade.

THE Breast-bone in an Horse is not flat on the outside as it is in Men, but stands out with a ridge, and is something like the keel or bottom of a Boat, jetting out with its middle on the outside, and is hollow on the inside. It is of a spongy substance, neither so solid nor so white as most of the other Bones of the Body. In Foals it is rather gristly than bony, and does then consist of more parts than it does in grown Horses; for as by age the Gristles grow into a bony substance, so they do unite so one to another in time, that no footsteps are left of their first division.

The Sternum, its figure and substance.

In its upper part towards the Throat it is rather pointed and sharp, than horned as it is in Men; however on the inside it is hollowed, for the more convenient descent of the Wind-pipe. Without on each side of its upper end there is a little *Sinus* into which the heads of the Collar-bones are received or articulated. Betwixt which articulation of the Collar-bones into it, and its lower end, there are several *Sinus* on each side of it, to the number of nine, into which the gristly ends of so many true Ribs are jointed. Its lower end terminates in a Gristle even in old Horses, whose end is of a more obtuse or blunt shape than in Men, in whom it is called *Cartilago ensiformis*, or the Sword-point-like Gristle.

What parts articulate into it.

Its use is for the articulation of one end of the Collar-bones and true Ribs into it, and to serve as a Breast-plate for the safeguard and defence of the noble Bowels (*viz.* the Heart and Lungs) that are lodged within it.

Its Use.

The *Shoulder-blade* is called in Latin *Scapula*. There are two of them (*viz.* on each side of the upper part of the Chest one) as there are of all the sorts of Bones in the fore and also in the hinder Legs; but we shall for brevity's sake speak of the Bones onely of one Leg before and another behind, because the other two are in all things like unto these, wherefore it is not any way necessary to repeat the description of them, nor yet to speak of them in the plural number.

The *Shoulder-blade* is seated upon the side of the true Ribs, (like a Target) reaching from the *Vertebræ* of the Back almost to the bottom of the Collar-bone. It is in figure after a sort triangular, on the inside concave or hollow, and on the outside prominent or arched. It is jointed to no Bone but by its lower end to the Shoulder-bone; but yet it is knit to several Parts by the Muscles that are inserted into it, or rise from it; as to the hinder-part of the Head by the Cucullar Muscles, being the first of its movers; also to the *Vertebræ* of the Neck by its second pair; and to the Back by the Muscle *Rhomboides*, &c.

The Scapula, its situation, figure and connexion.

It hath three *Processes*. The first being the shortest, is called its *Neck*, which neck ends into a sinuated or hollow cup or head, which receiveth the head of the Shoulder-bone, and its brim is compassed with a thick Gristle.

Its Processes.

Gristle.

Gristle, whereby its Cavity is made the deeper that the head of the Shoulder-bone that is jointed into it should not so easily slip out. The *second* Process, which by some is accounted the first, is extended along its middle on the outside, and is called its *Spine*; and that end of this Spine that by a shallow Sinus receives one of the Heads of the Shoulder-bone, is called *Acromium*, that is to say, its point or tip. The third and last of these Processes is toward the lower and inside of the Bone, and from the likeness it hath with an Anchor is called *Ancyroides*, Anchor-like; some also who compare it to a Crows Bill, do give it the name of *Coracoïdes*: This Process doth somewhat help to hold the Shoulder-bone in its place, entering a little into a shallow *Sinus* of the said Bone.

Its Appen-
dices.

It hath five Appendixes about its Neck, three of which do afford an original to some Muscles, and from the other two do spring Ligaments which join the Shoulder-bone to the head of the Blade.

Its Cavities.

By means of the second Process that runs like a Ridge or Spine along the middle of its back there are formed on its outside two long Furrows or *Cavities*, in which several Muscles lie, especially the *Suprascapularis* and *Subscapularis*, which are otherwise called *Supraspinatus* and *Infraspinatus*, from their being placed the first above this Spine or on that side next the Neck, and the latter below it or on that side next the Ribs.

Table XL.

Represents all the Bones of the Chest, the *Vertebræ* of the Back and the Shoulder-blades.

Figure I.

AB Shew the length of the *Breast-bone*, (the Bones of the Chest being placed in a *supine posture*.)

CC The upper end of the same Bone.

DD That *Gristle* which in Men is called *Cartilago ensiformis* or the *Sword-fashioned Gristle*, at its lower end.

1. The *Collar-bone*, (imitating a *Rib*.)

2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. The *seventeen Ribs*.

EEE The several *Vertebræ* of the *Thorax* into which the *Ribs* are articulated.

FFFF The *cartilaginous* or *gristly* part of the *Ribs*.

Figure II.

Shews the *seventeen Vertebræ* of the *Thorax* or *Chest* on one side, the better to shew how the *Ribs* are articulated into the sides of the said *Vertebræ*.

AAB The two *Productions* of the first *Vertebra* of the *Chest*, which were articulated into or with the *seventh Vertebra* of the *Neck*.

CCCC Several of the small *Ligaments* which did bind in the heads of the *Ribs* into the articulations of the *Vertebræ*.

I. II. III. IV. V. VI. VII. VIII. to XVII. The *seventeen backward Processes* or *Spines* of the *Spondyls* or *Rack-bones* of the *Chest*.

Figure

Figure III.

Shews the *Scapula* or *Shoulder-blade* with that side that is next the *Body* outermost.

H *The Cup into which the great round head of the Shoulder-bone is articulated.*

N *The Process which is inserted into the Shoulder-bone.*

M Q *The under-side of the Blade-bone.*

Figure IV.

Shews the *Scapula* with its outer or right side uppermost.

H *The Cavity or Cup into which the Shoulder-bone is articulated.*

N *The Process which is inserted into the Shoulder-bone.*

O P *The upper end of the Scapula, its Cartilage being taken off.*

S *That Process of the Scapula which is called its Spine or Ridge.*

C H A P. XI.

Of the Os humeri or Shoulder-bone, and the next Bone under it called the Cubit.

THE Bones of the *Fore-leg* under the *Scapula* or *Shoulder-blade* are The Bones of the Fore-leg. the *Shoulder-bone*, the *Cubit-bone*, the *Seven Osselets* or little Bones that make the *Knee*, answering to the eight little Bones that make the *Carpus* or *Wrist* in *Humane Bodies*, the *Shank-bone* answering to the Bones of the *Metacarpus* or back of the *Hand*, the great *Pastern* answering to the first *Joint* of the *Fingers*, the little *Pastern* to the second *Joint*, and the *Coffin-bone* to the last *Joint*, on which the *Nail* grows, as doth the *Hoof* of the *Horse* on the *Coffin-bone*. Of the similitude there is betwixt these several *Joints* in a *Horse's Fore-leg*, and those in the *Arm* and *Hand* of a *Man*, I have already discoursed pretty fully in the *Book* of the *Muscles*, where I treated of the *Muscles* of these *Parts*: wherefore I shall in this place speak no more of that, but proceed to the description of the before-named *Bones* in their order.

The *Shoulder-bone* is that which reaches from the *Shoulder-blade* to the *Elbow*. Both its ends are called *Heads*, being thicker than the rest of the *Bone*, the upper of which that is inserted into the cup of the *Blade-bone*, is naturally an appendix to the *Bone*, but in time grows to be a part or process of the *Bone* it self. The Shoulder-bone.

This *Head* is large and orbicular, covered over with a *Gristle*, that it might be turned more glibly within the cavity of the *Cup* of the *Blade*. On the outside of this *Head* there bunch out two rough and uneven *Processes*, into which two *Ligaments* are inserted for the strengthening of the *Joint*; (one of which is like a second *Head*, and is articulated into the shallow cavity of the *acromium*, or end of the *Spine* of the *Shoulder-bone*;) and betwixt these two *Processes* there is a long and round *chink* What Bones it articulates with.

through which the nervous Head of the Muscle *Biceps* doth pass. There is also on the inside another round Cavity in the side of the Head, out of which the strong Ligament springs that ties this Head in the cup of the *Scapula*.

The lower Head of this Bone which in Men is articulated with two Bones, *viz.* the *Ulna* and *Radius*, in a Horfe is jointed but with one, (which I call the Cubit-bone) yet is so jointed to that one, that it receives it and is received by it, having three Processes, and two *Sinus* betwixt them, much like the same Processes and *Sinus* in the same Bone of a Man.

Besides these Processes already mentioned, it hath on its inside another notable one, from which arise the Muscles that lie on the inside of the Leg upon the Cubit-bone: and on its outside it hath yet another Process, but something less than the former, from whence do arise the Muscles that lie on the outside of the Leg upon the Cubit-bone. About the middle of this Bone, on its inside, may be perceived a hole, through which both Veins and Arteries pass to the Marrow contained in this Bone, for its nourishment.

The Cubit-bone, its Articulations.

The next part of the Leg is called the *Cubit*, consisting, as hath been said, in Men of two Bones, but in a Horfe onely of one: The two Bones in Men reach from the Elbow to the Wrist; and this one in Horfes from the Elbow to that Joint commonly called the Knee, but which might properly enough have the same name as in Men, seeing it is of a like fabrick. This Cubit-bone in its hinder and upper part hath a notable Process, long and round, onely something flattish, which entrencheth into the larger *Sinus* or Cavity of the lower Head of the Shoulder-bone, and maketh that bunching-out which we call the Elbow. This Process is something rough and uneven, partly that the Ligaments might be the more strongly knit to it that encompass the Joint; and partly for the insertion of some Muscles of the Cubit, as also to give original unto the Muscles that bend the lower part of the Leg and Foot; for which cause also the Bone it self is rough at the root of the Process. The circumference of the *Sinus* into which it is inserted, is also rough, that from thence Ligaments might issue. Its lesser and inner Process is received by the lesser *Sinus* of the Head of the Shoulder-bone. There are three cavities in this upper Head, for the reception of as many Processes of the lower end of the Shoulder-bone. Its lower end articulates with the three upper little Bones of the Knee (that make the first range) as shall be shewed in the next Chapter.

CHAP.

C H A P. XII.

Of the seven Osselets or little Bones of the Knee, of the Shank-bones which reach from the Knee to the great Pastern, and also of the two Pastern-bones and the Coffin-bone.

Between the Cubit-bone and the Shank-bone there are two ranges of ^{The number of the little Bones of the Knee.} little Bones, one above another, being in number seven, that is to say, three in the first and four in the second range: all which are joined one to another so firmly, that they are not easily to be separated. The upper range are articulated with the lower end of the Cubit-bone, and the lower range with the upper end of the Shank-bone.

These Bones do differ one from another in their magnitude, form and situation, and are said in their first generation to be all Griftles and not Bones, but in process of time they become hard and grow bony. Their substance is spongy, as are all the rest of the Bones which of Griftles become bony, of which kind are all the Appendices of Bones, the Bones of the Breast and such like. They are all covered over with both a membranous and griftly Ligament, whereby they are so compacted together, that without dividing the said Ligaments, and separating the Membranes or Skins, it is a hard matter to distinguish them one from another, so that at the first view they may be thought to be all of them but one Bone.

They have a double *Superficies*, one outer, which is gibbous or bunching, and another inward which is concavous or hollow; and in their upper part where they join to the Cubit-bone, they are smooth and crufted over with the before-mentioned Griftle.

These Bones I will not undertake to give proper names to, but shall distinguish them by their order and number, calling that the *first* that is placed on the inside of the *upper rank*. ^{The upper rank.} This is something longish and curved inward, articulated with the Cubit-bone above, and below with the second Bone of the lower rank, yea it toucheth both the third and fourth of the same rank. Its inside joineth closely to the inside of the second Bone of its own rank.

The *second* of these Bones is close knit to the former, being something less than it. It is joined to the Cubit-bone in its upper part, which part is hollowed to receive the Appendix of the said Bone. It is also joined with the first Bone by one side, and by the other or rather hinder part to the third Bone, and lastly by its bottom to the seventh Bone or fourth of the lower rank.

The *third* is also joined above with a plain *Superficies* to the Cubit-bone, by its inside to the second Bone of its own rank, and by its lower part to the fourth Bone of the next rank.

The *fourth* Bone or *first* of the *lower rank*, is something smaller than ^{The lower.} any of the before-mentioned three, and is in shape almost round. It is smooth, not being hollow nor protuberated as the rest are. It is joined above

above to the outside of the lower-part of the first Bone, below to the Shank-bone, and on its inside to the fifth Bone or second of its own rank.

The fifth (or *second* of the lower rank) hath several little *Sinus's*; It hath one notable one above into which the first Bone of the upper rank is articulated, and another below for the reception of part of the Head of the Shank-bone.

The sixth (or *third* of the lower rank) is joined with a plain Superficies on each side to the seventh (or *fourth*) and to the foregoing; above, to the second, and below to the Shank-bone.

The seventh (or *fourth* of the lower rank) is not much unlike the former, on its inside being joined to the foregoing, on its upper side to the third of the upper rank, and on its lower to the head or top of the Shank-bone.

The Shank-bone, its Articulation.

The next part of the Leg which answers to the *After-wrist* or back of the Hand in a Man, is made of three Bones, one of which is long and round and much larger than the other two. It reaches from the Knee to the great Pastern, being articulated above with every one of the lower rank of the little Bones of the Knee; and below it is joined to the great Pastern by a mutual articulation, having two round heads and three small Cavities at that end of it for that purpose. This we call the *Shank-bone*.

The Splent-bones.

To each side of this Bone is fastned another long thin Bone, in figure something like a Bodkin, being somewhat thick and round at their upper part, and from thence as they run down towards the Foot, becoming thinner and sharper, till at last they end in a sharp point, a little above the joining of the Shank-bone with the great Pastern. Between these two Bones do run the Tendons of the Muscles that move the Foot, as they descend down the Shank-bone. These two we may call the *Splent-bones*, standing on each side of the Shank-bone like two Splents, such as Bone-setters use for broken Bones.

The next is the Bone which answereth to the first joint of the Fingers in Man, in whom they are five in number, by the wonderfull wisdom of the Creator so ordained as was fittest for that variety of motions to which they are design'd. But an Horse being *Solidipes* or a whole-footed Creature, hath all his Foot necessarily moved together, and the Bones thereof in each Joint being single, answer but to the Bones of one Finger.

The great Pastern.

The form of this Bone, which is called the *great Pastern*, is gibbous and crooked. At its top, where it is articulated with the Shank-bone, it has three small Processes and two Cavities betwixt them: also two small triangular Bones fastned to its back-part. Its outside is plain and smooth, and without any roughness at all. Its lower end consists of two heads which are round and bunching and are articulated into the *Sinus* of the *lesser Pastern* which is under it.

The little Pastern.

The next is the *little Pastern*, answering to the second Joint of the Fingers. This is not much unlike the former, onely it differs in the length, for it is not much above half so long. Its upper end (as was said) is articulated with the great Pastern, and its lower end is received by the Coffin-bone in the same manner as it self received the lower end of the great Pastern by its own upper end.

The

The next and last Bone of the Foot is the *Coffin-bone*, so called (I suppose) from its hollownes on its under-side. Its *figure* is femilunary or Half-moon-fashioned. It is thick at its top, (where it has cavities to receive the heads of the lower end of the little Pastern) but thin and broad at its bottom and toward its edges, for its more firm fixing upon the ground. Its *substance* is fungous or spongy, having innumerable little holes piercing through its sides for the passage of the Vessels; as also very many small *Sinus's* whereinto are implanted the ends of the Tendons of the Muscles that move the lower part of the Leg, and the Foot: whose Fibres being at any time affected either by bruises, ill shooing, or by standing in the water after hard riding whilst the Horse is hot, or but by standing still in the Stable for several days without having the Feet stopp'd up, and the like; I say the tendinous Fibres being affected by these or other means, cause the Horse to have such great pain in his Feet, that he can scarce endure to tread upon them; which lameness we call a *Founder*. Now this distemper is so much the harder to cure by reason these Fibres lie so far out of reach, most of them running on the upper side of the Bone (betwixt it and the Hoof) and not to its bottom; so that the Hoof growing upon the sides as the Soal doth at the bottom, there is great hazard but we shall miss of effecting a cure, if we onely pull the Soal out, and do not cut part of the Hoof off also. This is not my bare opinion, but the experience of those that have had good success in curing foundred Horses, who by raising the Hoof from the Coronet or top of it to the very bottom, in five or six places, untill they have made the Blood come, and then applying their remedies to those places, have made those Horses found, whom the drawing out of their Soals would not cure.

*The Coffin-bone.
Its figure,
substance and
Sinus's.*

*The cause
and cure of a
Founder.*

Table XLI.

Represents all the Bones of the Fore-legs as well joined one to another as separate.

Figure I.

Shews the Bones of the near Leg before, all joined together, (the Blade-bone being taken off.)

- A B** The heads of the Shoulder-bone which were articulated into the cavities of the Shoulder-blade.
C A production in the side of the said Bone, from whence some Muscles of the Leg do take their rise.
D Its lower head which is jointed with the top of the Cubit-bone.
E The outer part of the first Osselet or little Bone of the upper range or rank that make the Knee.
F The Process of the Cubit-bone called the Elbow.
G The top of the Cubit-bone jointed with the lower end of the Humerus or Shoulder-bone.
H The bottom of the said Bone.
I The first range of Osselets or little Bones of the Knee.
L The second range or rank of the said Bones.

M The

- M The little Bodkin-like (or Splent-) Bones on each side of the Shank-bone.
- N The top of the Shank-bone, where it is articulated into the second range of the little Bones of the Knee.
- O The bottom or lower end of the said Shank-bone.
- Q The great Pastern.
- Y The two little triangular Bones which are joined to the back-part of the great Pastern near the top of it.
- R The little Pastern.
- T The Coffin-bone.

Figure II.

Shews the Bones of the Off-leg or right Leg, all of them *in situ*.

- A B The heads of the Shoulder-bone that articulate with the Scapula.
- C The production in the side of the said Bone.
- D Its lower head with which the Cubit-bone is articulated.
- E The first Osselet of the first range of the Knee.
- F The production of the Cubit-bone called the Elbow.
- G The top or head of the Cubit-bone.
- H The bottom or lower end of the said Bone.
- I The first range of the little Bones of the Knee.
- L The second range of the said Bones.
- M The Bodkin-like (or Splent-) bone that is on the side of the Shank-bone.
- N The top of the Shank-bone.
- O The lower end of the said Bone.
- P The great Pastern.
- S The little Pastern.
- Y The two little triangular Bones fastned to the top of the great Pastern-bone.
- V The Coffin-bone.

Figure III.

Shews the fore-part of the Shoulder-bone separated from the other Bones.

- A N The heads of the Shoulder-bone that are articulated with the Scapula.
- B The production in the side of the same Bone.
- E The heads at the bottom of the said Bone, which are articulated into the cavities of the upper end of the Cubit-bone.
- D The cavity into which the long production of the Cubit-bone is articulated.
- OO The body of the Shoulder-bone.

Figure

Figure IV.

Shews the hinder-part of the Shoulder-bone by it self.

- A The great round head at the top of the Shoulder-bone.
- B The great production of the same Bone.
- CD The division of the head at the lower end of the Shoulder-bone.
- O The little eminence in the side of the said Bone.

Figure V.

Shews the fore-side of the Cubit-bone.

- A The top of the long production at the upper end of the Cubit-bone, called the Elbow.
- B The middle of the said production.
- C The cavities at the upper end of the Cubit-bone, into which the lower heads of the Shoulder-bone are articulated.
- G The body of the Cubit-bone.
- PH The round heads at the bottom of the Cubit-bone.

Figure VI.

Shews the back-side of the Cubit-bone.

- A The top of the long production of the Cubit-bone.
- BB The upper heads of the said Bone which are articulated with the lower end of the Shoulder-bone.
- CC The lower heads of the said Bone which do articulate with the upper range of little Bones of the Knee.
- F A cavity of the lower end of the said Bone, into which one of the little Bones of the upper range doth articulate.
- H The body of the said Bone.

Figure VII.

Shews the fore-side of the Shank-bone.

- DD The upper head of the said Bone, as also of the two Bodkin-like Bones on each side of it, where they were articulated with the lower range of the little Bones of the Knee.
- C The two lower heads of the said Bone, whereby it was articulated into the cavities of the upper part of the great Pastern.
- M The body of the said Bone.
- NN The two cavities or dens at the sides of the lower heads of this Bone, into which cavities the heads of the great Pastern were implanted or articulated.

Figure

Figure VIII.

Shews the back-side or hinder-part of the Shank-bone, on which the back Sinews lie.

- OO *The heads of the Shank-bone and of the two Bodkin-like Bones on each side of it.*
 PP *The two heads at the lower end of this Bone which were articulated with the great Pastern.*
 C *The cavity between these two heads, in which is articulated a Proceß of the upper end of the great Pastern.*

Figure IX.

Shews the fore-part of the great Pastern.

- A *The dens or cavities in its upper part which receive the heads of the lower end of the Shank-bone.*
 B *The heads at the lower end of this Bone which were articulated into the Sinus or cavities of the upper end of the little Pastern.*

Figure X.

Shews the back-part of the great Pastern.

- A *The Sinus or cavity into which the heads of the two little triangular Bones were articulated.*
 BB *The two heads at the lower end of the great Pastern, which were joined with the little Pastern.*
 V *The cavities at the upper end of this Bone which did receive the heads of the lower end of the Shank-bone.*

Figure XI.

Shews the fore-part of the great Pastern with the two triangular Bones fastned to the back-part of it.

- RR *The two triangular little Bones.*
 VV *The cavities into which the two heads of the lower end of the Shank-bone were articulated.*
 Z *The body of the great Pastern.*

Figure XII.

Shews the little Pastern on its fore-side.

Figure XIII.

Shews the back-side of the little Pastern.

Figure XIV.

Shews the bottom of the Coffin-bone.

Q The circumference of the said Bone which gives the round shape to the Foot.

S The cavities or hollownesses whereinto the heads of the little Pastern were articulated.

Figure XV.

Shews the sides and top of the Coffin-bone.

A Shews all the outside of the said Bone.

Figure XVI.

Shews the fore-side of the two little triangular Bones separated from the upper part of the great Pastern-bone.

Figure XVII.

Shews the back-side of the said Bones.

C H A P. XIII.

Of the Os sacrum or holy Bone, together with the Coccyges or Rump-bones, otherwise called the Bones of the Dock or Tail.

THE *Os sacrum* or holy Bone, is seated at the lower end of the *Os sacrum*, Back, at the end of the *Vertebræ* of the Loins, to the last of ^{its seat,} which one end of it is articulated, and the other end to the first of the ^{connexion, figure and surface.} Bones of the Dock or Rump-bones. It is much the broadest and largest of all the Bones of the Back. Its *figure* is almost triangular, having a broad beginning, and ending by degrees into a narrowness. On the inside it is smooth and hollow, but something unequal; behind or on its outside it is gibbous and also rough, because of the Muscles of the Back and their Ligaments cleaving unto it. Its *acute* Processes or Spines are very small; and the *transverse* ones but obscure: as for the *oblique*, there is no appearance of *them*, save in the first *Vertebra*. On its outer side near its edges there are certain *Sinus's* or hollownesses, to which the Haunch-bones do cleave firmly by an intervening Cartilage.

Its *Vertebræ* are in number six, whose Spines are much less than the ^{Its Verte-} Spines of the *Vertebræ* of the Loins, and the lower or nearer to the ^{bræ.} Rump-bones, the lesser they are still.

This holy Bone is perforated in several places; as first, quite through ^{Its Holes.} its length it hath a large hole or cavity to receive the Spinal Marrow; out from which there go many other lesser for the egress of the Nerves;

and these are not in the sides of the *Vertebræ* as those are that be in the *Vertebræ* of the Neck, Back and Loins, but on the inside and outside or and above, of which those below are much the larger.

The Rump-
bones.

To this Bone at its lower end are joined the *Rump-bones*, which in this Animal we are treating of are in number eighteen. These are joined to each other by a Cartilage or Gristle, but so loosely, that the Horse can bend his Rump which way he will. Those of these Bones that are next to the holy Bone, are something thicker and broader, than those further from it; for as they descend down, they each grow less and less, so that the lowest grows into a cartilaginous or gristly point, as you may see in the figure of the Skeleton, where they are all lively represented *in situ*. These Bones are not so hard as most of the other Bones are, but more soft and spongy; neither have they any Process, or any hollowness, except the first of them, which hath a small cavity or den to receive the last *Vertebra* of the *Os sacrum*, which *Vertebra*, is the furthest part whither the Spinal Marrow reaches.

Table XLII.

Represents the *Os sacrum* and Rump-bones joined together; also the *Os sacrum* joined with the *Vertebræ* of the Loins; and several other figures of these Bones.

Figure IV. and V.

Shew the *Vertebræ* of the Loins joined with the upper end of *Os sacrum*.

1. 2. 3. 4. 5. 6. 7. Shew the seven Spines or backward Processes of the *Vertebræ* of the Loins.

1. 2. 3. 4. 5. 6. The six Spines of the holy Bone.

1. 2. 3. 4. 5. Holes in the *Os sacrum* for the egress of the Nerves from the Spinal Marrow out of that Bone.

G The hole of *Os sacrum* which contains the Spinal Marrow.

DDD The long and flat Productions or transverse Processes at the sides of the *Vertebræ* of the Loins.

VVV The little Productions in the sides of the *Vertebræ* of the Loins whereby they are articulated into each other.

Figure VI.

Shews the last *Vertebra* of the Loins removed from the rest and turned on one side.

Figure VII.

Shews the last *Vertebra* of the Loins with that side forwards whereby it was join'd with the last but one, in which *Vertebra* is to be seen the hole where the Spinal Marrow did pass through it.

Figure VIII.

Shews the same Bone with that side uppermost that respects the cavity of the Body.

Figure

Figure IX.

Shews the lower side or inside of *Os sacrum*, as also the Rump-bones joined to it.

AA *The foremost Productions of the said Bone, which were articulated with the last Bone of the Loins.*

BB *The two long and wide Productions of the *Os sacrum*, which were joined with the Haunch-bone or *Os ilium*.*

C *A cavity at the upper end of *Os sacrum* which did receive the head of the last Vertebra of the Loins, and was articulated with it.*

D *The hole in which the Spinal Marrow was contained.*

GG *Other Productions of the *Os sacrum* which were articulated with the *Os pubis*.*

HH *The holes in the *Os sacrum* out of which did pass the conjugations or pairs of Nerves that are distributed about all the hinder parts.*

1.2.3.4.5.6.7.8.9.10.11.12.13.14.15.16.17.18. *The eighteen Rump-bones or Bones of the Tail.*

Figure X.

Represents the upper part of *Os sacrum* that joins to the Loins, as also partly its inside turned upward.

A *The round cavity into which the head of the last Vertebra is articulated.*

BB *The lower side of the broad Productions of the *Os sacrum*, which join with the *Os ilium*.*

C *The cavity in the said Bone wherein the Spinal Marrow is contained.*

FF *The two little foremost Productions with which the hindmost of the last Vertebra of the Loins are articulated.*

Figure XI.

Shews that side of the *Os sacrum* which looks to within the Body, as also its several perforations through which the Nerves do issue forth from the Spinal Marrow.

A *The cavity that receives the round head of the last Vertebra of the Loins.*

CC *The two Productions that are articulated with the hinder ones of the lowest Vertebra of the Loins.*

DD *The lower side of the two broad Productions of the said *Os sacrum*.*

EEE *Its holes through which the Nerves do pass from the Spinal Marrow contained in it.*

C H A P. XIV.

Of the nameless Bone, commonly divided into the Hip, Haunch and Share-bones.

Os innominatum, or nameless Bone.

THE *Hip-bone* (commonly so called) is by Anatomists divided into three parts. First, *Os ilium*, so named because the Gut *Ilium* lieth under it. The next is called *Os coxendicis*, or *Ischium*, which is the lower and outer part of the nameless Bone, (or *Os innominatum*) which is the name of these three Bones as joined all together, for they are truly but one Bone in old Horses, though in Colts they are divided one from another by Cartilages, from whence this distinction is made, and they come to be discoursed of by three several names. The third part of this Bone is called *Os pubis*, also *Pectinis*, or the *Share-bone*.

Os ilium or Haunch-bone.

That part that is called *Os ilium*, is the uppermost and broadest, which is joined to the holy Bone. In figure it is semicircular, and its semicircular circumference is called its *Spine*. On its outside it is something arched, but within hollow; the arched part is called *dorsum*, its *Back*, the hollow part *costa*, or its *Rib*.

Its Spine.

That part which is called its *Spine*, is in many places unequal, that some Muscles might take their original from it, *viz.* the *Oblique ascendent Muscle* of the *Abdomen* or *Paunch*, the *Deltoides* of the *Thigh*, the first Extender of the *Leg* called *Membranosus*, &c. And on the back of this Bone there are unequal inscriptions or lines for the rise of the three Muscles of the *Thigh* that help to make the *Buttocks* (called *Glutæi*;) and also for other Muscles that lie under these.

Coxendix or Hip-bone.

The second of the parts of this nameless Bone is called *Os coxendicis*. This is the lower and outer part of it, in which there is a great *Sinus*, called *Acetabulum*, the *Cup* or *Sawcer*, into which the head of the *Thigh-bone* is exceeding strongly articulated. This *Cup* has its edges environed with a *Gristle*, called *Supercilium*, its *brow*; in whose circumference there are observed three *Sinus*, two *Protuberations* and an acute *Process*, and lastly an *Appendix* that is very thick: all which were ordained for the production partly of *Ligaments* and partly of *Muscles*.

Os pubis or Share-bone.

The third and last part of this nameless Bone is called *Os pubis*, or the *Share-bone*. This is originally two Bones, parted one from another in the middle with a *Gristle*, but in continuance of time the *Gristle* it self becomes bony, and so unites them into one Bone. It is placed at the bottom of the *Paunch*, betwixt the two hinder *Legs* as the *Horse* stands. On its outside it has on each side a *Sinus* for the descent of the *crural Vessels*. On the same side also it is rough to give the firmer original to the streight Muscles of the *Abdomen* and to the second *Bender* of the *Leg*. It is but a thin Bone, being hollow within, and perforated with the greatest hole of any such-like Bone in the whole *Body*. On its hinder and inner side it has two *Processes*, from whence the nervous bodies of the *Yard*, and some Muscles take their original.

Pelvis or the Basin.

These Bones with the holy Bone do make that cavity which is called *the Basin*, which is the place wherein are contained part of the *Guts*, and the *Bladder* in a *Horse*; and in a *Mare* part of the *Guts*, the *Bladder* and the *Womb*.

Table

Table XLIII.

Represents the three Bones that make the *Os innominatum* or nameless Bone.

Figure I.

Shews the said Bone with the right side upward.

- BB Shew the upper part of *Os ilium*.
 CC The two Productions of the said Bone which are fastened by very strong Ligaments to the Processes of *Os sacrum*.
 DD The Spines or Ridges of the said Bone.
 EEEE The *Os coxendicis* or lower and outer part of the nameless Bone.
 FF The two holes in the *Os pubis* or Share-bone made for the ingate and outgate of Vessels.
 G The Seam which divides the Share-bone in the middle.
 HH The extremities or ends of the said Bone.

Figure II.

Shews the *Os innominatum* turned the upside downward.

- II Shew the Cup of the *Os coxendicis*, into which the head of the Thigh-bone is inserted.
 MM The extremities or ends of the Share-bone.
 NN The two large holes in the bottom of the said Bone.
 OO PP The inside of *Os ilium*.
 QQ The Spines or Ridges of the said Bone.
 R The Seam of the Share-bone which divides it into two parts.

C H A P. XV.

Of the Thigh-bone and Patella or little Bone of the Stifle.

THE Thigh is called by the Latins *Femur à ferendo* to bear, because the Creature is born up or sustained by it. This Bone (like the Bone of the Shoulder) is but one, reaching from the Hip-bone to the Stifle. The figure of it is long, round and streight, except where its Heads and Protuberances bunch out; of which it hath, above, one Head, one Neck, and two Processes; and below, it determines into a Head which hath two Productions and a Cavity between them.

The upper Head is an orbicular Appendix standing upon the Neck, and is the thickest and largest Head of any Bone in the whole Body. It is round and long the better to enter into the Cup of the Hip-bone, which is not onely deep of it self, but rendred deeper by a large Gristle that compasseth the edges thereof. For it was necessary that a very firm articulation should be in this place, because of the huge weight which the Thigh was to sustain. And besides, to strengthen it the more, and to fasten the

The Thigh-bone.

Its upper Head.

two

two Bones the firmer together, there ariseth out of the Cup of the Hip-bone an exceeding strong and round Ligament, which is implanted into a little *Sinus* that is in the Head of the Thigh-bone. This Head is smooth and crufted over with a Gristle, that it might move the more glibly within the Cup.

Its Neck

The slender part under this Head is called the *Neck* of the Thigh-bone. This is pretty long and oblique, reaching upward but inclining inward, and is a Procefs of the Bone. At its lower end, where the Bone grows broader, do arife two other Proceffes, called *Trochanters* or *Rotatores*, from the Muscles of that name that are inferted into them. The upper of these Proceffes is greater than the lower, nay greater indeed than any Procefs in the whole Body which is not joined to another Bone; It bends upward and outward; but the other which is much lefs than this, bendeth backward and somewhat inward.

Its lower Head is divided into two.

The Thigh-bone below its middle becometh thicker, and its lower end terminateth into an ample and broad Head; out of the backside of which are produced two Proceffes, as it were two other Heads, betwixt which there is a large space left about two inches wide, which receiveth a protuberation or fwelling of the Head of the Leg-bone.

These two Heads at the lower end of the Thigh-bone are on their out-fides rough, but their infides are covered with a Gristle, and thereby are made smooth and slippery for the more eafy motion of the Joint. One of these Heads is thicker, and is feated inward; the other is thinner but broader, and is feated outward. From them do some of the Muscles that move the Leg arife; and into them are some that move the Thigh inferted. The fides of these Heads are full of little holes, out of which do iffue the roots of the Ligaments which strengthen the Stifle-joint.

Their Cavities.

These Heads have alfo four *Cavities*, two of which are in the middle between the two Heads, and one on the outside of either of them. One of the middle Cavities, being the foremost, is made to receive the protuberation of the *Patella* or Pan, and is therefore crufted over with a Gristle for that purpose. The fecond of the middle Cavities being more backward, is deeper than the other, alfo rough and unequal, made to receive the protuberation of the Leg-bone. The third is at the outside of the outer head, and the fourth at the outside of the inner, through both which the Tendons of feveral Muscles of the Leg defcend.

The Patella.

At the lower end of this Thigh-bone, betwixt it and the Head of the Leg-bone, on the fore-side, is placed a small roundish Bone, (called the *Patella* or Stifle-pan) about three inches broad, being plain without, but within bunching, bored through with many small holes. It is covered over on its infide with a Gristle, and is made firm in its place by the broad Tendons of the fecond, third and fourth Muscles that extend the Leg, to which the *Patella* is very firmly knit. This Bone strengtheneth the jointing of the Thigh-bone with the Leg-bone, and hindreth their diflocation forwards.

C H A P. XVI.

Of the Leg-bone and Ranges of Osselets which make that part we call the Hock, answering to the Heel of a Man.

TH E R E is the same difference between the hinder Legs of an Horse The Shank-bone is but one. and a Man's Legs, as we shew'd above to be between the Fore-legs of an Horse and a Man's Arm. For as in Man there are two Bones which reach from the Elbow to the Wrist, and but one Bone in that Joint of an Horse's Fore-leg that answers to this (reaching from his Elbow to that Joint we commonly call the Knee;) so whereas in a Man's Leg there are two Bones, called *Tibia* and *Fibula*; in the same Joint of an Horse that reaches from the Stifle to the Heel, there is but one, which we shall call by the name of *Tibia*, or the Shin or Shank-bone, because the Bone of a Man's Leg that goes by that name, is the more considerable of the two.

The *figure* of this Bone is long, and *round* in an Horse, but in a Man Its figure. it is three-square. The upper part of it which joins with the Thigh-bone, is broader and thicker than the lower.

Its *upper Head* in which are two cavities and a prominence betwixt Its upper Head. them, is crusted over with a Gristle, and both receives and is received by the two Heads and cavity of the Thigh-bone; which Gristle is fastned to it by Ligaments. This Gristle is slippery and smooth, and the cavities which it lines are full of an unctuous or oily matter or humour, which serves to further the motion of the Joint by rendring it moist and slippery.

The lower part of this Bone, or its lower Head, is round and likewise covered with a Gristle, with which it is made something broad, but not Its lower Head. withstanding equals not the largeness of the upper Head.

This Bone hath several *Sinus's* and *Appendices*, as well as the Thigh-bone hath; the former for conveniency of the Tendons of some Muscles to descend by, and the latter for the rise or original of other Muscles which are to move the Foot. Its Sinus's and Appendices.

This Bone as well as the Thigh-bone (and most other Bones) is notably hollowed within, having its cavity filled with Marrow. It is also perforated in several places, admitting through its perforations several Vessels to the said Marrow. Its Cavity.

Next come we to the little Bones of the *Hock*, which Joint answereth to the Instep and Heel of a Man. These are of the same number as those of the Knee in the Fore-legs were, and do also lie in two ranges, the one above the other, *viz.* three in the upper, and four in the lower. These Bones, as those in the Knee, are so closely articulated one with another, and so closely wrapt up and bound together with membranous Ligaments, that it is not easie for the Dissector to discover where all of them are divided: so that without diligent inspection they may be taken to be not above half the number they are truly of. The seven little Bones of the Hock.

To treat of every particular Bone of them and of their connexion one with another, or lastly of their jointing with the Shank-bone above, or with the three Bones of the *Metatarsus* below, would be in a manner the repeating

repeating of the same description over again that we gave above of the seven little Bones of the Knee. Onely that which is the hindmost and largest of them deserves to have particular notice taken of it, and that is it which is truly, and ought to be called the Heel-bone, whose shape and posture you may see in the following Figure. Into this Bone it is that several of the Tendons of the Muscles that bend the Leg are inserted. On its inside it has a large *Sinus* by which the Tendons of those Muscles that move the lower Parts of the Foot do descend, as also the larger Vessels thereof.

The Instep-bones.

The next Bones to these are the three that answer to those five that make that part of the Foot in Humane Bodies which is called the *Metatarsus* or Instep. These I say are but three in a Horse, though in a Man they are five, to answer to the number of the five Toes. They reach from the lower range of the little Bones of the Hock before-mentioned, down to the great Pastern. One of them is a large, long and round Bone; the other two are much more slender, and shorter, being the one of them placed on the inside and the other on the outside of it, adhering so closely thereunto, that they are not easily to be separated from it. These little Bones answer in all things to the like Bones which run down by the sides of the Shank-bone of the Fore-legs, which from their shape I called the Bodkin-like Bones, (as likewise the Splent-bones, because they stand by the sides of the middle great Bone, like the Splents that Bone-setters make use of for strengthening broken Bones till they are knit again;) I say these are like those, and therefore may be called by the same names.

The Pastern-bones and Coffin-bone.

The remaining part of the Bones of the hinder Leg and Foot are the great Pastern (with the two little triangular Bones adhering to the top of it,) the little Pastern, and the Coffin-bone; of all which having already treated where I described the Bones of the Fore-legs, (with which these of the Hinder-legs agree in every particular) I shall for brevity's sake omit speaking particularly of them, and here conclude my discourse of the Bones.

Table XLIV.

Represents the Skeleton of an Horse, (drawn exactly by one that I keep standing in a Press.)

AA The Shoulder-blade.

B The Breast-bone.

CC The Shoulder-bone.

DDDD The Leg-bones both before and behind.

EEEE The little Bones that make the Knee and the Hock.

FF The Shank-bones.

ff The Instep-bones.

GGGG The Bodkin-like or Splent-bones.

HHHH The great Pasterns.

III The little Pasterns.

KKKK The Coffin-bones.

LLLL The little triangular Bones that cleave to the upper end of the great Pastern.

MM The Os ilium or Haunch-bone.

N The

N The Os coxendicis or Hip-bone.

OO The Os pubis or Share-bone.

PP The Thigh-bones.

QQ The little Bone of the Stifle, called Patella.

RRRRRR The Cartilages at the end of the Ribs.

SSSSSS The seventeen Ribs.

TTTTTT The upper end of the Ribs where they are articulated into the
Vertebræ of the Chest.

V The Os hyoides, in situ.

W The lower Jaw.

X The upper Jaw.

Y The Os occipitis or Noll-bone.

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. Are the seventeen Verte-
bræ of the Chest.

1. 2. 3. 4. 5. 6. 7. The seven Vertebræ of the Loins.

1. 2. 3. 4. 5. 6. The six upper Productions or Processes of the holy Bone.

From the Cypher 1. to 18. are represented the eighteen Bones of the Rump
or Dock.

I. II. III. IV. V. VI. VII. Shew the seven Vertebræ or Rack-bones of the
Neck.

C H A P. XVII.

*Of the Hoofs of an Horse answering to the Nails of a Man's
Fingers or Toes.*

Concerning the Nails of a Man's Fingers and Toes (to which the
Hoofs of Horses bear a resemblance) learned Men are divided into
several opinions about their generation. *Hippocrates* is affirmed to be
of opinion, that they are made of a glutinous matter or moisture parch-
ed and dried by heat, and driven to the extreme parts. *Empedocles* thinks
them to be made of the extremities of the Nerves, calling them *Nervo-
rum clausulas summas*, the utmost terminations or boundaries of the
Nerves; and that therefore when these fall off, it is a sign of great weak-
ness. *Aristotle* in lib. 2. cap. 6. *de generatione Animal.* saith, that the
Nails, Hairs, Beaks of Birds, Hoofs of Beasts, and such like, are inge-
dred of *adventitious* aliment. And lastly, *Columbus* thinks they take
their original partly from the Skin, and partly from the Tendons of the
Muscles which move the Fingers and Toes, and that they are encreased
like the Teeth by an apposition of aliment to their root.

As for the Hoofs of Horses, whatever be their original matter, out of
which they are formed, their growth seems to be (according to the opi-
nion of the last mentioned Authour) from the addition of new particles
to their roots, which drive down successively those before them. They
are of a middle substance betwixt Bones and Gristles: not so hard as
Bones, for then they would be apt to splinter and break; nor so soft as
Gristles, for if they were, they could not support so great a bulk as
the

*How the
Hoofs are
nourished,
and how sup-
ported upon
the Foot.*

the Body of an Horse, much less endure to travel amongst stones, &c. But they are of a horny substance, without sense, growing pretty firmly to the parts included within them, and fastened to the Coffin-bone by a Ligament that proceeds from their top or root, which root the Skin also somewhat encompasseth.

Under them lie many twigs of Nerves, and Tendons of Muscles, which run even to the very bottom of the Hoof or Soal of the Foot, upon pricking of which with a Nail or the like, or when they are but bruised with riding in hard way, the Horse presently bemoans himself, as was more at large shewed before in the twelfth Chapter of this Book.

C H A P. XVIII.

Of a Cartilage or Gristle.

AS an Appendix to the history or doctrine of the Bones, it will not be unnecessary to speak somewhat of the *Cartilages* or *Gristles*: especially seeing through the whole discourse of this Fifth Book we have had occasion ever and anon to mention them, but have not as yet given any particular account of them; as neither of a *Ligament*, which we have also often mentioned: but of this latter in the next Chapter, and onely of the *Gristles* in this, because they come nearest to the nature of Bones.

*A Gristle
what.*

A *Cartilage* is a *similar part, cold and dry, made* (as some Authours affirm) *out of the most glutinous part of the Seed.* They are flexible and without sense, and are much softer than a Bone, though the nature of the one is not so much distant from the other, but that several Gristles in tract of time, and as the Creatures grow old, harden into Bones.

Their uses.

The *uses* of the *Gristles* are many. For *first* they help the motion of the Bones at their jointings one with another. For which end in the Joints that are subject to great motions, the edges of the *Sinus*, or Cups and Cavities of the Bones that articulate one with another, are generally lined with a Gristle, to make the motion more glib and secure; such are the articulation of the Shoulder-bone with the Shoulder-blade, of the Thigh-bone with the Hip-bone, and several others.

A *second* use of the *Gristles* is by *yielding*, a little to give way to the violence of outward injuries; whereas if Bones had been in their places, they would have been in danger of breaking, from their hardness and stiffness: for which end the ends of many Bones which are exposed to external injuries are furnished with Gristles, as the Nose and Ears, and the like.

Another use of the *Gristles* is, that by their mediation, as it were by a glue, some Bones might be conjoined; as the Share-bones in particular are by this means united to one another.

There are many other *peculiar* uses of particular *Gristles*, some belonging to the Sight, some to the Hearing, some to Smelling, some to Respiration or breathing, and the like; all which have their several denominations:

nations: But of these we have already treated as they fell in our way, when we discoursed of the parts to which each did belong. I shall not therefore need to enlarge any further upon them in this place.

C H A P. XIX.

Of a Ligament.

AS the lubricity or slipperiness of Gristles makes the motion of the Bones more easie and glib; so the *Ligaments* do secure that motion by strengthening the articulation of one Bone with another.

A *Ligament* is a *similar part, cold and dry, of a middle nature betwixt a Gristle and a Membrane*; harder than Membranes, lest in vehement motions they should be broken; and softer than Gristles, that they might the more easily follow and obey the Muscles which move the Bones. Those that tie one Bone to another are generally insensible, as well because they receive no Nerves into them, as also lest being perpetually moved they should breed perpetual pain. But such as tie other parts, as the Ligaments of the Liver, of the Womb, the bridle of the Tongue, &c. these are endued with sense.

The *differences* of Ligaments are many, being taken first from their *substance*, whence some are said to be hard, others soft, the former of which are called cartilaginous, and the latter membranous Ligaments. The epithet of *membranous* is likewise given to some from their breadth, in opposition whereto others are called *nervous*, because they are round like Nerves.

They are also distinguished from their *original and insertion*; for some arise from Bones, some from Gristles, and some from Membranes; and are accordingly diversly *inserted*. And lastly they are differenced from their *strength and figure*. To give particular instances of all which, would be a needless curiosity: I shall therefore break off when I have added a word of their *use*.

The *uses* of the Ligaments, as well as Gristles, are many: for *first* they confirm and strengthen the articulations of the Bones: they *also* bind and fasten the Bones to one another where there is no true articulation. *Thirdly*, they serve as an outward garment to the Tendons of the Muscles, many of which are throughout their whole length covered with Ligaments and Membranes. *Fourthly*, they interpose like a Pillow betwixt the Bones and the Tendons of the Muscles. *Fifthly* and lastly, some of them do serve to suspend the Bowels, that they should not fall with their great weight, such are the Ligaments of the Liver, &c.

The End of the Fifth Book.

THE
APPENDIX,

Containing Two

DISCOURSES:

The one, of the

GENERATION

OF

ANIMALS:

And the other, of the

MOTION of the CHYLE,

And the

CIRCULATION of the BLOOD.

By the same Authour.

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SECTION I.
Of the Generation of ANIMALS.

The PREFACE.

IN the Introduction to the foregoing Anatomical Treatise I premised, that my inducement to compile and publish it was to instruct those of my own Profession in the frame and use of the Parts of that Creature which is the Subject of our Art. And because most Farriers are Persons of small literature, I promised and intended to write the Discourse in such plain and familiar phrase as they might be capable of apprehending, that they might reap that benefit from it which was designed them. (And I have as much as I could endeavoured to serve that first intention.) But upon publishing my Proposals for printing this Book, finding that it would not be unacceptable to Persons of the best rank, as well of the Nobility as Gentry, I thought it adviseable not to pen it in too paltry and homely a style, lest it might be nauseous and unpleasant to such worthy Persons as by their Subscriptions were pleased to give me encouragement to go on with the Work. So that I hope in the perusal of it, it will both be delightfull to these latter sort of Readers, and yet instruct and benefit the former, for whom onely (as I said) it was at first intended.

But now as to the following Discourse which was also mentioned in the Proposals, I found that not onely the Men of my own Profession made small reckoning of it; but I was censured by some of note, for pretending to treat of things above my capacity. I must confess I was a little abashed and discountenanc'd at this Censure, as having but a small share of that confidence whereby so many recommend themselves to the World: insomuch as growing jealous of my own ability, I took advice upon it. And it was my good fortune to meet with a Person, that upon my imparting my thoughts to him, encouraged me to go forward, promising, if I needed any, to lend me some assistance. And I must acknowledge that the Reader (and my self)

The Preface to the Discourse

self) are very much owing to his kindness for the beginning of this Treatise; and partly also for the composition of the Remainder; (though the Observations, which are the ground of the Discourse, be wholly mine own:) for I durst not trust my Pen alone in what I perceived would be scan'd with some severity. He that doth not understand it, may believe it was not writ for his use; and he that doth, is desired to accept it in good part.

And now to give some more particular account of it:

It will not be expected that an Appendix or Supplement should contain an History of the Generation of all Animals; for that would require several Volumes: but it will suffice to describe the Generation of one Oviparous and another Viviparous Creature (the Young of one being formed without, and the other within the Body) to which all others whatsoever may be reduced.

By Animal I understand every thing that hath sense and motion. Concerning which it will not fall in my way to discourse of their several natures or actions, those considerations lying before him that would treat of Animals already perfectly generated and matured: but my province will be to shew (1) from what original matter, and (2) by what efficient cause Animals are generated, and (3) in what order and by what degrees their Parts are first delineated, and at last come to be perfected.

1.
The original
matter of
Animals.

First then as to their original matter, I affirm universally of all Animals, that it is an Egg, either formally, or something analogous thereto, and which upon many accounts may not improperly have that appellation given it: Yea this term may be applied not onely to Animals, but to the Seeds of Plants or Herbs, and Kernels of the Fruit of Trees also. And indeed seeing the Young of every Animal in their several species arrives to a considerable bulk before it hath any Animal life, during which time it encreases and grows merely as a Vegetable; there is no such great difference in the first principles and manner of growth of Vegetables and Animals as is commonly conceived. And therefore to satisfy the Curious, and to lay the lower and firmer foundation for my design, I shall in the first place premise the manner of procedure in the vegetation of Seeds from the microscopical observations of Malpighius in his second Part of the Anatomy of Plants.

Now

Now that both Vegetables and Animals should proceed from Eggs, will seem no very strange notion to him that hath read the Saying of some old Philosophers, *Ex Ovo omnia*, that all things are from an Egg: though I must confess that it is not necessarily to be understood in my sense, but possibly means no more than that the first formation of all things was from an Egg, according to the opinion delivered by Aristophanes in his *Aves*, p. 573. (quoted by Doctour Cudworth in his *True Intellectual Systeme of the Universe*, p. 121.) namely that at first there was nothing but Night and Chaos, which laying an Egg, from thence was produced Love, and that mingling again with Chaos begot Heaven and Earth, and Animals, and all the Gods. Whose Greek Verses to this purpose are thus translated by the aforesaid Learned Doctour.

First all was Chaos, one confused heap,
 Darknes enwrapt the disagreeing deep;
 In a mixt croud the jumbled Elements were,
 Nor Earth, nor Air, nor Heaven did appear;
 Till on this horrid vast Abyfs of things
 Teeming Night, spreading o'er her cole-black wings,
 Laid the first Egg; whence after Time's due course
 Issu'd forth Love (the World's prolifick source)
 Glistring with golden Wings, which flutt'ring o'er
 Dark Chaos, gendred all the numerous store
 Of Animals and Gods, &c.

I know that the term Egg is not alike properly applicable to the first seed or principle out of which every thing is formed; but for distinction sake it may seem more proper and intelligible to call such principle by several names; as in Humane kind and Quadrupeds to call it a conception; in Fishes to name them Roes (though in Latin they have no other name but Ova, Eggs;) in Frogs, the Spawn; in Insects, as Butterflies, &c. Worms (according to Aristotle;) as likewise in Plants to term them Seeds; in the fruits of Trees, Kernels. I say it may seem more proper to retain this vulgar way of speaking, and rather use these sundry appellations, than to confound them all under one general one: I will not therefore contend about words, but shall readily permit every man to use his own phrase; onely I contend for the thing, hoping to make it appear

The Preface to the Discourse

appear that there is so great an analogy or likeness in Nature amongst all these, that nothing (but the common way of speaking) hinders, why they might not all be included under one denomination.

If any think I begin too far off my scope, to treat of the vegetation of Plants, when my design is to explain the generation of Animals; besides what Apology the thing it self will make for me with every Intelligent Reader, Moses's History of the Creation seems to authorise such a method, and to chalk out my way for me. We find the Almighty proceeding every day from the more imperfect and ignoble Creatures to the more perfect and noble: Whence on the third day he commands the Earth to bring forth Grass, the Herb yielding Seed, and the Fruit-tree yielding Fruit after his kind, whose Seed is in it self, upon the Earth. On the fifth day he commands the Waters to bring forth abundantly the moving Creature that hath life, and Fowl that may flie above the Earth in the open Firmament of Heaven. And lastly on the sixth day he bids the Earth bring forth the Living Creature after his kind, Cattel and creeping thing, and Beast of the Earth after his kind: and on the same day he created Man in his own image to have dominion over the Fish of the Sea, and over the Fowl of the Air, and over the Cattel, &c. Whether God observed such a successive order of time in the Creation, as the holy Text describes, or whether the History be onely so delivered for our better apprehension, is too deep and bold a speculation for me to meddle with: but it is plain that it literally accords with the nature of the things created; seeing the progress is natural from Vegetation to Animality, and from thence to Rationality. For thus a Man is for some months onely a sort of Vegetable, capable of increase of Parts, but without sense or motion, which afterwards he comes to be indowed with, but without any exercise of Reason till some time after his birth. But this last consideration is beyond my purpose, and onely mentioned to shew, that the same method Moses observes in the History of the Creation, is natural enough to follow in an History of Generation.

2.
The efficient
Cause of Ge-
neration.

As to the efficient Cause of Generation, that is the geniture of the Male. I speak of proper generation, and of such Animals whose species consists of Males and Females. For there is a generation called equivocal, such as that is said to be of
Frogs

of the Generation of Animals.

7

Frogs generated out of the Mud of the River Nile by the heat of the Sun: and there are some Animals whose whole Species are Hermaphrodites as it were, partaking of both Sexes, and generating within and of themselves, even as Plants do. Of these I must not be understood, but of such whose generation is performed by a copulation of Male and Female.

Lastly, as to the method and order of the formation and increase of the Parts of the Animal, till it come to be a perfect one of its kind, it would be preposterous to enter upon the treating of them in this place; I shall therefore refer the Reader to the following Discourse, to which I now address my self.

^{3.}
The order of
the forma-
tion of the
Parts.

C H A P.

of the Generation of Animals

From generation out of the kind of the River Nile by the heat
of the Sun: and there are some Animals whose generation
are Heteroploides as it were, partaking of both sexes, and
generating within and of themselves, even as Plants do.
These I must not be understood, but of such whose generation is
performed by a copulation of Male and Female.

The order of
the letters
of the
Title

As to the method and order of the formation and
increase of the parts of the Animal, till it come to be a perfect
one of its kind, it would be propitious to enter upon the treat-
ing of them in this place; I shall therefore refer the Reader
to the following Discourse, to which I now address my self.

CH A P

C H A P. I.

Of the Vegetation of Seeds, particularly of a Wheat-corn.

THE conception of an Animal and the first formation and encrease of an Embryo in the Womb, corresponds very much (as we have already hinted) to the Seed of a Plant and its vegetation in the Bosom of the great and common Mother, the Earth. Wherefore the observing in what manner a Seed proceeds to a Plant being obvious to every Man; to give an account of such observation may much conduce to the better apprehending by what degrees a Conception grows to a perfect *Fœtus*. But the parts of a Seed being so minute, that the naked Eye can make no perfect discovery of the first rudiments of the Plant that is formed out of it, it is necessary to make use of a Microscope to greaten the Objects, which the most curious *Malpighius* hath done with that accuracy as to render further inquiry and examination needless. I shall therefore give you an account of his observations of this kind in as few words and as plain as I can.

The Eggs (or Seeds) of Plants being excluded out of the Mother's Egg-bed (called a Pod, or Husk, or by whatever other name distinguished) requiring further fostering and brooding, are committed to the Earth by the officious Winds, or by the industry of Men. This kind Mother having received them into her Bosom, doth not only give them incubation or brooding by her own halituous vapours joined with the heat of the Sun-beams; but doth by degrees abundantly supply what the fruitfull Seeds stand in need of. For she every-where abounds with little chanelles or sinuous passages, in which the Rain-water satiated and impregnated with fruitfull Salts does run like the Bloud and Chyle in the Arteries of Animals; which moisture is transcolated or strained through the Pores or Pipes of the outer rind or husk (corresponding to the Membranes that invest the Embryo's of Animals) on the inside of which lie the thick seminal Leaves, which are commonly two, (though in that which we shall instance in by and by, it is but one) that answer to the *Placenta* or Womb-cake in Women, or to the Cotyledons in Brutes. For the substance of these two Seed-leaves consists of a great number of little bladders or bottles; and of Navel-vessels, or a Navel-knot. Into the bottles is received the fruitfull moisture of the Earth that is strained through the rind of the Seed, which makes a small fermentation with that proper juice that was inherent originally in the Seed-leaves; and this fermented Liquor is conveyed by the umbilical Vessel to the Trunk of the Plant, and to the Germ or Bud that is continued to it; whereupon a vegetation and increase of the Parts succeed.

This, in short, is the manner of procedure in the vegetation of Plants; how far it agrees with the first formation and encrease of the Embryo's of

Animals, will be made more plain by and by. In the mean time, that what I have here abstracted out of the above-mentioned most ingenious Authour, may be the better understood, I have thought good further to transcribe out of him an instance or example of this procedure, and to exhibit the same also in a curious Figure to the Eye of the Reader that cannot so well conceive of it by the bare verbal description. My instance shall be in a grain of *Wheat*.

An History of
the vegetation
of a Wheat-
corn.

“The *first* day after it is sown, it grows a little turgid, and the secundine or husk gapes a little in several places. The body of the Plant A being continuous with the conglobated Leaf, (which is called the flesh of the Seed that makes the flowr) swells not onely with the Gemm or Sprout, that is, with the future Stem B, which is opened and waxeth green by degrees; but also the lateral Roots CC do bunch out a little; and likewise the lower Root D becoming green jets somewhat out; whence the *Placenta* or Seed-leaf E becomes loose and gapes. The body of the Plant is continued and knit, by the Navel-knot F, to the conglobated Flowr-leaf, which supplies matter for vegetation.

“In *two* daies the Secundine or Husk G being broken through, the Stem, or top of the future Straw H appears on the outside of it, and with its top is a little distant from the Leaf (that is continued to it) growing upward by degrees. The Seed-leaf I guarding the Roots, becomes turgid with the little bladders, and puts forth a white down; this Leaf being pulled away, you may see the Roots of the Plant made bare, of which the long one K is very apparent, but the two others LL are more obscure. The top of the Stem H is crooked; and within, the Gemm or Bud and future Leaves and Stalk lie hid. Between the Roots and ascending Stem, the trunk of the Plant is knit by the Navel-knot M to the Flowr-leaf which is very moist, but as yet keeps its white colour, and its proper and natural taste.

“The *third* day approaching, the pulp of the conglobated or round Leaf becomes turgid with the juice that it has received from the Earth fermenting with its own genuine juice. The Plant encreases in bigness; and its Bud, or Stem N becoming taller, from whitish turns somewhat green; and the lateral Roots OO break forth greenish and pyramidal from the gaping Sheath P, which adheres closely to the Plant. The lower Root Q becomes longer and hairy, having many Fibres growing out of it. At the same time, in such Seeds as are more quick and forward, the lower Root R is larger, growing green in its end, and the Side-roots sprout out of the Sheath S that invested them: which Sheath swelling with white and thick bladders, is continued, like a bark, with the outer and investing substance. Abundance of hairy Fibres hang all along upon the Roots, except upon their tip: those which grow about their basis are longer, and those which follow, become shorter and shorter. They twirle about the saline Particles, and little lumps of Earth, like Ivy, whence they grow curled. The *Placenta* T fades by degrees, and above the lateral Roots SS there break out two other little ones UU. The Stem X being roundish and waxed bigger grows streight upwards.

“Towards the *end* of the *third* day, the Stem Y tending upwards, makes as it were a right angle with the seminal Leaf Z lying horizontally: it is slenderer and more longish; and its outer cover is white, and bright or transparent, guarding the tender and greenish Gem. The

“last

“ last Roots *a* jet out more; and the other three growing larger are cloath-
 “ ed with a down, that straitly embraces the lumps of Earth: this down
 “ is so luxuriant, especially where it meets with any vacuity, that its hairs
 “ uniting with one another make a kind of net. The conglobated or
 “ Flowr-leaf *Z* is softer, and milky as it were; whence if one bruise it, it
 “ yields a white and sweetish juice like Barly-cream: if one pull the
 “ Plant from it, the Roots and Stem of the Plant are plain to be seen:
 “ also the intermediate Navel-knot *b* appears, whose outer and investing
 “ part is more solid like bark; but the inner part is more soft and mar-
 “ rowy.

“ At the end of the *fourth* day, the Stalk tending upwards, (the outer
 “ or Sheath-leaf *c* being loosened) puts forth the *Stable-leaf d* that is green
 “ and folded. Below, the afore-described Roots grow longer; and there
 “ appears a new tumour (sometimes two,) of a future Root *e*. The Seed-
 “ leaf *f* also that hangs upon the Plant begins to fade, whose remaining
 “ juice notwithstanding is as yet white and uncorrupted. If one cut the
 “ Stem insunder, the rise of the tender Stalk *g* appears to be from the Na-
 “ vel-knot, from which also the Roots take their beginning: outward-
 “ ly likewise the Sheath-leaf *c* is to be seen, wherein the Stalk, and its
 “ Leaves, and the rise of the Roots are infolded.

“ About the *sixth* day, the *Stable-leaf b* being loosened, the Plant
 “ mounts upward, the thick Sheath-leaf *i* as yet cleaving about it like a
 “ bark. The Seed-leaf *k* on its outside is sinuous or full of crinkles, and
 “ faded: this being cut and freed from the husk or secundine, the *Flesh*
 “ or *Pericarpium* is not alike all over; for its outer part, whereby the
 “ outside of the Seed or Grain is heaved up, is more solid, and looks like
 “ a concave Leaf: it hath the same appearance also in that part whereby
 “ it sticks and is continued to the Navel-knot: but its inside is fistulous
 “ and fill'd with humour, especially that part of it that is next to the Na-
 “ vel-knot. The Leaves being pull'd off, the Roots torn, and the Flowr-
 “ leaf removed, the trunk appears, in which, not far from the Roots,
 “ the Navel-knot *l* bunches out, which is solid, and hard to cut: above,
 “ there is the mark of the Sheath-leaf *i* that was pull'd off: under this,
 “ as in an Arm-pit, the Gemm *m* is often hid; beyond which there is like-
 “ wise a knot, with the skar of the torn off Leaf *n*, and in the top the
 “ soft Gem *o* is kept; and thus the whole bulk of the future Stalk is had
 “ in this *compendium*. The hinder-part also of the Plant shews the
 “ breakings forth of the Roots; likewise the faded *Placenta* or Seed-
 “ leaf *p*, and the skar of the Sheath-leaf *i*, with the following Knots and
 “ Gemm *o*.

“ After the *eleventh* day, the Seed-leaf *q* often as yet sticking to the
 “ Plant, is crumpled and almost corrupted; for being opened, it yields
 “ an humour with airy bubbles: within, it is hollow, and about the se-
 “ cundines the mucous and white substance of the Seed, being continued
 “ even to the Navel-knot, formes a cavity. All the Roots becoming lon-
 “ ger put forth new Branches out of their sides; and the Stalk, though it
 “ have taller Leaves, yet for the most part it is no longer than the trunk
 “ above delineated: for as yet the knots and gems being very near to one
 “ another, are not far from the Navel-knot. Sometimes, the vegetation
 “ making progress, the spaces betwixt the knots are larger; and the
 “ Sheath-leaf *r* being pull'd off the side, a Knot *s* appears, out of which
 “ there sprouts forth a Leaf *t* that fosters the ascending Stem. In the mean

“ time the seminal Leaf withers, and is emptied on its inside ; and if one
 “ prefs it, it yields nought but Water. The white and solid internode
 “ (or space between the Knots) is lengthned, and new Gemms appear ;
 “ and the middle Root grows to be several inches long.

“ After a *month*, both the Roots and Stalk being grown longer, new
 “ Buds *uu* appear to be breaking forth of the first Knot, and very little
 “ Tumours *xx* bunch out, which at length break forth into Roots : for
 “ Roots sprout out so easily, that sometimes if one pull off the first
 “ Roots, there will abundance of new ones arise in their stead. Like-
 “ wise at the same time, the Stem being established with its usual Roots,
 “ puts forth new ones *yy* which break through even the Sheath-leaf that
 “ cloaths it : and it also rises up with a white joint that is full with-
 “ in. Above the Roots from the same Knot grow two Buds *zz*, guard-
 “ ed with their proper Leaves ; and the intermediate Stalk runs up-
 “ wards.

This History it was thought good to translate at its full length,
 (though there are some particulars that may seem beyond our purpose,
 and which are not mentioned in the general description of Vegetation
 that was premised) lest we should be injurious to the most ingenious
 Authour by concealing any of his discoveries. But passing by *them*,
 it will appear plainly by the following discourse, how little the forma-
 tion of an Embryo and first encrease of its Parts, differs from the first
 springing of a Vegetable ; and then the Reader will further see how
 natural and reasonable it was to begin with the description of this latter,
 the better to explain the former.

C H A P.

C H A P. II.

Of the first rudiment of an Egg, and what way it passes to the Uterus; also how it attains to its great bulk, and how it becomes fruitfull.

ANIMALS are commonly, distinguished into *Oviparous* and *Viviparous*; by which we are not to understand any specific difference in the first principle or original matter of one and another, as if *Oviparous* Animals propagated their Species by Eggs, and *Viviparous* theirs by a mixture of the Male and Female's Seed in the Womb, out of which a Conception should be formed; as many Philosophers have taught: but no more ought to be meant by it, than that some Animals exclude their Eggs out of their Body, which are afterwards hatched either by incubation or brooding, (as in Fowls;) or by the bare warmth of the Sun, (as in Insects;) or by some other means; whereas others retain their Eggs within their Bodies, which are hatched (as it were) in their *Uterus* or its *Cornua*, and when an Animal of their respective Species is formed out of any one, it is afterwards excluded. Which truth, that it may the better be entertained by the prejudic'd Vulgar, I will first shew the procedure in the generation of *Oviparous* Animals, and afterwards examine what analogy thereto there is in *Viviparous*, and in both of these to Vegetables, as to the Embryo or first lineaments of the *Fœtus*, both as to formation and nutrition.

What the difference is between *Oviparous* and *Viviparous* Creatures.

Being then in the first place to deliver the History of the generation of *Oviparous* Creatures, I shall wave such as exclude Eggs that are less perfect, as Insects, Reptiles, and Aquatiles, (which last we have no opportunity to examine) and pitch upon Fowl whose Eggs are most perfect; and out of them shall chuse an *Hen*, which is most familiar and ready at hand for making observations upon. And that I may omit nothing that will illustrate the similitude, it will be convenient to begin with inquiring, *first*, into the first principle, or rudiment of an Egg; then, *secondly*, see by what way it passeth to the *Uterus*; *thirdly*, how it attains to that great bulk it hath when excluded; *fourthly*, how it becomes fruitfull; and *fifthly* and lastly, by what degrees a Chicken is formed out of it, exhibiting in Figures taken from the life, of what shape it appears each day from that time any of its Parts are so discernible as to be delineated, till it is become so perfect, that one cannot take a view of or examine its inward parts without dissection. The first four heads of inquiry I shall dispatch in this Chapter, leaving the last of them (which is the main one for our purpose) to the next.

The *first* thing to be examined is the *Ovary* or Egg-bed, where the first rudiment of the Egg appears. And here it would be too far from our purpose to shew the differences of the *Ovary* of an *Hen* from that of some other Fowl, much more of Fishes, Serpents, &c. seeing those differences consist onely in lesser circumstances, which concern not our scope: for in this they all agree that they have an *Ovary*, and that the first principles of the Eggs are to be found therein.

The first rudiment of an Egg.

This

The Ovary.

This Ovary in an Hen is seated at the Back-bone upon the great Artery and Vein descending, a little lower than the Liver, at the same place where the Cock's Stones lie, which is about the place where in Viviparous Animals the preparing Vessels that go to the Testicles arise. In this the Eggs appear first of a white colour, being as small almost as Sea-fand. But after they are grown a little bigger, viz. about as big as Hail-shot they turn yellow, and are truly onely the Yelks of the Eggs that shall be, which afterwards acquire Whites, as we shall shew by and by. Each of these Yelks is invested with a proper Coat, and besides, borrows another from the Ovary, by which they are severally knit to its *foundation*, or *root*, that is, to that part of it that sticks to the descending Trunks of the great Artery and Vein; so that hereby they are sustained in their place, even as the Testicles in Men are clad and suspended by their *vaginal* Coat that is borrowed from the Rim of the Belly (or *Peritonæum*.) Those of the Yelks that are outmost are largest, those in the middle less, but those the nearest the foundation, least of all.

2. *Which way the Egg passes from the Ovary to the Uterus.*
Secondly, Adjoining unto and embracing the Ovary is the *Infundibulum* or *Tunnel*, which consists of a very thin and yielding Membrane. With its Orifice it encompasses the Ovary, and descending lengthways of the Back is continued unto the upper and narrower part of the *Uterus*, by Doctour *Harvey* called the *Process* of the Womb. As the Yelks of the Ovary come to maturity, they drop off it one after another, and fall immediately into the mouth of the Tunnel, in which they make no stay, but are conveyed by it quickly into the *Process* of the *Uterus*. This *Process* hath many folds or cells, like as the Gut *Colon* has in most Creatures, which contribute not onely to the longer stay of the Egg in it, but make it more convenient for the collection of that whitish clammy humour that so plentifully bedews it, out of which the Yelks gather their White. For

3. *How it is encreased.*
Thirdly, Though the Yelks while they remain in the Ovary are nourished and encreased by the Arterial blood as all other Parts of the Body are; yet as soon as they are dropt off from thence, they never adhere afterwards or grow to any Part whereby any Blood-vessels should be inserted into them: but as they make no stay in the Tunnel, so do they not adhere to the sides either of the *Uterus* (specially so called) or of its *Process*. But there being great store of Arteries dispersed through them both, these spew as it were out of their small mouths (that open into the Cavity of the *Uterus* and its *Process*) a great quantity of a whitish chylous liquor, which the Yelks by an innate vegetative principle attract and assimilate to themselves, and which constitutes their White. Now seeing (as we noted above) that the Yelks as they come from the Ovary, have two Coats, one proper, and another borrowed; I am of an opinion that the White is collected betwixt these two; namely, that the uterine humour transudes through or is imbibed by the borrowed Coat, but is stopped from proceeding further towards the centre of the Egg by the proper Coat which is more dense and close. For the *foundation* of the Ovary from whence this outer Coat is borrowed, is of a loose spongy substance, whence 'tis probable the Coat is so likewise. Onely 'tis likely that some particles of this humour penetrate through the inner Coat also, by which the Yelk receives increase, and also some alteration in substance from what it was of, while it remained in the Ovary. Though I think this opinion is new, yet I am the bolder to profess it, not onely because it can-

it cannot well be conceived how a new Coat should be acquired in the *Uterus*, seeing the Egg adheres to no part from which it should receive it; but much more from the Analogy there seems to be between the nutrition of an Egg (in Hens) and that of a Conception (in Viviparous Animals.) Now every Body knows that a Conception when it is never so small, is clad with two Coats, the *Chorion* and *Amnios*, and that the Albuginous liquor of the Womb transudes through them both for the nourishment of the Embryo contained in the *Amnios*. I say it passes through *both* the Membranes of a Conception, because it was necessary it should arrive at the Embryo which it nourisheth; but seeing the Yelk is so far from resembling the Embryo, that no Part of the Chicken is formed out of it, (for it onely serves for a grosser sort of nourishment for it) the like liquor in an Hen passeth onely through the outer Coat which answers to the *Chorion*, betwixt which and the inner it is collected for the use of the future *Fœtus*. But if we will suppose with Doctour *Harvey*, that there are two Whites, the inner of a thicker consistence, and the outer of a thinner, and that these are included each in a particular Membrane; then as these Membranes answer exactly to the *Chorion* and *Amnios*, so must we suppose that the Coat that was borrowed from the Ovary, was *originally* double, and now onely *begins to appear* so. (But enough of this.) The Egg then beginning to encrease in bulk on this manner at first in the *Process* of the *Uterus*, doth by degrees descend down into the *Uterus* it self, wherein it grows to its full proportion.

Now the *Uterus* is of a carnous substance, but such as may be easily stretched lengthways or breadthways, and except when it is distended with a perfect Egg, is very full of wrinkles and folds, as we described its *Process* (above) to be. When the Egg hath arrived at its just bigness, so that it can no longer be contained in the *Uterus*, it begins to acquire a Shell, which according to Doctour *Harvey* is hard while the Egg is yet in the *Uterus*; though according to *Aristotle* and *Aquapendent* the Shell owes its original to that viscous and clammy humour that bedews the surface of the Egg when it is lay'd, the watery part whereof evaporating, the remainder presently hardens into a Shell. But any Country Housewife may decide this controversie as well as these great Philosophers, who by feeling with their Finger whether the Hen be with *soft* or *hard* Egg (as they use to phrase it) know whether she will lay that day or no: for if she do, the Egg feels, comparatively, hard, though not quite so hard as after it is lay'd.

Fourthly, If one compare an Egg lay'd by an Hen that hath never been trod by a Cock, one shall not find it differ in any one respect (so far as the Eye can judge) from another that is lay'd by one that has used to be trod every day; so that it seems difficult to give a reason why the one should be fruitfull, and the other not. I think it is peculiar to a tame Hen (of which we are speaking) to lay as well without a Cock as with him: in whom therefore the treading is no efficient cause of the Egg, but onely of making it fruitfull.

Now it is very considerable what Doctour *Harvey* and others have observed, that one treading is sufficient to fertilize a whole knot of Eggs, be they twenty or a greater number; which besides what we shall say afterwards, may sufficiently detect the vulgar opinion of Errour, *viz.* that those specks in the Yelk which we commonly call *the treddle*, are the Seed of the Cock; for how can he be imagined to spend so much at one time

The Uterus described.

4.
How an Egg becomes fruitfull.

time as all these must amount to? But to pass by that, it is certain that none of the Cock's Sperm can come to the Ovary; for if the Cock have any *Penis* at all (which Doctour *Harvey* denies) yet it is so short that it cannot reach one quarter of the way between the outer Orifice and the Ovary: yea that part that is between the *Uterus* and outward Orifice, which answers to the *Vagina* in Viviparous Animals, is so full of folds and wrinkles that one cannot pass any thing from without inwards, not so much as a Bristle; so that it is not easy to conceive how the Cock's *Penis* (if he have any) should penetrate even so far as the *Uterus*, which yet is two or three inches distant from the Ovary. But notwithstanding the *impossibility* of the Sperm's reaching the Ovary, and the *improbability* that it is injected so far as into the *Uterus*; yet it is without all question that the fruitfulness of the Eggs is wholly owing to some virtue derived from the Seed. Not that any of its grosser substance doth constitute any part of the Egg; but some subtil *effluvia* or spirituous steams exhale from it into the *Uterus*, which ascend from thence by the Process and Tunnel to the Ovary, fecundating the same. I say the rudiments of the Eggs are fertilized in the Ovary; for it is not probable that the *Uterus* onely should be impregnated thereby with a fecundating virtue or power, which it imparts to the Egg after its descent from the Ovary into it. For though in a tame Hen the Yelks separate and fall off from the Ovary of their own accord, whether she be trod or no: yet in other Fowls it is not so, in whom, naturally, the Hen lays no Eggs if she be withheld from the Cock: and it is not to be imagined but that the Eggs of both are made fruitfull in the same place. Seeing then it is owing to the geniture of the Cock not onely that the Eggs of wild Fowl become fruitfull, but that they lay any at all; (and therefore the prolifick virtue of the geniture must be exerted upon the Ovary from whence the Eggs issue:) we may from hence conclude, that though a tame Hen (by a peculiar property) do lay without treading; yet as these Eggs are all of them addle, so those that are hatchable into Chickens were fecundated before they were parted from the Ovary; for it would be absurd and unreasonable to suppose so great a difference in the impregnating the Eggs of the same Species of Animals, as the contrary opinion intimates, *viz.* that one should be made fruitfull in the Ovary, and the other in the *Uterus*.

But thus much may suffice to have spoken of the origine, encrease and fruitfulness of an Egg; it remains to examine by what means and degrees a Chicken is formed out of it.

C H A P. III.

By what means and degrees a Chicken is formed out of an Egg.

Aristotle in his First Book of the history of Animals, says, an Egg is *An Egg what.* that *ex cujus parte fit principio Animal, quod generatur : ex altera alimentum ipsi generato, i.e.* of one part whereof the Animal is generated, and of another, nourished. It is both the seed and principle of the Young, and also the Womb wherein it is formed, fostered and nourished. Out of one Egg is but one Chicken generated : for if at any time there be two, then are there really two Eggs included in one Shell, as we many times see two Kernels in one Nut-shell.

Now that we may the better know out of what part of the Egg the *Its Parts.* Chicken is formed, and by which part nourished, we are to give an account of *all* the parts of an Egg.

The first and outmost is the *Shell*, which is as the *Womb* wherein the Chicken is hatched. The next is the *White* (or as Doctour *Harvey* will have it, two Whites, the outer being thinner, and the inner thicker) which answers to the nutritious Juice or Chyle in the Womb of Viviparous Animals, and from which the Chicken by its umbilical Vessels receives its first nourishment. And indeed it might as properly be called Chyle, as the Chyle whereby the *Fœtus* in Viviparous Animals is nourished, is called *Albumen* or an *albugineous* Liquor, deriving that name from the White of an Egg, which is so called in Latin : for their names may well be confounded, seeing they are not onely of the same use, but of the same nature also both as to colour and taste, and agree particularly in this, that both of them by the warmth of the Fire will congeal into a gelly.

The next part is the *Yelk*, in Latin called *Vitellum*, from *vita*, because the Chicken *lives* by it. It is otherwise named *Luteum* (the *Yelk* or *Yellow*) from its *colour*. This part also serves for the nutrition of the Chicken, but is of a more terrene and gross nature than the White, and therefore comes to nourish it onely in the second place, when the White is spent, as shall be shewed farther by and by. Both the Yelk and the White are each invested with a Membrane ; yea if there be two Whites, as Doctour *Harvey* affirms, then is the inner and thicker White divided by a proper Membrane from the outer and thinner. Which two Membranes of the White answer exactly to the *Chorion* and *Amnios* in Viviparous Animals, which contain the chylous or albugineous Liquor for the nourishment of the *Fœtus*, as was hinted in the foregoing Chapter. In the Membrane that cloaths the Yelk, towards each end of the Egg is placed a speck or little transparent knot, which are commonly called the *Treddles*, from an opinion that they are the Sperm of the Cock, and that the Chicken is formed out of them. But seeing there are two in each Egg (one towards each end) if these were the Seed or first vegetative principle of the Chicken, then should there be two formed out of every Egg. But Doctour *Harvey* does most ingeniously call them the *Poles* of this

Microcosm, serving for no other purpose, than for the uniting of the Yelk to the White; for though they adhere to the Membrane that invests the Yelk, yet does the larger diameter or half of them jet out into the White. They are called in Latin *Grandines*, Hail-stones, from their colour, as being of a more white and lucid substance than the White, and resembling much both in shape and colour the smaller Hail-stones when they have been a little wet.

Having enumerated all these parts of an Egg, and not supposing any of them to be that which is the first principle of the Chicken, it may be wondred by some, what part is left to which we can assign that dignity. The opinion of the often before-cited Doctour *Harvey* is clear and convincing as to this, *viz.* That it is neither of the Knots before-mentioned, but another white, round and smooth Speck (about as big as a Lentil) that likewise adheres to the Coat of the Yelk, about the middle space betwixt the Treddles. And though it is very little, yet that can be no prejudice to the opinion, with him that considers, that the Conceptions (or *Ova*) of Viviparous Animals, even of the most bulky, are no bigger than a Musquet-bullet, when they are separated from the Testicle or Ovary, which state this white Circle or speck is now conceived to be in, and of which I shall say no more, lest I seem to impose upon the learned and ingenious Reader, whom I would rather advise to peruse Doctour *Harvey* himself as to this opinion, than satisfy his curiosity with this short Abstract of it. But partly for the sake of those that want Doctour *Harvey's* Book *De generat. Animal.* and partly that what follows may be the better understood, I thought it convenient to give a touch of it.

5.
By what means and degrees a Chicken is formed out of it.

Having then concluded upon the first *Seed* or principle out of which the Chicken is formed, let us next consider by what means and degrees it vegetates, and has an Animal generated out of it. We have shewn in the foregoing Chapter, that as to the examination by the Eye, there is nothing in a fruitfull Egg which is not in an addle one; yea even this white Circle or Speck last mentioned is equally found in both: and the reason why it is barren in one and fruitfull in another is its *being* or *not* being impregnated by the Cock's Sperm; such Hens as are not trod laying always addle Eggs, but such as are, for the most part prolifick. (But of this enough before.)

The means is Incubation.

Now the means of putting this generative (or more properly, I think, vegetative) principle into act, is the *incubation* or brooding of the Hen, which influences this *Seed* (or Egg within an Egg) out of which the Chicken is formed, even as the cherishing and benign beams of the Sun foster the Seeds that are committed into the Bosom or Womb of their kind Mother the Earth. Onely here is the difference, that the Seed or Egg of a Plant contains nothing but the vegetative principle, in which as soon as the plastick power is excited, it attracts nourishment from *without* it self, from the Capillary Veins or *meatus* of the Earth, as was shewed at large in the first Chapter; whereas the Egg is both Seed and Womb, containing all *within* it self, necessary both for the formation and nutrition of the *Fœtus*. The reason of which is apparent, namely, that a Plant (be it an Oak of two or three hundred years old) is still but an Infant in regard of its nutrition, by its Roots as by so many Mouths sucking the turgid Breasts of its teeming Mother: whereas a Chick (like all other Animals) as soon as its Parts are once formed and animated, is presently emancipated, as it were, from the Womb of its Mother, neither receiving nor needing any further nutri-

nutriment from thence, but becoming its own Caterer and Carver. Now though the sitting of the Hen excite the plastick power in the aforesaid white Circle, yet is there no vertue derived to it from the Hen her self, seeing an elementary heat which is as gentle, equal and constant as that of the Hen, will have the same influence upon it. Thus as Historians relate, the Egyptians used to hatch their Eggs by the warmth of a Stove; and thus the Estriches Eggs being covered with Sand are hatched by the warmth of the Sun, (which in *Africk* where these Fowls are bred, is much more intense than in these *European* Countreys) the Hen her self neglecting that office, if the opinion of divers Commentators upon the Book of *Job* may be relied upon, where chap. 39. vers. 14, 15, 16. it is said, that *she leaveth her Eggs in the Earth, and warmeth them in the dust, and forgetteth that the foot may crush them, or that the wild Beast may break them. She is hardned against her Young ones as though they were not hers, &c.* Concluding then that a gentle warmth, be it Animal or Elemental, is the *means* whereby a Chicken is formed out of an Egg, we shall proceed to our every days observations, by what *degrees* it is so formed.

As for the first three days all is so imperfect that the state or condition of the Embryo could not with any elegancy or intelligibleness be drawn by the Painter, whom I employed to draw the following Figures for the Engraver: but from the fourth day forwards to the thirteenth, and afterwards on the fifteenth and seventeenth days, you have in the following Table in what state it appeared every day, which I thought good to exhibit to the Eye, that the discourse may be the better understood.

I therefore for this purpose set fourteen new laid Eggs (gathered from several Hens with mine own hands, that I might be sure none of them had been sat upon before,) under one Hen, *July* the first, 1680. upon which I made these following observations.

At the end of the *first* day (or of twenty four hours) the Yelk had changed its situation, being removed from the centre of the Egg up to its blunt end; and it was likewise half turned about; for the Treddles that were towards the two ends of the Egg (the one opposite to the other) were now turned towards the sides: and that white Speck or Knot that adheres to its Coat (out of which the Chicken is formed) instead of being toward the side of the Egg, was now on that side of the Yelk that looked towards its sharper end. This Speck was also a little bigger, but without any other sensible alteration. At the blunt end of the Egg the hollownes, which is natural to all Eggs, was somewhat enlarged, and the Yelk was risen so near it, that it might be seen through the White, or rather through the Membrane of the White, the White it self being almost wholly retired to the sharp end. The Shell, lastly, looked a little more dusky than before.

At the end of *two* days (or 48 hours) the said Speck was enlarged to the breadth of a silver Penny, and seemed to be of different colours, some Parts looking more bright and others more obscure; and its whole Body jetted out into the White without making any dimple or impression into the Yelk, to whose investing Membrane notwithstanding it still adhered. Doctour *Harvey* compares it in this state to an *Eye* (yea calls it by that name) supposing its Centre to resemble the *Pupilla* or sight of the Eye, and its outer Circle (as he calls it) the *Iris*; affirming that the *Pupilla* is the vegetative Seed or principle of the Chicken, and that the

outer Circle consists of the most pure and crystal-like part of the White (being contained within a proper Membrane) from which the Seed receives its first encrease, and that therefore as the former dilates its self, this latter is consumed and obliterated. And this is just what happens in Viviparous Animals, in whom the *Ovum* imbibes some of the pure albugineous Liquor that bedews the sides of the Womb; yea it is the same that happens to the vegetable Seeds of Plants, which attract the like moisture through their Husks (or Secundines) from the Earth: for they all three receive their nourishment this way, till their Navel-vessels are formed, and the first growth of *all* of them is pure (and alike proper) vegetation.

Third day.

At the *end* of the *third* day, I took a third Egg, and breaking it at the narrow end, I found a great alteration in it from the state it was in the day foregoing. For in the centre of the aforesaid Speck I observed a little red Body of the colour of blood, sometime plain to be seen, and anon disappearing (by turns.) In the circumference of the Speck a pretty distance from the centre there was a reddish Circle, betwixt which and the red Body in the centre there run very many slender red streaks. The red Body observed a constant turn of dilating and contracting it self (like to the pulsation of the Heart, which Part it afterward proved) for almost a quarter of an hour, in which time the Egg being grown cold, its motion then ceased. By this motion it appears there is now a progress made from vegetation to some degree of Animality. The slender red streaks that run from the centre to the circumference, seemed all to arise from one Trunk, and afterwards proved the Navel-vessels, which branching out both into the White and Yelk convey nourishment from thence to the Chicken.

Fourth day.

At the *end* of the *fourth* day all these Parts-before-mentioned appeared more plain. The little red Body in the centre now seemed to consist of two parts, whereof whilst the one contracted it self, the other was dilated, and on the contrary; which gave me a suspicion, that one of them was the Heart, and the other the Earlets, whose contractions and dilatations (or systole's and diastole's) in perfect Animals observe that tenour; and so I perceived they afterwards proved. The bloody streaks were now extended further than the reddish circle, both towards the White and towards the Yelk: and the Trunk from whence they sprang, looked not now so fair red as it did before, but somewhat more dusky, as if something of an ashy or dull white colour adhered to its outside, being as it were of a woolly substance, and sticking upon the Trunk of the Vein like moss upon the bough of a Tree. The cavity at the blunt end of the Egg was grown a pretty deal larger than before. The two little red Bodies continued their beating longer than the one had done the day before; and as soon as they ceased I took them out, and also the Ash-coloured part of the Trunk of the Vein, and put them in fair-water; wherein as the first presently lost their colour, so the latter lost its shape and aspect it had within the Egg; for I had fancied it to appear like the first rudiment (or *stamen*) of the Body of the Chicken; but the woolly substance was not of consistence firm enough to retain its former figure in the water: however I perceived as well by the experiment of the next days Egg, as also by another Egg that I since broke on the fourth day, that I had fancied right. The form it was in, when taken out of the Shell on this fourth day, you have delineated in the *first Figure* of the following Table, which

which shews the Ash-coloured Trunk and woolly substance, and some of those red streaks adhering to it, or proceeding from it.

At the *end* of the *fifth* day the two little red beating Bodies were grown of a fainter colour, for by this time the Parenchyma of the Heart was begun to gather about them. A little distance from these there appeared the first rudiments of the Head, consisting of four bubbles, two of which were clear and transparent, but the other two of different colours. The two clear ones were the Brain and Cerebel, and those of different colours were the Eyes: These two last appeared much bigger than either of the other. One might also discern the Bill which looked white. In the same Egg I observed likewise the rudiments of the Lungs and Liver, which last gathered upon or grew out of the Umbilical Vein. The woolly substance before-spoken of, that gathered about the Trunk of the Vein, was now of a more solid and close contexture, and did plainly appear to be the first rudiment of the Carcase of the Chicken, out of which both Wings and Legs were begun to bud and to be very discernable. This Embryo, though all its Parts were imperfect, did yet appear to have life in it, for I could observe it to bow it self to and again. Of what form it appeared when it was taken out of the Liquor wherein it swam, you have delineated in the *second Figure* of the following Table, being drawn by one that was taken out of an Egg that the Hen had sat upon five days compleat; which Embryo as also all the rest that we shall hereafter in the following discourse speak of, I did preserve by a Liquor prepared for that purpose, and have them all hanging up against a Board in the same posture as they are represented in the said following Table.

At the *end* of *six* days all the forementioned Parts were more visible, yea there is not any Part of the whole Body but a scheme of it now appeared. The Heart had acquired its proper shape, but looked white, as did also the Lungs and Liver; the Eyes stood gogling out of the Head, and each of them was as much bigger than the Brain, as the Head (taking in all its Parts) was bigger than all the rest of the Body. The Brain and Cerebel were as yet onely of a watery substance, of which the latter stood jetting out above the former. One might make some faint discovery of the Spine or Back-bone, looking whiter than the rest of the Parts about it, as also of the Ribs that were extended forward from it like the finest and whitest threads of Lawn. There were also the Lineaments of the Intestins, which, as also the Heart, Liver and Lungs, may be seen without dissection; for as yet and for some days after, all the trunk of the Body lieth open before, so that the Entrails lie bare, the first rudiments of the Body beginning backwards and reaching forwards by degrees; even as Ship-carpenters begin with the Back or Keel of the Ship first, and raise up her Sides from thence. The Legs were not onely apparent at this time, but the Feet were also distinguished into Claws, both which it could move. The form of it you have described in the *third Figure* of the following Table.

As for the *seventh* and *eighth* days, some business calling me out of Town I was prevented from making my observations on this brood of Eggs; but in others that had been sat upon seven daies, I found no alteration from the appearances of the day foregoing, saving that every Part was more plain and compleat; as neither in others on the eighth day, saving that once in an Egg that had lain under the Hen but eight days, I could not see the Heart beat without a little dissecting the Breast, which was

was begun to close it self over it. The state of the Chicken on these daies you have delineated in the *fourth* and *fifth* Figures.

Ninth day.

At the *end* of the *ninth* day (being returned home again) I broke another of the Eggs, and could not now discover the Heart, for the Chest was closed over it though but very loofely and imperfectly. (Though in another Egg broken at the same time, which another Hen had sat on, I could see the Heart move without dissection.) I perceived the Chicken to move its Legs, Wings and Head, and indeed all its Parts: Its Head was almost as big as all its Body besides; but especially its Eyes continued of a prodigious bigness, staring out of its Head: They were at least as big as small Pistol-bullets. The White of the Egg was a great part of it consumed already on the nourishment of the Chicken; and I could plainly see its umbilical Vessels now reach to the Yelk, which seemed as yet to have no part of it spent; its Parts were of different consistence, some thinner and some thicker; that was thinner wherein I could perceive the capillary Threads of the Navel-vessels to be dispersed. Both the Heart, Liver and Lungs were still of a whitish colour, and their Parenchyma had acquired no firmness of substance, though they had attained very near to their proper shape. The *sixth* Figure expresses the Chicken in the posture of this day.

Tenth day.

At the *end* of the *tenth* day I examined another, wherein I found the Chest pretty firmly closed, but the *Abdomen* or lower Belly lay yet quite open, and the Stomach and Guts hung out of it. On its Back I discerned a great many blackish specks, which were the rudiments of the Feathers breaking out. The Eyes continued much in the same posture as on the day before, being as yet but very little drawn within their Orbits. Neither were the Brain and Cerebel as yet perfectly withdrawn to within the Skull. The White of the Egg was still more decreased, but the Yelk little or nothing diminished. Concerning which there is this one thing very remarkable; That though addle Eggs begin to stink and grow rotten by the warmth of the Hen, within four daies time from her first sitting on them, and every day encrease in their putrefaction the longer they are sat on: yet till this time the White that remains and also the Yelk in fruitfull Eggs, retain their proper smell and favour; yea the Yelk, that is not all of it consumed when the Chicken is hatched, (but is part of it received to within its Belly) I say what remains of it till then, tastes as sweet as the Yelk of a new-laid Egg. (But this by the way.) See the Chickens shape of this day in the *seventh* Figure.

Eleventh day.

At *eleven* days *end* I broke another, and admired to see the Feathers so much encreased; for not onely those on the Back, which I observed breaking out the day before, were now become plain Feathers, but all its Body over almost was covered with the like. Its *Abdomen* lay yet open, and its Guts jetted out of it; but the Brain and Cerebel were now withdrawn perfectly within the Skull; but its Eyes stood gogling out still. One might discern its Rump also formed, and Feathers budding out of it resembling the Tail. But though the Chicken had attained to this maturity, yet neither this, nor that I examined the day before, lived so long as those on the two or three days before; but this I believe, happened through my chancing to wound the Navel-vessels in both, which caused them to bleed, and thereby I suppose hastned their death. The *eighth* Figure expresses this days Chicken.

All the Parts being now entirely formed, it would be but the repetition of the same things over again and again to give a particular account of each days proceeding, from the *twelfth* to the end of the *seventeenth*, till which time the Abdomen lies open still: onely I shall give a short account of some little alteration that happens in this interval; which is not so much in the Chicken it self, as in the Liquors it is fed by, and in its umbilical Vessels. Doctour *Harvey* says its umbilical Vessels are five, three Veins and two Arteries. One of the Veins arises from the *Cava* above the Liver: this is the largest, and sends forth its branches into the White, which being now in a manner spent, the branches of the Vein begin to wither, and by degrees are obliterated: But the other two Veins which spring from the *vena Portæ* continue longer, having their branches distributed into the Yelk, which as yet is but a very little of it consumed. These are accompanied by two Arteries that spring from the *Lumbares* or Loin-arteries. As the White is spent, the Membranes that contain'd it, begin to shrivel up and contract themselves, and to cleave one to another, as the *Chorion* cleaves to the *Allantoides* in Viviparous Animals. The Chicken now having no Liquor to swim in (as it did whilst the White remained) rests its Belly upon the Yelk (which is drawn closer towards its *Abdomen* by the Membranes, still more and more contracting themselves) with its Head commonly under the right Wing. If one dissect its Breast, one shall find its Heart and Lungs to have obtained almost their natural redness; but the Liver looks of somewhat a yellowish white. If one open the Head, the Brain hath acquired a pretty solid substance, whereas till of late both the Brain and Cerebel seem'd to consist of nothing but water. The Eyes continue still to stand staring out of their Orbits a pretty deal further than they do when the Chicken is hatched. Its gradual encrease in this interval, *viz.* on the *twelfth, thirteenth, fifteenth* and *seventeenth* days you have expressed in the *ninth, tenth, eleventh* and *twelfth* Figures of the following Table.

On the *eighteenth* day the Guts are withdrawn to within the *Abdo-* *Eighteenth*
men, and together with them that which remains of the Yelk, from *day.*
 which the umbilical Vessels continue to derive nourishment to the Chick, even after it is thus included in the Belly; yea, even after the Chicken is hatched: for it is not all spent till several days after. And this was a necessary provision of Nature, that seeing the Hen affords it no nourishment (as Viviparous Creatures do to *their* Young ones) but it must be its own Carver and feed it self after the same manner as its Mother does; I say, Nature for this reason hath prudently provided, that it should still be nourished by its umbilical Vessels, till its Bill have acquired some strength, and it have learned to pick for it self. The largest umbilical Vein that is derived from the *Cava* and was distributed into the White, is now quite obliterated, the White being all of it consumed. One may perceive the Chicken to bustle about in the Egg, and if one hold it to his Ear, it may be heard sometimes to peep, but more and more towards the twenty-first day, which is the usual day of hatching; till which time from this eighteenth day it were to no purpose to give any Figure of what state the Chicken is in, seeing, now that the *Abdomen* is closed, there would appear no Part but onely the surface of its Body which is all covered with Feathers. We shall speak therefore no further of the manner and degrees of its generation, nor exhibit its daily condition in Figures, but onely add a word or two of its *hatching*.

How the
Chicken is
hatched.

Three weeks is reckoned the usual and natural time for Chickens to be hatched in. At the one and twentieth day therefore, or at the longest on the two and twentieth the Chicken having spent all the provision Nature had provided for it in its little mansion; but more especially wanting a freer Air to breath in, it begins to be uneasie, and to meditate and endeavour an exit. It is to be noted that naturally there is in every Egg a little cavity in its broader end, which is filled (as I may say) with congenit Air: As the cavity encreases, this Air must needs be rarefied so as to fill up the empty space; for the Shell seems of so dense and compact a substance as to admit none of the external Air into it: or if we do suppose it to be so porous as that the outward Air can insinuate it self into it, yet will it not be sufficient for so free a breathing as is necessary for our mature and full grown Animal; much less would that congenit Air, before-mentioned, (so much rarefied as it must be) suffice for it. The Chicken hath however some sort of respiration, or else it could not peep; for that voice must be formed by the Air in expiration. But I say it requires a freer breathing than this comes to; and therefore by scratching and pecking against the Shell, it strives to break prison. In doing which it hath no help from the Hen, (whatsoever some may affirm of her breaking the Shell for it) as Viviparous Animals afford to their Young, whose Wombs that contain the *Fœtus*, being molested by its tumbling, are excited to endeavour an expulsion; whence the birth is almost wholly owing to the Dam, that by her throes excludes her *Fœtus*, and to the *Fœtus* no otherwise than as by its motion it causes an uneasiness to the Dam. The Shell notwithstanding (that is like an external Womb) is partly prepared for the easier exit of the Chicken; for by its having been kept warm so long by the Hen's brooding upon it, and by the White's being consumed within it, it is now become dry and brittle, and readily admits of the impressions of the Chickens Bill pecking against it; and much more easily will the Membranes wherein it is invested (which may be called its Secundines) be penetrated and broken through by such means. The Chicken then is wholly owing to its own pains for its exclusion out of the Egg; for by its Bill (as with a battering Ram) it demolishes and dismantles the walls of its Prison, and passing out through the breach obtains its freedom.

Hitherto it may suffice to have prosecuted this instance of the generation of an *Oviparous* Creature; it remains that in the next place we proceed according to promise, to give another instance of that of a *Viviparous* Animal; having done which we shall make a short comparison of the one with the other, and of both with the vegetation of the *Seed* of a *Plant*.

C H A P. IV.

Of the Generation of Viviparous Creatures.

HAVING finished the history of the generation of *Oviparous* Animals, we come in the next place to that of *Viviparous*, wherein we shall be the shorter, by reason there is that analogy betwixt them, that to be too particular would be tedious, seeing it were but to repeat the same things over again. For an *Egg* is as it were a *Conception without* the Body; and a *Conception* may properly enough be called an *Egg within* the Body. I have not had my self opportunity to examine each days proceedings in the generation of this sort of Animal (*viz.* of *Viviparous*) but have such observations made to my hand by the curious *De Graef*, whose Instance is in Rabbits. His observations I shall make use of so far as they are for my purpose, omitting what is otherwise. But before I proceed to them, a few things are to be premised.

First, Those parts which we commonly call the *Testicles* in Females are truly Ovaries, from whence the Eggs (one or more at a time) as they are impregnated with the Geniture of the Male, separate, and being conducted into the Womb or its Horns, by the Trumpers, become there what we call a *Conception*.

Secondly, This Animal whose generation we instance in, forms its Conceptions not in the *bottom* of the Womb as a Mare and some other Creatures do, but in its Horns, into which it is presently divided from the *Vagina* it self, without any *fundus* or bottom at all.

Thirdly, A Rabbit going with young but so short a while, it is to be supposed that all things even from the very first, proceed with so much greater haste, as their gestation is shorter than that of other Animals respectively.

Fourthly, A Rabbit is one of the *placentiferous* Animals, each *Fœtus* having its proper *Placenta*; whereas Mares and very many other Creatures have no *Placenta*, but instead thereof *Cotyledons*, as was noted in the First Book, Chap. 28.

Having premised these things I now proceed to the observations.

“ We made the first tryal (says the above-named Authour) on a Female Rabbit that had not yet accompanied with the Male, in whom the Testicles were small, but contained very many limpid Eggs, which being cut open there issued out a clammy liquor like the White of an Egg.

“ We opened another (says he) *half an hour* after she had taken buck, the *Cornua* of whose Womb lookt a little redder, but the *Ova* in the Testicles were not yet changed, unless they had remitted a little of their clearness: but neither in the *Vagina* nor in the *Cornua* could we perceive any Seed or any thing like it.

“ About *six hours* after the coupling we dissected another, in whose Testicles the Cases of the *Ova* inclined to redness, out of which being prickt with a Needle a clammy and clear Liquor issued first, but Blood followed, flowing out of the Blood-vessels dispersed through the Cases. There was no Seed to be seen in this neither.

“ Four and twenty hours after the coupling we opened another, in one
 “ of whose Testicles we found three, and in the other five Cases of the
 “ Ova very much changed ; for being before the *Coitus* limpid and colour-
 “ less, they were now turned dusky and of a faint red, in the middle of
 “ whose Superficies a little *Papilla* (or Teat) as it were, discovered it
 “ self. When the Cases were cut open, there appeared a little limpid
 “ Liquor in their middle, and in their circumference a certain thicker and
 “ reddish Matter.

“ Twenty seven hours after the *coitus* we inspected another, the *Cornua*
 “ of whose Womb with the Oviducts or Trumpets looked more bloody,
 “ also the extremity of the Oviduct did on every side embrace the *Testi-*
 “ *cle* like a Tunnel. We found no Eggs in the *Cornua*, nor were their
 “ Cases in the Testicles much altered from what they were three hours
 “ before.

“ Eight and forty hours after the coupling we examined another, in
 “ one of whose Testicles we found seven, in the other three Cases chan-
 “ ged, in whose middle the Teats were something more eminent, through
 “ which, by pressing the substance of the Testicles, there issued a little
 “ liquor like the White of an Egg ; but the remaining reddish substance
 “ of the Eggs being now become something thicker, was not so easily
 “ pressed out as before.

“ Seventy two hours (or three days and nights) after the *coitus* we in-
 “ spected another, in which was great alteration ; for the end of the *In-*
 “ *fundibulum* or Oviduct did embrace the Testicles most closely, which
 “ being pull'd off we found in the Testicle of the right side three Cases
 “ a little greater and harder, in the middle of whose surface we saw a
 “ little knot with a small hole in it like a Nipple ; but dissecting these
 “ Cases through the middle, their Cavity was quite empty ; wherefore
 “ we searched the ways through which the Eggs must pass, again and
 “ again, and found in the middle of the right Oviduct one, and in the
 “ outer end of the *Cornu* of the same side two very small Eggs little big-
 “ ger than small Pins heads, which notwithstanding their smallness are
 “ cloathed with a double coat ; out of these Eggs being pricked there is-
 “ sued a most clear Liquor. In the beginning of the left Horn we found
 “ onely one Egg.

“ The fourth day from the coupling we opened another, in one of
 “ whose Testicles we found four, in the other three Cases emptied, and
 “ in the Horns of the respective sides, we found as many Eggs, greater
 “ than the former, which did not stick in the Oviducts or beginnings of
 “ the *Cornua*, but were now rolled on towards their middle ; in their
 “ Cavity we beheld as it were another Egg swimming, far clearer than
 “ in the other before.

“ The fifth day from the coupling we dissected another, in whose Te-
 “ sticles we told six emptied Cases, that had each a notable Nipple,
 “ through whose hole we easily put an ordinary Bristle into their Cavity.
 “ We found also the same number of Eggs, bigger than those on the day
 “ before, in divers parts of the *Cornua*, in which they lay so loosely, that
 “ by blowing onely, one might drive them this way or that way. The
 “ inner Tunicle of these, (or the Egg within an Egg as it were) was be-
 “ come yet more conspicuous.

“ The sixth day after the *coitus* we examined another, in one of whose
 “ Testicles we observed six Cases emptied, and in the *Cornu* of the same
 “ side

“ side we could light of but onely five Eggs near the *Vagina* brought as
 “ it were upon an heap; but in the Testicle of the other side we found
 “ four Cafes emptied, and in the Horn of that side onely one Egg. The
 “ cause of which difference we suppose to be, either because some Eggs
 “ by the Wave-like motion of the *Cornua*, (not unlike the peristaltick
 “ motion of the Guts) being carried downwards towards the *Vagina*
 “ were driven forth; or because being consumed in the Cafes they came
 “ not to the *Uterus*; or light on some other mischance. These Eggs
 “ were as big as small Pease.

“ The *seventh day* from the *coitus* we examin'd another, in whose Te-
 “ sticles we found some Cafes emptied that were greater, redder and
 “ harder than the foregoing, and saw as many transparent tumours or
 “ cells in divers parts of the *Cornua*; out of which being opened we turn-
 “ ed Eggs as big as Pocket-pistol Bullets, in which we could discern no-
 “ thing but the inner Tunicle very plain and a most clear humour. It is
 “ wonderfull that in so short a space of time the Eggs should imbibe so
 “ great plenty of liquor, that whereas before they might easily be taken
 “ out of the Womb, now they could very difficultly.

“ The *eighth day* after the *coitus* we opened another, in the right Horn
 “ of whose *Uterus* we saw one, in the left two cells; one of these was
 “ almost twice as big as the other: for Nature doth sometimes so vary,
 “ that there are Eggs of divers bigness found not onely in divers Animals
 “ of the same species dissected at the same distance from the *coitus*, but
 “ also in one and the same Individual. In the Horns of the Womb being
 “ opened we saw the Eggs a little bigger than the day before; but all of
 “ them, their Tunicles breaking, poured out their clear liquor before we
 “ could take them quite out: for which reason we tried another dissected
 “ likewise the *eighth day* after the *coitus*, to take out whose *Ova* we
 “ used the greatest circumspection; but their Tunicles were so very ten-
 “ der, that they burst as the former: which when we saw, the Eggs
 “ that remained we boiled with the Womb, whereby the liquor that was
 “ in them harden'd like the Whites of Hens Eggs.

“ The *ninth day* after the *coitus* we dissected another that was old; The
 “ Testicles of this were almost as big again as those of younger: In the
 “ right we saw two, in the left five Cafes lately emptied; and besides
 “ these, others that lookt very pale, which we judged to be those that
 “ had been emptied the *coitus* before this, although for the most part
 “ they leave onely some palish points or specks, to which the increase
 “ of the Testicles is owing. The Cafes of the last *coitus* had each a Teat
 “ upon them, but the others were smooth. In the right Horn there
 “ were two, and in the left five Cells, whose substance being more rare
 “ and clear than the other parts of the Womb, was interwoven with ma-
 “ ny twigs of Veins and Arteries. Opening some of these Cells, we
 “ could see the Eggs, but could not take them out whole; wherefore be-
 “ ing compelled to examine the content of the Eggs in the very hollow
 “ of the Cells, we found it clear like Crystal; in the midst whereof a
 “ certain rare and thin cloud was seen to swim, which in other Conies
 “ dissected likewise on the ninth day after the coupling, for its exceed-
 “ ing fineness escaped our sight. The inner substance of the Cells, name-
 “ ly that which receives the hypogastrick Vessels, being more tumid
 “ than the rest, exhibited the rudiments of the *Placenta*.

“ The *tenth day* after the *coitus* we inspected another, in whose right Testicle we found one Case alone emptied, which by reason of the Blood-vessels dispersed plentifully through it was redder and had a less Teat; in the middle of it there appeared as yet a very small Cavity: but in the left Testicle we found six such Cases. In the Horns of the Womb we found also so many Cells, namely one in the right and six in the left, distant a finger's breadth one from another; in the midst of which Cells lay a rude mucilaginous draught of the Embryo like a little Maggot; one might also plainly discern the *Placenta*, to which the Egg by means of its *Chorion* was annexed. The liquor of the Eggs being boiled with the Womb hardened like the White of an Egg, and tasted like the boiled congealed substance of the Eggs in the Testicles.

“ The *twelfth day* after the *coitus* we opened another, in one of whose Testicles we found seven, in the other five Cases emptied, and as many Cells in the Horns much bigger and rounder than the foregoing, in the middle of which the Embryo was so conspicuous, that one might in a sort discern its Limbs, having two bloody specks and as many white ones in its Breast: In the Paunch there grew a certain mucilaginous substance inclining here and there to red. We could not discern more in this shapeless little Animal because of its tenderness.

“ The *fourteenth day* after the *coitus* we dissected another, which had the Cells in the *Cornua* yet larger than the foregoing, and the Blood-vessels more, and more turgid. We also noted that the Cells the larger they grew, came also nearer to one another, the spaces between them being shortned. The Membranes *Amnios* and *Chorion* were knit together, tearing which we saw an Embryo (such as the eleventh Figure of the following Table represents) with a clear and pellucid head, with the Cerebel copped: its goggle Eyes, gaping mouth, and in some sort its little Ears might be discerned also. There was a draught of its Backbone, of a white colour, which bending in about the *Sternum*, resembled the Keel of a Ship: By its sides there run very slender Vessels, whose Branches were extended to the Back and to the Feet. The two bloody specks in the Breast, being greater than the foregoing were the rudiments of the Ventricles of the Heart; at the sides whereof were seen two whitish specks for Lungs. In the Paunch being opened there first shewed it self a reddish Liver, then a white body, to which was knit a mucilaginous matter like a writen thread, being the rudiments of the Stomach and Guts: All which in those that we dissected afterwards, had acquired onely a greater bulk and perfection. And therefore to prevent tediousness by repeating the same things, we will on purpose pass by all the other Dissections we made in this kind of Creature excepting onely one which we made the day before the kindling, that those things that in the former were onely confusedly discerned, may appear plain in this.

“ At length on the *twenty ninth day* after the *coitus* we inspected another that had kindled six weeks before, and in the *coitus* by which she was impregnated had voided all the thicker part of the geniture of the Male, which in some measure did resemble the consistence of a most limpid gelly. In her Testicles we found eleven little whitish Cases; and besides these, others far less, little or nothing differing from the substance of the *Testes*. These Cases of the Eggs in the Testicles seem not to vanish wholly, but to leave a certain speck in them; whence it
“ certainly

“certainly comes to pass, that Conies the oftener or the more young ones they bring forth, have the greater and whiter Testicles; so that one may guess by onely viewing the *Testes*, whether they have had many young ones or often. Having viewed the Testicles we past to the Horns of the Womb, which we found no longer distinguished into Cells, but all along distended like a Pudding: which was so agitated with a Wave-like motion, like the peristaltick of the Guts, that the young ones nearest the *Vagina* as yet included in their Membranes, were excluded, and that so hastily, that if we had not cut out the whole *Uterus* they had all certainly gone the same way. The Womb was no thicker than when they are not with young, (otherwise than it is in Women.) In its Cavity we saw eleven *Fetus* sprawling, which were all so closely coupled together by the Membrane *Chorion* (wherein all are severally involved) as if they had all been included in one and the same *Chorion*.

This is the account that the aforementioned curious Anatomist gives of the generation of this kind of Animal, and to it, that of all others that are *Viviparous* may be reduced, abating onely the differences mentioned at the beginning of this Chapter, or other like them, if there be any. And for the better illustration of this account, I have thought good to annex hereto a Table borrowed from the same Authour, expressing as well the figure of a Rabbet's *Uterus*, as the posture or condition the Conception and *Fetus* are in on each day whereon the foregoing observations were made.

Table XLV.

Represents the Genitals of a She-rabbet, the various figures of the *Ova* or Conceptions; as likewise a perfect Young one with its Securdines.

Figure I.

Shews the Genitals of a She-coney.

- A a *The Vagina.*
- B *The Piss-bladder.*
- CC *The Horns of the Womb drawn forwards.*
- DD *The beginning of the Oviduct where it springs from the Horn.*
- EE *The extremity of the Oviduct, widening by degrees like a Tunnel.*
- FF *The cavity of the Tunnel that encloses the Testicles.*
- GG *The membranous Ligament that knits the Tunnel to the Horn of the Womb.*
- HH *A portion of the Tunnel knit to the Testicles.*
- II *The Ovaries or Testicles drawn upwards.*
- KK *The membranous Ligament that knits the Ovary (or Testicle) to the Horn of the Womb.*
- LL *A most thin Membrane that goes betwixt the two Ligaments.*
- MM *The Bloud-vessels that run to the Testicles.*
- NN *Portions of the Vena cava and great Artery.*
- OO *The hypogastrick Vessels that are carried to the Womb.*

P A Coney's Testicle wherein two days from the coitus the Teats of the Cases appear.

Q A Testicle wherein on the third day from the coitus the thickness, and Cavities of the Testicles (in which the Eggs were included) appear.

Figure II. to XI. Shew the various figures of the Eggs or Conceptions.

Fig. II. Shews the Eggs as they are found in the Horns of the Womb on the third day from the coitus.

III. The same Eggs on the fourth day from the coitus.

IV. The same on the fifth day.

V. The same on the sixth day.

VI. The same on the seventh day.

VII. The same on the eighth day forming Cells in the Horns of the Womb.

A The Cell in the Horn of the Womb that contains the Egg.

B A Cell opened in whose Egg is found nothing but liquor.

VIII. The Eggs on the ninth day from the coitus.

A The Cell in the Horn of the Womb.

B A Cell opened in whose Egg there appears a thin cloud.

IX. The Eggs on the tenth day from the coitus.

A The Cell full of Bloud-vessels.

B A Cell opened in whose Egg is seen an Embryo like a shapeless Maggot.

X. The Eggs on the twelfth day from the coitus.

A The Cell.

B A Cell opened in whose Egg there appear the lineaments of an Embryo.

XI. The Eggs on the fourteenth day from the coitus.

A The Cell.

B The Embryo with its Placenta and Umbilical-vessels.

Figure XII.

Shews the young Coney with its Secundines.

- A *The Coney included in the Membrane Amnios.*
- BB *The Membrane Amnios blown up.*
- CC *The Urinary Membrane (or Allantoides) blown up, making divers Cells as it were.*
- D *Everhard's glandulous Body, or the whitish part of the Placenta.*
- EE *The ruddy part of the Placenta.*
- F *Needham's Omphalo-mesenterick Vessels (i. e. Vessels that pass from the Mesentery to the Navel) running to the Chorion, which in this Figure is removed.*

Figure XIII.

Shews the back-side of the Placenta pull'd from the Womb.

- HH *Everhard's glandulous Body having six or seven holes in it.*
- II *The ruddy part of the Placenta.*

Figure XIV.

Shews the fore-side of the Placenta into which the Navel-vessels enter.

- K *A line dividing the Placenta as it were into two parts.*
- LL *The umbilical Arteries dispersed through the Placenta with divers branchings.*
- M *The umbilical Vein likewise dispersed through the Placenta.*

CHAP.

C H A P. V.

Of the Analogy, or likeness, between the generation of Oviparous and Viviparous Animals; and how far the generation of both agrees with the vegetation of Plants.

Supposing, what has been demonstrated by the foregoing discourse, that the first principle of the *Fœtus* both of *Oviparous* and *Viviparous* Animals, is an *Egg*, and that the *Seeds* of Plants have analogy thereto, and may properly enough be comprehended under the same denomination; we shall as briefly as may be, consider the correspondence that one of these has to another in their procedure towards the production of a perfect Animal or Plant of their respective kinds.

As for *Vegetables*, the Sun is the common *father* of their whole *genus* or stock, for by his irradiation alone it is that any of their *Seeds* (or *Eggs*) are matured and become fruitfull: not but that the *Mother-plant* her self produces the whole substance of the *Seed*; but its becoming fructiferous or vegetative, is owing wholly to the ethereal and most pure and subtil influence of the Sun. In like manner the *Matter* of the *Eggs* in *Oviparous* Animals, or of a *Conception* in *Viviparous* is derived onely from the *Female*, whose *Egg* or *Conception* it is; but the vegetative or plastick power residing therein is derived from the impregnation (or if you will, *irradiation*) of the spirituous geniture of the *Male*, by whose influence alone they are rendred capable of producing a *Fœtus* of their proper species.

The *Seed*, *Egg* or *Conception* then being indowed with a vegetative virtue by these means, have need of suitable nourishment for the encrease of the first lineaments and rudiments of that which is produced out of them. *Seeds* are emancipated from the *Womb* of their *natural Mother* the *Plant*, (*viz.* the *Pod* or *Shell*) and committed to that of their *Foster-mother*, the *Earth*. Into which they are no sooner received, but they begin to imbibe the nitrous and balsamick juices wherewith she abounds, through their hulls or husks, by which they are made to swell and increase in bulk. And even just thus in *Viviparous* Animals, as soon as an *Ovum* is separated from the *Testicle* and arrives at the *Womb*, being cloathed with two *Membranes* (that answer to the husks of the *Seed*) it presently begins to imbibe some of the albugineous liquor that plentifully bedews the sides of the *Womb* at the time when a *Conception* is made: this liquor I say is imbibed through the *Membranes*, for as yet there is no *Vessel* formed to convey it, nor does the *Conception* stick to any part. And thus also the little white speck in an *Hen's Egg*, as soon as the vegetative virtue thereof is excited by the gentle warmth of the *Hen* brooding upon it, attracts unto it some of the thinnest and purest of the *White*, whereby it is enlarged in its dimension. And this encrease happens to all three, before there are any the least lineaments of that which afterwards is produced from them.

In the next place the Seed begins to put forth a gemm or sprout, which is as the first *Embryo* of the Plant; and at the same time the Seed-leaf (which serves for the *Placenta*) and Navel-knot are shaped. By the Navel-knot, which knits the Seed-leaf and trunk of the Plant together, is nourishment conveyed from *that* to *this* for its further growth. In like manner the first thing that appears tending towards a *Fœtus* in an Egg or a Conception, is the red beating speck and small reddish streaks proceeding from it, that prove the Navel-vessels, which in Viviparous Animals that are placentiferous, are implanted into the *Placenta* or Womb-cake, from whence they derive nourishment to the Embryo. In Oviparous, that have no *Placenta*, they are inserted into the Membranes that contain the White and Yelk, which Membranes 'tis probable may have some Glands adhering to them, through which the said liquors are transcolated into the Navel-vessels, and therefore may answer to the Cotyledons in such Brutes as are not placentiferous. At the same time or presently after appear some lineaments of the Spine, or trunk of the Body, answering to the trunk of the Plant.

The next progress of the vegetation of a Seed towards a Plant is the putting forth of Roots, which are as the Head and Mouth of the Plant, by which it sucks nourishment all its life-long from its Nurse-mother the Earth. In correspondence whereto the first part (next to the before-mentioned) that attains to any considerable bulk or perfection of shape in the *Fœtus* of Animals, is the Head, which by the two last before-going Figures you may perceive both in Chickens and Rabbits to be at first well nigh as big as all the Body besides. The reason of which *hasty* procedure in the formation of this part seems to be for two reasons: *First*, that the Brain which is the spring of the Animal function, might arrive at a capacity of elaborating and transmitting the Animal Spirits, by the Nerves, to all the parts of the little Animal, for the performing of such weak and imperfect motions as are necessary for it in that state. And *secondly*, that its Mouth might be in a forwardness towards so much perfection as is necessary for the sipping or sucking and swallowing that albugineous nutritious juice wherein it fluctuates, and which its parts being now grown more bulky and firm begin to stand in need of for their further nourishment and encrease.

But now our *Fœtus* (whether the off-spring of a Viviparous or Oviparous Creature) being advanced beyond the state and rank of Vegetables into that of Animals, we cannot deduce the parallel any further with that propriety and accuracy as hitherto: though it might still be further prosecuted according to the most ingenious observations of Doctour Grew in his Anatomy of Trunks, who hath discovered in them not onely several Sap-vessels answering to the Veins and Arteries (yea to the Milky-vessels and Lympheducts) but Air-vessels likewise, as if Plants were partakers of Respiration also, and consequently of some degree of Animality, wanting onely local motion and (perhaps) sense to difference them from true Animals. But to doe this would carry me beyond my purpose, which was to compare the *generation* (or rather first *vegetation*) of the one to the other, and not their after-nourishment and life. I shall therefore here break off the parallel or analogy of Vegetables with Animals; but shall continue a little further that of Oviparous and Viviparous Animals one with another.

By that time the purer part of the White of an Egg is the greatest part of it exhausted by the umbilical Veins, and spent in the encrease of the parts of the Chicken; its Bill, Mouth, Throat, &c. have attained to that perfection as that they can perform their office of sipping and swallowing, whereby the remainder of the White, that is more thick and earthy, comes to be consumed also. For that the Chicken swallows some of it, is plain, seeing if one open the Crop of one newly hatched, there is a clear liquor in it of the same consistence, colour and taste with the White, which can be conveyed thither no other way but by swallowing. In like manner the *Fœtus* of *Viviparous* Animals having arrived at such maturity as to have their Mouths, Stomachs, &c. perfected, though they continue still to receive part of their nourishment by the umbilical Vein, (even as a Chicken after it hath consumed all the White, yet still derives nourishment from the Yelk by other branches of the same Vessel) yet partly that the Stomach may be initiated into that office it is to perform after the birth (*viz.* concoction,) and partly that the *Fœtus* may be trained up and accustomed to that way of feeding whereby they are to be sustained after their expulsion from the Womb, they suck in at their Mouth a grosser sort of nutritious juice, (answering to the thicker White in an Egg) wherein they swim in the *Amnios*: which liquor is conveyed thither by the umbilical Arteries of the *Fœtus* in this manner. The umbilical Vein being implanted into the *Placenta*, or *Cotyledons* of the Womb, does imbibe therefrom that nutritious juice that is conveyed thither by the hypogastrick and spermatick Arteries of the Dam: which juice consisting of various particles is conducted to the *Fœtus*, with whose Blood it mixes, and its purer particles are assimilated to it; but the grosser and more earthy pass from the *Fœtus* by its umbilical Arteries towards the *Placenta* or *Cotyledons* again; but in their way thither-ward they divert into those branches of these Arteries that are dispersed through the *Amnios*, and are spued out of their extremities into its cavity, where this liquor is collected in great quantity for the use aforesaid.

Lastly, when the Chicken hath spent all its provision, and is grown so big that it becomes uneasie in its narrow Cloister, and likewise wants a freer air to breathe in, the Shell which is the Mother's (external) Womb, begins to be brittle and apt to chap, so that upon the Chickens bustling about and pecking against it, it cracks and gives way to its Exit. Thus when the *Fœtus* (in *Viviparous* Creatures) is full grown, and the sides of the *pelvis* permit not any further extension of the Womb, the *Fœtus* wanting Elbow-room as we say, tumbles about and creates an uneasiness to the Dam, and the Womb it self is provoked to an endeavour to exclude its burthen which is now become troublesome: whence partly from the endeavours of the Young to free it self of its confinement, and partly by the straining of the Dam (Nature having prepared the passage) the birth succeeds.

Thus I have prosecuted the history of the *Generation of Animals* from the first principles of their *Fœtus* till their bringing them forth; wherein I must confess to have borrowed much from other Mens observations: but as the Reader may have observed me so ingenuous as to mention my Authours where I have done so; so I hope it will be acknowledged I have produced some of my own, and improved those I have borrowed
to

SECTION II.

Of the Motion of the Chyle, and Circulation of the Blood.

I Am now entring upon so trite a Subject, and which has exercised the Pens of so many learned Anatomists, that I cannot invite the learned Reader to the perusal of this Discourse with the promise of outdoing those worthy Persons that have gone before me: but the main inducement of the annexing this to the before-going Treatise, was from a prospect that this Book will probably fall into the hands of such as never read the before-mentioned Authours, so that this Doctrine will be as new to *them* as if never any thing had been writ before on the same Subject. But yet I would not so prejudice even the learned (Anatomical) Reader against it, as that he should expect nothing but *Crambe recocta*, and so nauseate and reject it: for beside that the manner and method of the discourse is (I think) new, he will find something of Experiment, which (for any thing that I know) hath not been made by any other. However in the whole I shall be very concise, as having said something to the same purpose in the First and Second Books, in the Chapters of the Stomach, Guts, and Mesentery, and of the Heart.

S. I.
Of the motion
of the Chyle.

In the first place we shall begin with the motion of the *Chyle*, because *Chyle* is that out of which *Blood* is made. *Chyle* is defined to be a *milky juice, like Barley-cream, prepared and concocted in the Stomach from the Food that is taken.* For when the Animal has chew'd his Meat sufficiently, and thereby minced and prepared it, (in which action the *Saliva* or *Slaver* mixes with it) he swallows it down into his Stomach, which so contracts it self, that be the Meat little or much, it embraces it closely, and keeps both its Orifices shut. The Meat being thus stew'd as it were by the mild heat of the Stomach, enters upon a fermentation, which proceeds from the acidity of the *Saliva* and the acid or acrimonious ferment of the Stomach working upon the *salt* particles of the Food and dissolving or precipitating the same, (and together with them the *sulphureous*) which being so dissolved are diluted and turned into a fluid substance by the water or other liquor that the Animal drinks, and this is that we call *Chyle*. As for the other particles of the Food which are not thus dissolved and made fluid, as being of a more gross and earthy substance, they become like the Chymist's *caput mortuum*, and make that we call the *faeces* or *Dung*, which having once mentioned, my design will not give me occasion to take much further notice of.

The

The *Chyle* then being thus prepared in the Stomach passes by degrees out at its lower Orifice into the Guts, along which it is gently conducted (together with the *faeces*) by their peristaltick or Worm-like motion. Now into every one of the Guts are inserted more or fewer of those *Veins* which are called *milky*, from the whitish chylous liquor that is commonly to be found in them, and to distinguish them from the Bloud-vessels that look of a bluish or dusky red. These milky Veins being laid (as I may say) into the Guts like so many smaller (leaden) Pipes into a large Trunk, do every one of them imbibe or drink in part of the Chyle, and convey it whither and in what manner we shall shew presently. The part that sustains these Veins is the Mesentery, in whose folds the greatest part of the Guts are gathered (all but the beginning of the first (*small*) Gut, and last (*streight*) Gut.) But as for the fabrick of these parts I would rather desire the Reader to consult the ninth, tenth, eleventh and twelfth Chapters of the First Book, than be tedious with repetition. I say then these Veins being laid into the Guts, receive into their mouths the aforesaid liquor through the spongie slime that bedaubes the inside of the Guts, which serves as a strainer for the confused mass of the Chyle. But for the more easie separation of its purer parts from the impure and feculent, there happens in the Guts themselves a new kind of fermentation in the Chyle by the commixture of the bile and pancreatick juice with it, as was shewed in the aforesaid Chapters and the thirteenth of the same Book. Now the reason why the Chyle should rather divert into these slender Vessels than continue its course down the wide Guts, is not from any magnetick or electrick attractive faculty in the Vessels themselves, but from the continual agitation and squeezing of the Guts partly by their own peristaltick motion, and partly by their being heaved up and down by the continual motion of the Muscles of the Paunch, and of the Midriff in Respiration. These motions indeed hasten also the descent of the chylous mass down the Guts themselves; but he that considers the various windings of the Guts, and observes that the small ones lie the greatest part of them in the lower and fore-part of the Belly (into which most of the milky Vessels are inserted) whilst the *Colon* (that lies more backward) ascends up again as high as the bottom of the Stomach, and commonly is pretty full stuf with digested excrement of a pretty firm consistence, must needs conceive it to be a very natural motion for the Chyle to regurgitate as it were, or slide into the milky Veins while the Intestins are thus compressed. And if this may be allowed for a sufficient mechanical reason of its first entrance into them, we shall not need to be much thoughtfull for another, why it should ascend by *them* and the thoracick Duct to the Heart; seeing that which comes behind must needs drive on that which went before so far as there is passage for it, at least so high as the place from which their descent was. For every body knows that any Aqueduct will convey the water as high as the Fountain or Well-spring where it receiv'd it, though in its passage from the Spring-head to the place where it is discharged, it descends through a valley that is (suppose) an hundred paces perpendicular lower than either. All Meat and Drink then being received in at the Mouth, it is no wonder that the Chyle that is made of it should ascend up as high as the Heart, though it first descend to the lowest parts of the *Abdomen*, seeing the Heart comes so much short of the height of the Mouth. But this motion of the Chyle that we are speaking of, has a notable advantage above that of water

in a Tree or Pipe; seeing water descends, and consequently ascends therein onely by its own *gravity*, and is assisted in neither by the Vessels that contain it: whereas the Meat and Drink are not onely *driven* down into the Stomach by the motion of the Throat and Gullet; but the upper mouth of the Stomach presently closing upon them, hinders their ascent back again, and the aforesaid peristaltick motion of the Guts, and reciprocal dilatation and contraction of the Belly (as well as Breast) in respiration, force the Chyle along the pipes it passes through, as well as it self makes its way by its own weight. The milky Veins have also another advantage above an Aqueduct, in that they have Valves that hinder the relapse or retreat of the liquor contained in them; so that upon whatsoever agitation or compression of the Vessels there is a way open for it forwards, but it cannot return back again.

The Chyle then being received into the Lacteals as aforesaid, holds on its course in them through the Mesentery to the *common Receptacle* at the Loins. In this passage the *venæ Lactææ* enter several glands of the Mesentery, out of which other branches arise again, and these also are inserted into other glands, and other branches spring from them again, the branches themselves likewise inosculating one with another; but they all hold on forwards towards the great gland at the centre or root of the Mesentery where it adheres to the Loins, into which some enter and some march over it: But those that enter it, arise again out of it, and joining with the others that ran over it, discharge themselves all together into the *common Receptacle* before-mentioned.

This Receptacle is called *common*, because it is common both to the Chyle and *Lympha* (which latter humour what it is, you may see in the above-cited twelfth Chapter.) It is seated behind and a little above the great gland at the centre of the Mesentery, rather towards the left side, by the side of the *Cava* descending, and near the left Kidney. It is like a little bag or bladder, and is nothing else but the wider part or root of the *thoracick Duct*, which is continued from it. All the Chyle being imported into this Receptacle, and also the *Lympha* returning from all the Bowels of the *Abdomen*, and the inferiour parts, mixing with and diluting of it, ascend up the Loins and Back by the said *thoracick Duct*, which is a long Pipe (very thin and almost transparent) running up the whole length of the *Thorax* under or behind the *Aorta* (on the inside of the Spine) but rather inclining towards its left side; and at last passing under the *Thymus* it opens into the lower side of the left subclavian Vein, over against that place where the left jugular Vein opens into it on the upper side. Though the Duct usually be but one, yet it opens with five or six mouths into the said Vein, all which on the inside the Vein are covered with one broad valve, which permits the Chyle and *Lympha* to enter into the Vein, but hinders either them or Blood to slide out of the Vein into the Duct. This Duct has several Valves in it as well as the Lacteals of the Mesentery that hinder the retreat of the humours contained in it. You have this Duct with the Receptacle, &c. express'd in the next Table but one, *viz.* the forty ninth and last.

Thus the Chyle being discharged into the Subclavian Vein is therein mixed with the Venal blood, and passes along with it to the right Ventricle of the Heart, where it begins to be alter'd into Blood. We cannot therefore pursue its motion any further under its own name: for though it be not perfectly turned into Blood, it may be, in several times passing through

through the Heart in its circulation with the Blood; yet it is so jumbled and mixt with the Blood, that it is esteemed to be of the same mass with it. So that we shall leave it here, and onely advertise this further, that according to the strictest examination and most accurate experiments of the best Anatomists, all the Chyle passes these ways we have described, and no part of it is conveyed either to the Liver or Spleen, nor yet to the Womb in the time of its Gestation, or to the Udder in giving suck; I mean immediately and by proper Vessels; for it does indeed pass thereto, some part of it, by the Arteries, being confounded with the Blood, from which it is there separated again, for the nourishment of the *Fetus* or Young, as was shewed at large in the twenty eighth and twenty ninth Chapters of the First Book.

That the *Blood* is continually some of it issuing from, and other some returning to the Heart, by a *circular* motion, is now an opinion so generally entertained, that I need not take any pains to prove *That* it is so, but shall onely shew *How* and by what *Ways* this motion is performed.

In the foregoing Paragraph we had traced the Chyle to the *right* Ventricle of the Heart, into which it enters mixed with the venal Blood in the Heart's *diastole* or dilatation. Herein the Chyle and Blood are more intimately mixed one with another, and 'tis probable enter upon some degree of fermentation, but it cannot be much, considering their short stay therein, which is but during the interval betwixt the dilatation and the contraction that next succeeds it: for by the following *systole* is all that Blood and Chyle expelled out of the Ventricle into the pulmonary Artery, that was imported into it from the *Cava* by the foregoing *systole*. These humours then, which from henceforward we shall speak of under the notion of *Blood* onely, being entred into the *pulmonary Artery*, are conveyed by its two branches into both Lobes of the Lungs; the smaller twigs of which branches inosculating with the like twigs of the *pulmonary Vein* transfuse the Blood into them, which by this latter Vein is conducted to the left Ventricle. The Blood in its passage through the Lungs being inspired or impregnated with the nitrous particles of Air received into the Lungs in Inspiration and there insinuating themselves into the Blood, undergoes a greater fermentation in the left Ventricle than it had done before in the right, though it make no longer stay in the one than in the other. For the *systole's* and *diastole's* of both Ventricles are performed at the same time, and therefore the interval or cessation betwixt these two motions is equal. In the next *systole* therefore of the Heart the same Blood is driven forth of this left Ventricle into the *Aorta* or great Artery, which is the root of all the Arteries in the Body (except the pulmonary.) I shall not need here to describe the Valves at the orifices of the Ventricles, which hinder the recourse of the Blood into them (such are those of the pulmonary Artery and *Aorta*) nor those that hinder the regurgitation of the Blood out of them into the *Cava* and pulmonary Vein; for of these we have spoken enough in the eighth Chapter of the Second Book: but we shall proceed to trace the course the Blood further takes, now that we have follow'd it as far as the beginning of the *Aorta*.

The Heart is the Authour of the motion of all the humours that have once past it, be they Blood, *Lympha*, *Choler*, the nervous Juice, or any other. For the Heart (like a Pump) ejecting the Blood forcibly out of it, and that Blood which comes behind still driving forward that which

§. II.
Of the circulation of the Blood.

Its passage from the right to the left Ventricle of the Heart.

Its passage from the left Ventricle to the habit of the Body.

goes

goes before, and having all other humours either formally or materially in it; as new supplies are conveyed by it or along with it to any part, that which was in the part before the supply came, must give way to it and hold on its course, till either it be ejected out of the Body if it be an excrement, or be returned back again to the Heart if it be a profitable Humour, abating so much of it as is spent on the nourishment and refection of the parts, or may evaporate by insensible transpiration. More particularly: The *Aorta* having received the Blood from the left Ventricle is presently divided into two *Trunks*, the *Ascending*, and the *Descending*.

The Ascending Trunk of the Aorta.

The *Ascending* Trunk climbing up by the Wind-pipe to the top of the Breast sends forth two branches, called the *subclavian*, because they run under the lower side of the *claviculae* or Chanel-bones. These send out several branches both from their *upper* and *lower* side. From their *upper* side spring those Arteries called *Mammariae* (in Men) the *Cervical* (that are partly spent on the Muscles of the Neck, and afterwards entering to within its *Vertebrae*, ascend into the Brain by that hole by which the Spinal Marrow descends from it) and lastly the *Musculae* (that are also bestow'd on the Muscles of the Neck.) Out of their *lower* side proceed the *superiour Intercostals*. After having sent forth these branches, they pass out of the Chest to the Arms (or Fore-legs in Brutes) on the parts whereof they are bestowed. Just where the great ascending Trunk of the *Aorta* sends forth the *subclavian* Arteries side-ways, it is divided into two large branches (called the *carotid* Arteries) that ascend directly upwards, which first sending some small slips to the Tongue, the Muscles of the *Os hyoides*, &c. are afterwards each subdivided into the *External* and *Internal* branches. The *External* are bestowed on the Muscles of the Lips, Cheeks, Temples, &c. The *Internal* entering the Skull at the hole by which the wandring pair of Nerves (or *eighth* pair) come out of it, are dispersed through the Brain, the *dura* and *pia mater*, in which they make the *Rete mirabile* and *Plexus Choroides*, uniting with some twigs of the *cervical* Arteries before-mentioned. The Blood that flows by these Arteries to the Brain, &c. after it hath served the necessities thereof, returns back again towards the Heart by the *Jugular* Veins, which are also *External* and *Internal*, observing the same course with the Arteries. The *External Jugular* is that which appears so fair in the Neck, which we commonly open in Horses. And here it may be convenient to inquire in what manner the Blood passes out of the Arteries into the Veins, whether by inosculating the one with the other, or by what other way. That I might satisfy my self herein I made the following Experiment.

An Experiment to prove, that there are no Anastomoses of the Arteries with the Veins.

Having bled an Horse to death, that both Veins and Arteries might be empty, with the greatest dispatch I could, whilst the Horse was warm, I took up one of the *carotid* Arteries and cut an hole in it pretty near the Breast, into which hole putting a quill I blew into it as hard as I could, whereupon I perceived the branches of Arteries on both sides of the Face, &c. to swell, yea and also the *carotid* Artery on the other side of the Neck: but I no sooner left off blowing, but they were immediately emptied again, the wind, 'tis likely, proceeding forward, on the contrary side, towards the Heart. Upon which I tyed the Artery on the other side about the same place where I had made the hole on this, to stop the progress of the wind, and then blew again; upon which the Arteries on both sides were very much distended: and then I speedily made a ligature a little above the Orifice, whereby the Arteries and all their branches

branches in the Neck, Face, &c. continued distended. Which having viewed a-while, I took off both the Ligatures one after the other, and perceived the wind to retire both ways, and to leave the Arteries and all their branches empty. But all this while the jugular Veins were not swelled at all: upon which I made this conclusion, That the Arteries did not inosculate with the Veins at all, but onely with one another. In which opinion that I might be further confirmed, I afterwards took up the external jugular Vein on one side, making a hole in it, and tyed the same Vein on the other side; I put my quill into the orifice I had made, and blew into it as I had done into the Artery before; whereupon the jugular Vein on the other side of the Neck swelled as well as that on this side, and both their branches about the Face, &c. As soon as they were all well filled, I made a ligature above the orifice, whereby the Air was pent in, and both Veins and their branches continued to be swell'd till I unloosed the Ligatures, upon which they presently became empty. But by thus blowing into and filling the Veins, the Arteries were not at all moved, which further satisfied me, that there are no Anastomoses between the Veins and Arteries, by which the Blood should pass out of these into those or out of those into these; but that such are onely to be found amongst Vessels of the same kind. I speak as to the *habit* of the Body; for that there are such in some of the Bowels, as particularly of the pulmonary Artery and Vein in the Lungs, of the splenick Artery and Vein in or near the Spleen, and of the *Porta* and *Cava* in the Liver (the first of which from its double coat may be esteemed rather an Artery than a Vein) is past dispute. It may be wondred then, if indeed there be a circulation of the Blood, how it should pass out of the Arteries into the Veins, if there be no communication by inoscultation betwixt them. But we must consider that in *living* Bodies all the parts are much more porous and spongie than in a dead Carcase; for upon the cessation of the motion of the humours many of the smaller passages by which they use to be conveyed, are stop'd by the coinciding of their sides. So that although, according to the Experiment, there is after death no passage even for wind out of the Arteries into the Veins, nor on the contrary out of the Veins into the Arteries; yet in living Bodies it is not, from hence, necessary to deny it. For though we cannot grant any inoscultation of the one with the other (in the habit of the Body, as was abovesaid;) yet there is another way whereby the humours may be transfus'd out of one into another, and that is thus: The Arterial blood by the pulsation of the Heart is extravasated or driven forth of the utmost ends of the Arteries into the very substance of the parts; which being rare and porous permits the Blood to flow in; but the pores being very strait can contain but a small quantity, and therefore seeing the influx of the Blood is continual, there must also be a continual efflux or discharge of the same, for which office there are no other Vessels adapted but the Veins, which by their extremities imbibe or suck up the Blood being thus extravasated, and convey it back into the larger branches, and these discharge it into the *Cava*, and that, to the Heart. Now that the Blood is extravasated out of the Arteries into the substance of the parts is very certain, seeing if it were not so, the parts could receive no nourishment from the Blood; for while it is in the Vessels, it may indeed contribute warmth to the parts through which it flows, but it cannot nourish them, seeing even the larger Vessels themselves are not nourished by that stream of Blood

that glides along their cavity, but by capillary Vessels running along their coats. Against this manner of the Bloods passing out of the Arteries into the Veins I know nothing can be objected, unless it be the hasty circulation of the Blood, which according to the computation of the most accurate Anatomists is supposed to be so quick, as that the whole mass of Blood passes several times through the Heart in one hours space: from whence some think it necessary to admit of *Anastomoses* of the Arteries with the Veins all the Body over, whereby the Blood may run in a fuller current out of one into the other, than 'tis probable it can do by way of extravasation; though from the nutrition of the parts, they believe it necessary to admit this latter way too. To this objection I shall onely oppose the before-going Experiment, which to me seems a plain demonstration that there are no such *Anastomoses* at all. Having therefore shewn all the branches of the *Ascending Trunk* of the *Aorta*, we shall proceed to those of the *Descending*.

The Descending Trunk of the Aorta.

The *Descending Trunk* of the *Aorta* is larger than the *Ascending*, as being to supply more parts with heat and nourishment. It descends by the Gullet towards the Midriff, at which before it arrive, it sends forth the *inferiour Intercostal* branches, and the *Bronchial*, which latter accompany the branches of the Wind-pipe in the Lungs. When it arrives at the Midriff, there spring out of it, the Phrenick Arteries, which are dispersed through the Midriff, and *Mediastinum* or Partition-membrane of the Chest. Having pierced the Midriff, it descends in one Trunk as far as the last *Vertebra* of the Loins, but by the way sends forth many branches: as first the *Cœliaca* or *Stomach Artery*, which arises single, but is divided afterward into its *right* and *left* branches. The *right* furnisheth the right side of the Stomach, (*viz.* the *Pylorus*) the investing Membrane of the Liver, the Gall-bladder, the right side of the Caul and that part of the *Colon* on which it cleaveth, the beginning of the small Guts, and the Mesentery: The *left* (called its *Splenick* branch) sends some twigs to the middle part, left side and upper orifice of the Stomach, and to the left part of the Caul; but the greatest part of it runs to the Spleen, into which before it enters, it sometimes sends forth the *vas breve arteriosum*, which goeth to the left part of the bottom of the Stomach: but in Horses this *vas breve* springeth from it after it is entred into the Spleen, as may be seen in the seventh Table annexed to the sixteenth Chapter of the First Book, where all these branches of the splenick Artery are delineated. The Veins that accompany this *Cœliack* Artery are branches of the *Porta*, and have the same names with those of the Artery. Next to the *Cœliack* there springs out of the Trunk of the *Aorta* the *upper Mesenterick*, that is bestowed upon the upper part of the Mesentery and the small Guts. The next are the *Emulgent* Arteries, the right and left; each of which dividing themselves into two or more branches, enter into the Kidneys of their respective sides, and discharge there the *serum* or wheyish part of the Blood that makes the Urine. Below these the *Aorta* sends forth the *spermatick* Arteries, which in Horses are commonly two, and in Mares oft-times more, on each side. These run to the Testicles, Womb, &c. Then the *lower Mesenterick*, that go to the lower part of the Mesentery and to the great Guts. By this time the Trunk of the *Aorta* being come to the top of *Os sacrum*, having thus far descended under the *Cava*, begins to climb upon it, and is divided into two equal branches, called the *Iliack*; which are presently subdivided into the *interior* and *exterior*. From the *interior* spring the *Musculæ*, or Muscles-

Muscle-arteries, being bestowed on the *Psoas*, the Buttock-muscles, &c. also the *Hypogastrick*, that run to the parts of Generation in both Male and Female, and also to the Bladder, &c. and lastly the *Umbilical* Arteries, which in the *Fœtus* ascending by the sides of the Bladder, proceed to the Navel, and run to the Womb-cake or Cotyledons; of which in the twenty eighth Chapter of the First Book. From the *exterior Iliack* branches arise first the *Epigastrick* Arteries, which turning upwards run on the outside of the Rim of the Belly, betwixt it and the straight Muscles, as far as the Navel, and there meet the *Mammary*. Secondly, the *Pudendæ*, which are spent upon the Privities of both Male and Female. Afterwards the *Iliack* branches descend to the Thighs, and then begin to be called *Crural*.

Thus we have given an history of all the larger branches of the *Aorta*, whereby the Blood is conveyed from the Heart to all the parts of the Body; it would not be very material to give the like of the *Veins*, seeing every one of these Arteries has a Vein accompanying it, for the most part of the same denomination; so that by knowing the Artery that comes to any part, we must know the Vein also that returns the Blood from it, especially in the Limbs and outward parts. For indeed within the Body, especially in the *Abdomen*, there is some variation: the rather because some of the Veins thereof spring from the *Cava*, and others from the *Porta*. This latter supplies the Bowels that perform the first concoction, as the Stomach, Guts and Mesentery; as also the Spleen, Sweetbread, Caul, and the Liver in part. These branches of the *Porta* receiving into them that Blood that is superfluous to the nourishment of those parts into which they are inserted, unite into one Trunk in the lower or *under* side of the Liver; which Trunk spreading it self into many roots through the whole substance of the Liver, does transfuse its Blood into the like roots of the *Cava* that arises out of the *upper* side. In which passage of the Blood out of the *Porta* into the *Cava*, the Bile is separated from it. But that Blood which is received *immediately* by the branches of the *Cava* dispersed to the other parts of the Lower Belly, as also by those that run to all other parts of the Body, whether from its Ascending or Descending Trunk, passes through no Bowel in its return towards the Heart: But being imbibed by the capillary twigs out of the pores of the parts, is conveyed first into the smaller branches, and from them into the larger, and lastly from these into one of the great Trunks of the *Cava*, by which it is poured again into the right Ventricle of the Heart, there to be inspirited anew and sent about in a second circulation.

Table XLVIII.

Represents all the sanguiferous Vessels of the whole Body of an Horse as well Veins as Arteries, as also the several Bowels through which they pass.

- A *The Ascendent Trunk of the great Artery.*
 B *The Descendent Trunk of the same.*
 C *The Ascendent Trunk of the hollow Vein.*
 D *The Descendent Trunk of the same.*
 EEEEE *The division of the Ascendent Trunk of the great Artery into the Carotid and Cervical Arteries which go to the Neck and Head; as also into the Subclavians which go down the Fore-legs; likewise into the Mammary branches, so called in Humane Bodies, though improperly in Horses or Mares.*
 FFFF *The branchings of the Ascendent Trunk of the hollow Vein into the external and internal Jugulars, and into the Subclavian branches.*
 GGGG *The branchings of the Descendent Trunk of the great Artery into the Iliack, Epigastrick, Hypogastrick and Crural branches.*
 HH *The like branchings of the Descending Trunk of the hollow Vein.*
 I *The Heart in its natural position.*
 KK *The Lungs in the same.*
 L *The Liver in the like.*
 M *The Spleen also in its place.*
 NN *The Mesentery turned on one side.*
 OO *The Kidneys.*
 pp *The Deputy-kidneys.*
 QQ *The Ureters.*
 RR *The Spermatick Veins.*
 SS *The Spermatick Arteries.*
 TT *The Testicles.*
 VV *The deferent or ejaculatory Vessels.*
 WW *The cremaster Muscles.*
 X *The Bladder of Urine.*
 YY *The prostate Glands.*
 ZZ *The seminal Bladders.*
 aa *The body of the Tard.*
 b *Its Glans.*
 cc *The Emulgent Veins.*
 dd *The Emulgent Arteries.*
 eee *The Mesenterick Vessels.*

Table XLIX.

Represents as well the Chyliferous as Sanguiferous Vessels of the Body
of a Mare, as also her Genitals, &c.

- A *The Heart.*
 B *The Descending Trunk of the great Artery.*
 C *The lower end of the said Artery cut off, the better to shew the Receptaculum Chyli that lieth under it.*
 D *The Receptaculum Chyli.*
 E *The Mesentery.*
 F *The great Kernel of the Mesentery.*
 GG *The Lacteal Vessels running from the great Kernel of the Mesentery to the Receptaculum Chyli, into which they empty their Chyle.*
 HH *The Thoracick Duct that conveys the Chyle from the Receptacle to the subclavian Vein into which it is emptied.*
 I *The insertion of the said Duct into the subclavian Vein.*
 KK *The Descending Trunk of the hollow Vein.*
 LL *The Ascending Trunk of the same.*
 MM *The Ascending Trunk of the great Artery.*
 NNNN *The Jugular Veins and Carotid Arteries.*
 OOOO *The Deputy-kidneys.*
 PPPP *The Cephalick or Basilick Veins and Arteries which branch into the Fore-legs.*
 QQQQ *The Mammary Veins and Arteries.*
 RRRR *The Epigastrick Veins and Arteries.*
 SSSS *The Hypogastrick Veins and Arteries.*
 TTTT* *The Crural Veins and Arteries.*
 VV *The Kidneys.*
 WW *The Ureters cut off from the Bladder.*
 XX. *The Spermatick Arteries and Veins.*
 YY *The Testicles.*
 ZZ *The Tubæ or Trumpets of the Womb.*
 aa *The Horns of the Womb.*
 bb *The Body of the Womb.*
 c *The Bladder of Urine turned aside.*
 dd *The bottom of the Womb where the Foal lies.*
 ee *The jagged Orifices of the Trumpets of the Womb.*
 ff *The broad Ligaments that sustain the Womb.*
 g *The Clitoris.*
 hh *The outward Orifice of the Sheath of the Womb.*

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T H E E N D.

E R R A T A.

Pag. 123. lin. 37. for *inner* reade *outer*. *ibid.* lin. 40. for *outward* reade *inner*.

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SNAPPE, Andrew, jr. (b.1644-?). The anatomy of an horse. Containing an exact and full description...expressed in forty nine copper-plates. To which is added an appendix containing two discourses:...of the generation of animals;...of the motion of the chyle, and the circulation of the blood. Folio. 6 leaves, 237, 45pp., 3 leaves. With the frontispiece portrait drawn and engraved by R. White and 49 fine copperplates, the first signed N. Yeats. Eighteenth century tree calf, rebacked, endpapers renewed but a fine copy on large paper (page size: 34 x 22 cm.) London: T. Flesher, 1683. \$1250.00

FIRST EDITION [GARRISON-MORTON 298] of the first English book on equine anatomy--one of the greatest English books on the horse, and the first great English book on veterinary medicine. Although Snape mainly presented an English adaptation of Ruini's Dell anotomia et dell-infirmita del cavallo (1598), he neglected to credit Ruini, thus leaving himself open to charges of plagiarism. However, Snape's own text and illustrations were so outstanding that his own book was later plagiarized.

Snape was farrier to Charles II, to whom the work is dedicated. His appendices on embryology and the circulatory system are chiefly based on the works of Harvey and Malpighi.

This copy on large paper must be one of the finest extant.

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See Dibner 186.

Cole, History of comparative anatomy (1949) pp.83-97; esp. 86-87.

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