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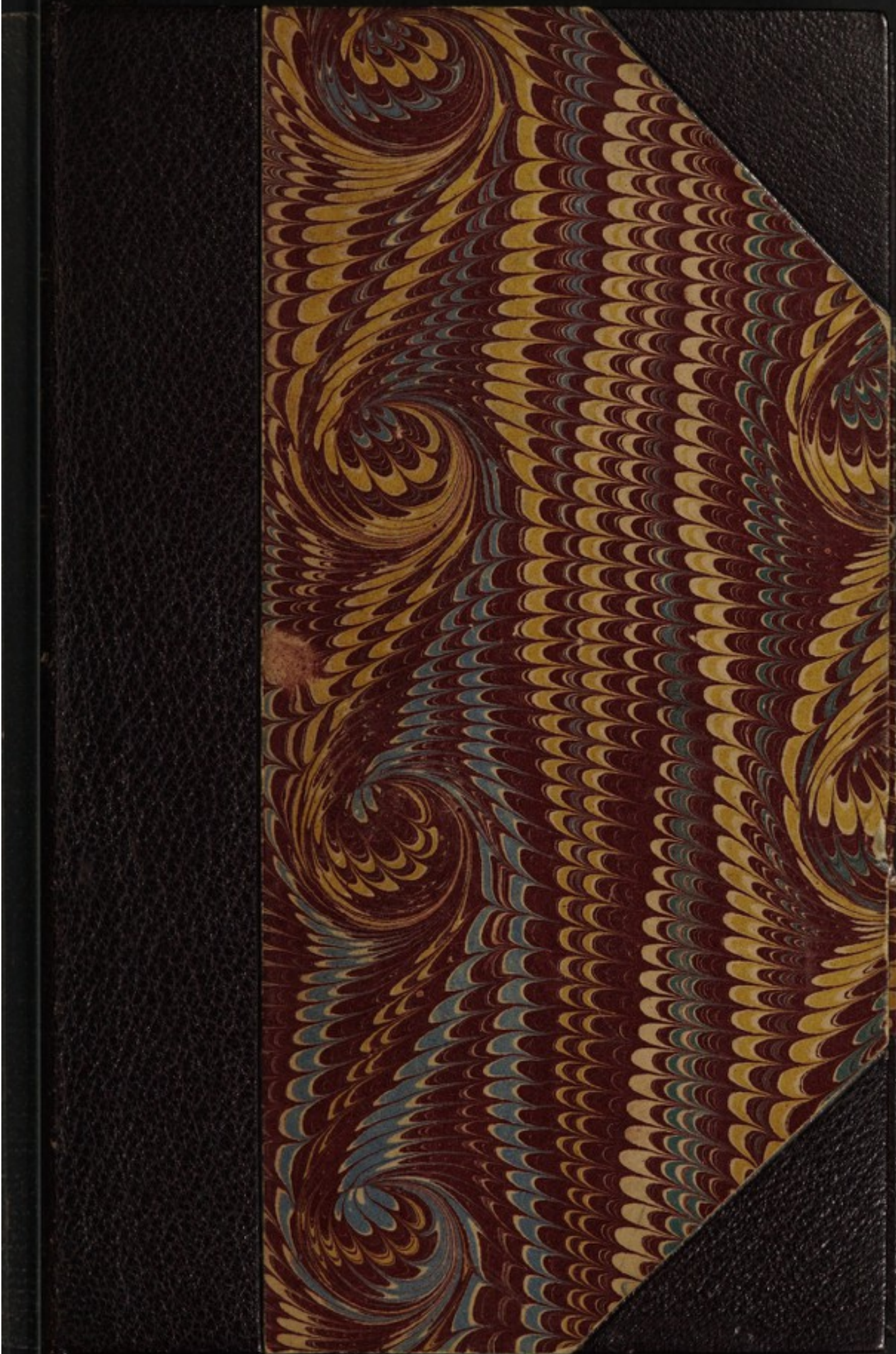
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ANATOMY
OF
THE BRAIN
—
H. RIDLEY.



1693







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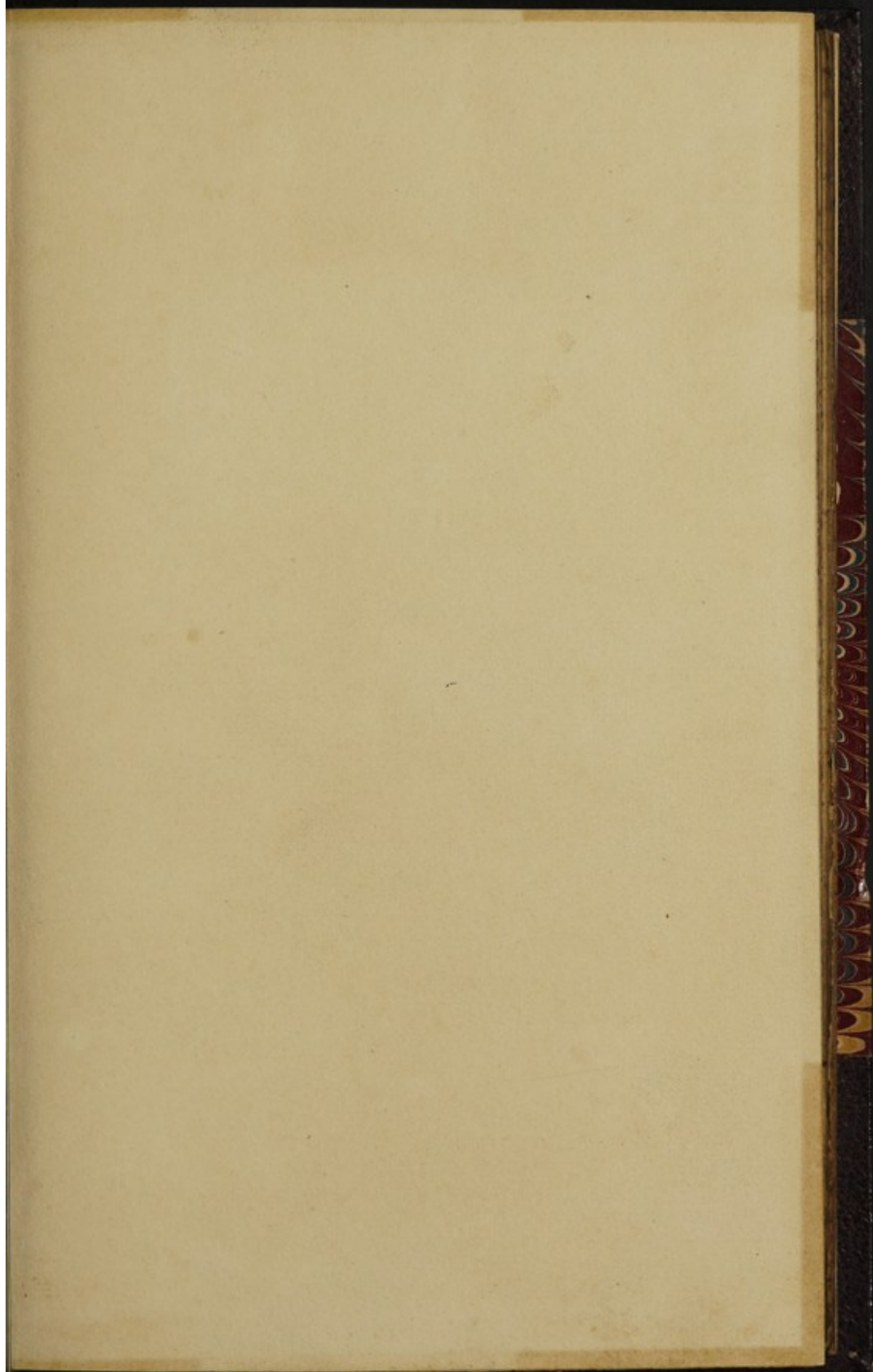
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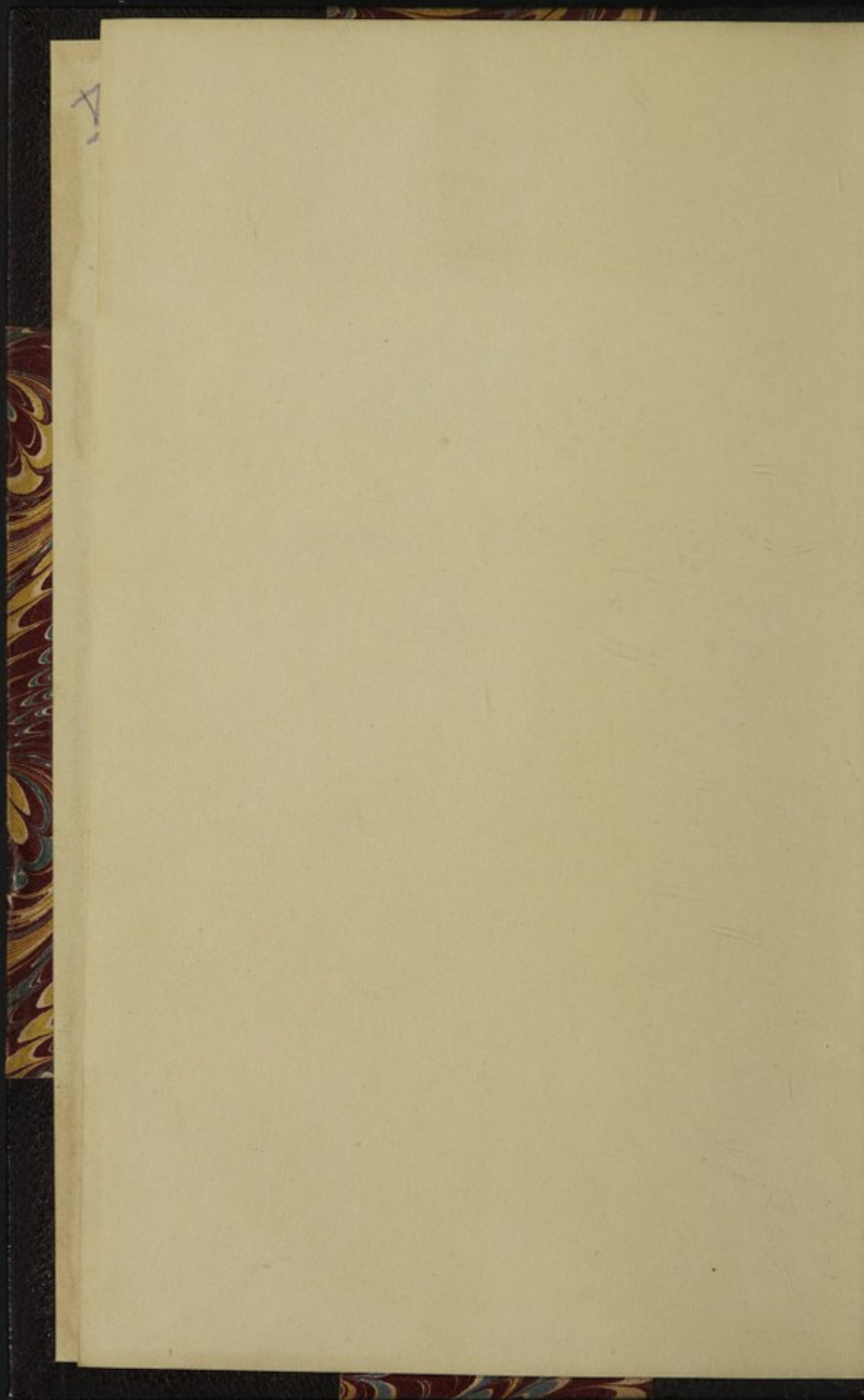
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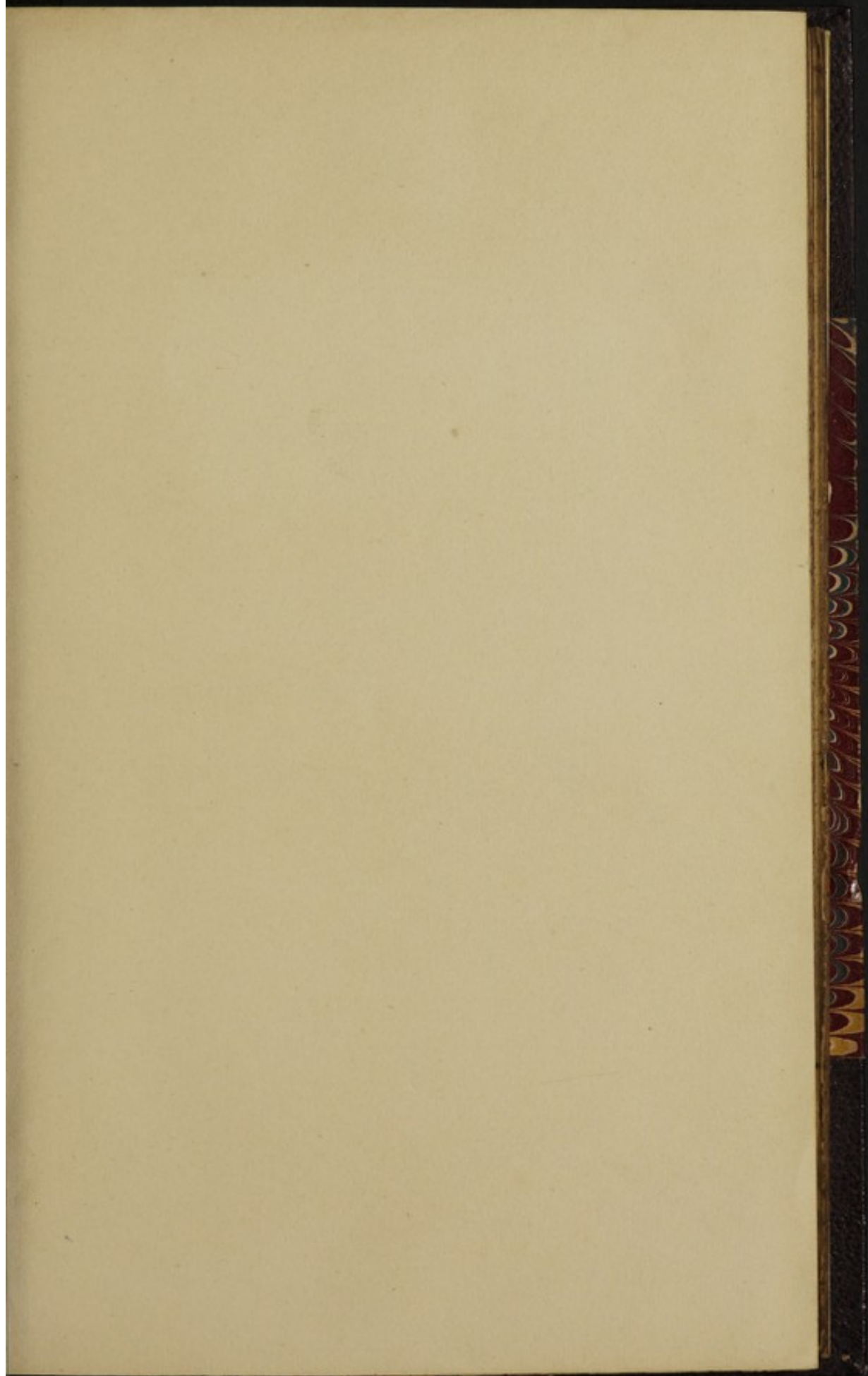
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VI 6

Tractatum hunc cui titulus

The Anatomy of the BRAIN ;

Dignum Judicamus qui Imprimatur,

Thomas Burwell, Præses.

Samuel Collins,

Fred. Slare,

William Dawes,

Tancred Robinson

} Censores.

Dat. ex Ædibus
Collegii in Co-
muniis Censor.
Sept. 7. 1694

No White

MEDICAL SOCIETY OF LONDON
THE
ANATOMY
OF THE
BRAIN.

Containing its
Mechanism and Physiology ;
Together with some
New Discoveries and Corrections
OF
Ancient and Modern Authors
Upon that SUBJECT.

To which is annex'd a particular Account of
ANIMAL FUNCTIONS
AND
Muscular Motion.

*The Whole illustrated with Elegant Sculptures
after the life.*

By H. RIDLEY, Coll. Med. Lond. Soc.

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D. B. JOHANNESSEN

30 CENTS

FOR THE

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FORWARD

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AND

D. D. JOHANNESSEN

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author of the "American Republican" is now

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D. D. JOHANNI LAWSON

Collegii Regalis Medicorum London.

Preſidi Digniffimo

S O C I I S,

Et inter eos ſpeciatim

CENSORIBUS

Vel eo nomine Clariffimis

**SAMUELI COLLINS,
RICHARDO TORLESS,
EDVARDO TYSON,
MARTINO LISTER.**

N E C N O N

D. D. Electoribus Meritiſſimis
Omnibus & Singulis.

*Tam præ Univerſali Exquiſita ſua eruditione,
quam Artis Apollineæ Praxi feliciffima
longe Celeberrimis*

CÆTERIS Denique,

Egregiis Viris

Inclytiſſimæ hujus Societatis aſcriptis

Paginas has eorum juffu in lucem prodeuntes,

Honoris & Obſequii Ergo

quam Humillimè Offert,

H. R.

3. The first of the

B. D. JOHANNES

Collegii Regii Medice London

Præfati Dignissimi

3. O. C. 1. 2.

Et inter eos

CE. R. 1. 2.

Et co. nomine

2. R. 1. 2. 3.

R. 1. 2. 3. 4.

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M. 1. 2. 3. 4.

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CE. R. 1. 2.

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THE
P R E F A C E
TO THE
Reader.

THAT Reason which, upon first thoughts, seemed of most force to dissuade me from engaging my self upon the Subject I have made choice of in these few following Sheets, (which was, its having been already undertaken by two so eminent Persons, as the late *Willis*, and the present *Vienssenius*) upon second became the greatest motives to it. Seeing that even after the best Proofs they have either of them been able to give of *Skill*

The P R E F A C E

or *Industry* upon this Subject, there hath yet escap'd undiscover'd both a great deal of the Materials which Nature is wont to furnish for the framing of Parts, and Contrivance too in ranging of them, in order to bring about that great design of making them all contribute their share to the conservation of the whole.

The cruth of this becoming still more evident whilst I became more conversant in *Dissection*, after some time, put me upon an endeavour, by a deeper Scrutiny, to discover something more than what as yet had come to light : and this I undertook so much the more vigorously, as by how much I reckon'd it more preferable to contribute my Mite towards the perfecting of a Work already so happily begun

To the R E A D E R.

gun and successfully carried on, than to break the Ice only (the common Fate of the first attempt) of another. With what success I have done it the Reader must be Judge.

Through the whole description of Parts I have offer'd nothing but Matter of Fact, and have taken all possible care to avoid being impos'd upon my self, by making Experiments in proportion to my Doubts. Some of them have been upon Subjects in their natural, some in their morbid estate, some upon those of Untimely Death; and on those last sometimes whilst the natural Fluids remained in their proper Vessels, though after a preternatural manner occasion'd by Strangulation; sometimes when in the room thereof, other Bodies have been introduc'd
by

To the R E A D E R.

by Injection, as *Tinged Wax* and *Mercury*, the first of which by its consistence chiefly, the other by its permanent nature and colour, contribute mightily towards bringing to view the most minute ramifications of Vessels, and secretest recesses of Nature.

By this various disposition of the Subject it is that so great Difficulties are overcome in search after Truth, many things appearing oftentimes very plain in one state, which either lay concealed, or seemed otherwise modified in any of the other.

The Figures were delineated by the hand of that Compleat Anatomist Mr. *Cowper* the Surgeon, whose great Skill in Dissection renders that Talent so fortunate both to himself and his Friends : and how exactly that

The P R E F A C E

that Work is performed, I submit to the Severest Censure of any who will be at the pains to compare any of the Cuts to the life.

What I have said upon the *Physiologia*, in relation to *Nutrition* and *Muscular Motion*, depends on Microscopical Observations ; and as to the *Postulatum* on which they both depend, though at first sight it may appear surprizing, yet I am confident it will become far less so to those who have been acquainted with what hath been said of the Vascular Compages of Plants by *Malpighius* and *Grew*, and of several other Subjects by *Lewenhoeck*.

And to conclude, I must confess I have been the better satisfied with it my self, since I met with some Passages in the
Works

The P R E F A C E

Works of those learned Micrographists Dr. *Power*, and of Mr. *Hooke*, relating to this Subject, in which last, the *medium* made use of for solution of that famous *Phænomenon* of that Plants contraction at the first appulse of Touch from external Objects, as well as the manner of its acting, is the same with that made use of here as a *Postulatum*, upon which the whole of what is said about *Muscular Motion* is built: Altho' at the same time I am sensible 'tis not so apply'd in that place by the afore-said Author, whose opinion in reference to *Muscular Motion* (being the same with that of Dr. *Mayow* already taken notice of in the following Sheets) is expressly otherwise in the account he gives of those natural *Hygrometers* the Beards of *Wild Oats*, of all the sorts of *Cranes Bills* and

To the READER.

and *Cats Guts*, conformable to the manner of Nature's acting on which, in order to make them proper *Indexes* of the various Changes of Weather (*viz.* by *wreathing* and *unwreathing*) he supposes that to be of *Muscular Motion*.

I have quoted Authors, not out of ostentation, but both for their Truth and Errors, to the end that at the same time we may see it reasonable and convenient to read all they say, we may be render'd cautious how we believe; and to put us in mind, that as we find something done to our hands by those who have gone before, there is reason we should do something for those who are to come after.

THE

T H E
INTRODUCTION.

HOWsoever the Controversie may stand amongst Learned Men, about the Method and Order which Nature makes use of in the framing the different Parts of Animals, especially as to precedency of Time, some of them supposing a rudimentary delineation, or pre-existence of the whole, which, as the Ingenious Bruner hath rightly observed, must necessarily imply an actual existence of the whole Race of Mankind at once, either in the Testicle or Ovarium of Eve, according to the Learned Harvey, Malpighius, Swammardam, &c. or in that of Adam, according to Lewenhoeck, Dr. Garden, and several others, and consequently must needs also infer an extinction of the same Progeny, as soon as the number of those humane Germens or Animalcles shall be exhausted; others a gradual formation of parts,
one

The Introduction.

one after another, by an intestine motion begun and carried on from the time of coition, by the subtle matter in the Cicatricula of the Egg: I see no reason to make my self a Party on either side at this time, seeing the fineness of structure and dignity of functions are sufficient to give preference to one above another, and to render it more worthy of a particular consideration. And this part I take to be the Brain, the delicacy of whose structure is such, that with no little resemblance to its divine Author, whilst it gives us the greatest and clearest discoveries of other things, lies most concealed it self.

And seeing all that Mystick Knowledge, which in ancient times, in the eyes especially of the Vulgar, appeared meer Necromancy or Witchcraft, as well as all the Curious Discoveries of more modern Ages upon the whole subject of Nature, now going under the more familiar and proper term of Refined Sence, or Philosophy, hath been meerly owing to a more accurate knowledge of the parts and modification of Matter, I see not any more likely way of conquering the difficulties yet
be.

The Introduction.

behind upon any particular Subject, than the endeavouring after a further and more nice scrutiny into it by such means and experiments as serve to bring its most minute parts and texture under the test of Sense, which so assisted, doth the same office to the discerning faculty as good artificial Glasses do to it, bringing the Object and Judgment to such a nearness, that even the first Link of the Chain becomes discernable, and the mechanical proceedings of Nature so highly instructive to the Understanding, in its finding out and assigning proper Causes to Effects much more obvious and intelligible.

I shall therefore treat this Noble Part after the aforesaid manner, with all the Justice I can, leaving those invisible, and almost divine things called Animal Spirits, to be treated of more at large, by those more illuminated Philosophers, who see best when their Eyes are shut, and content myself with making an inquiry into, and giving a description of, whatsoever upon this Subject, by Dissection, shall offer it self as an Object of our Senses.

THE

THE
ANATOMY
OF THE
BRAIN.

CHAP. I.

Of the Anatomy of the Brain.

THE topmost part or *Olla* of the *Cranium* being removed, the first part of the *Brain* that comes in view is the *Dura Mater*, which, with the subjacent *Pia Mater*, is accounted only an *improper part of the Brain*, strictly so called, however of great use in many respects to it.

'Tis by *Spigelius* and other Anatomists reckon'd, and I think not undeservedly, the thickest and hardest Membrane of the whole Body, enclosing the whole Brain, properly so called, somewhat loosely, sticking almost

most inseparably to the *Basis* of the *Cranium*, and to the top and sides, under the Coronal, Sagittal, and Lamdoeid Sutures, very fast by the *Sinus's* whose description will come in another place.

In some places of the upper part of the *Cranium*, which on each side of the Sagittal Suture or Vertex are called *Ossa Bregmatis*, it adheres not to the Bone, notwithstanding the positive Opinion of *Van Roonhuysse*, in his Letter to *Du Foy*, to the contrary, who for that very reason would fain take away in a great measure the use of the *Trepan* and *Trefoyne*, and altogether the use of the Instrument called *Decussorium*, which skilful Surgeons do often make use of to make room for the discharge of subfided matter below the fractur'd place in many Accidents of the Brain.

'Tis very discernably double, as *Columbus* and several others formerly, and *Vieussenius* lately, have observed, having very strong and large Fibres on the inside, but very small, and hardly visible, on that side next the Skull; as appeared to me, after having first let it lye a little time in boiling or at least very scalding Water.

But

But as to the distribution of the double sort of Fibres on each side this Membrane, I could not by any means find them agreeing with the description *Vieussenius* hath given of them, as running in an oblique semicircular manner, externally from before backwards, and in the same figure internally from behind forwards; but far otherwise, on the inside, where they are very strong, they seem manifestly to have three originals from the top part of the *Processus Falcatus*, before, behind, and in its middle; those before running in a curved manner backwards, half the length, and a great width of the *Dura Mater*, and those behind running after the same manner forwardly with this difference, that a great number of them bend soon after their rise from that process in a kind of a semilunary way to it again a little on this side the rise of the middle *Series* of Fibres, others of them making a bigger arch after having stretched themselves wider upon the *Dura Mater*, bend back again to, and terminate in the Falx a little beyond the rise of the aforesaid middle *Series* of Fibres.

Those from the middle part of the Falx run backwardly, but less curved than the rest, terminating as the Fibres which arise backwardly do, at some distance from the Process in the inward Superficies of the *Dura Mater*.

As to those belonging to the external side or second *Lamina* of the *Dura Mater*, they are extream small and obscure, running from behind forwards.

Besides these, there are no less remarkable ones belonging to the Falx itself, of two sorts of Orders, the one running streight about half the length of it, on its upper part, from before backwards, the other transverse, from the inferiour or fifth *Sinus* to the superiour or third, on the hinder part of the Process, and are most conspicuous there, as the other are towards its foremost part.

As to the Use of these Fibres, it may be remembred that this Membrane consists of two *Lamina's*, between which the Veins which reduce the Blood from the Arteries, which furnish the whole Brain with it, run for some space after the manner of the Ureters in the Bladder, in large Trunks,

Trunks, before they enter the *Sinus* ; so that the Fibrous Constitution of this Membrane here, where the Blood-vessels are largest (together with the curved entrance of them into the *Sinus*, especially in an erect position of the Body) do the office of Valves, support the weight, and promote the ascent of the Blood. But that which is most considerable, is this, That if the inward *Lamina* of this part, which makes the inferiour and lateral part of the *Sinus*, was not in some measure furnish'd with additional strength on this side suitable to that which it hath on the other, by reason of its cohesion to the Skull, the Blood which is continually running through it with no small rapidity, especially in great plenitude of the Vessels or preternatural Ebullitions, would frequently burst out, or at least cause such distentions as could not but be very injurious to a part so very exquisitely sensible ; yet notwithstanding, tho' Nature seems plainly to have made a double provision against such Accidents, by the transverse Ligaments within the *Sinus*, and these strong and numerous Fibres without, I have rarely open'd any strangled

Body, where some such Rapture, or at least Distention, hath not hapned.

This Membrane hath plenty of Nerves from the foremost Branch of the fifth Pair, and is thereby made very sensible, so that from any molestation given it by the ill *Crafsis* or undue motion of the Blood, it becomes accordingly affected. And as the various distribution of Fibres before described serve in a natural estate to give a kind of springiness to the Vessels, whose Coats are extended by the Blood as they run between the *Lamine* of this Membrane, to the end the same may be the more readily circulated through them; so in a preternatural estate, no doubt, they are subject to Spasms, which may retard the course of the Blood in such sort, that in some kind of violent Headachs, where the Membrane is affected through overfulness of Blood, and particularly in those which are wont to proceed from Vapours (so called) or Convulsive Motions of Nervous parts, we often observe a fixed ruddiness in the Face, attended with a kind of stiffness and foreness in the Eyes, proceeding doubtless from a stagnation in some measure of the Hu-

Humours in those parts, through the too slow passage of them into the reductory Vessels or *Sinus's*. And to this preternatural affection of the *Sinus's* may certainly many other ill Symptoms of the Brain be imputed, and not to any irregular *Systole* and *Diastole* of the Membrane it self, occasion'd through any convulsive or paralytical state thereof, as that curious Speculatist Dr. *Mayow* hath affirmed, seeing not any living Dissection hath ever been found to give Authority to any such Hypothesis. *Mayow, Tr. 4. P. 49*

The First
Process of
the Dura
Mater.

It hath two Processes, the first of which arises from that part of the *Os Ethmoides*, called *Crista Galli*, and is extended from thence backwards, as far as the concurrence of the four greater *Sinus's*, commonly called *Torcular Herophili*, in the figure of a Sicke, whence it hath that denomination of *Falx*, and by reason of the strict connexion it hath by certain Membranous Fibres with the *Cranium* in those places which are immediately under the Sutures, and with the Brain it self, by the intervention of the *Pia Mater*, (to which it is joyned both by the intervention of large Blood-vessels, propagated thence to the longitudinal

and lateral *Sinus's*, and certain car-nous Adnascencies, as it descends down betwixt the two Hemispheres of the *Brain*, and afterwards at its approach to the back of the *Corpus Callosum*, (over which that Membrane is loosely expanded) both by continuity of its Membranous Substance and Rami-fications of *Blood-vessels*, terminating in the fifth *Sinus*, at the bottom of the Process, so that in a *Diseased Brain* I once saw it drawn up the length of an Inch from the said *Corpus Callosum*, in the exact form of a membranous thin Production, continued to the fifth *Sinus* running at the bottom of this Process,) it keeps the *Brain* suspended in such a natural conformation, that it needs not, to that internal part by the Ancients call'd *Fornix*, nor that by *Vieussenius* of late substituted in the room of it, call'd *Corpus Callosum*, for its support.

Another Use it hath is, partly to defend the *Cerebellum* from Compression, to which, by its connexion with the *Galli Crista*, it doth not a little contribute, but chiefly the two Hemispheres of the Brain from the like Injury from each other, upon its various position in Sleep or otherwise ;
and

and therefore is wanting in many other Creatures, as Calves, Sheep, &c. which not only Sleep less, but for the most part in a less injurious posture.

The Second
Process of
the Dura
Mater.

The second is that which arising so forwardly as from the hindermost Process of the Wedglike Bone, which composes the back and uppermost part only of the *Sella Equina*; it passes up betwixt the *Cerebrum* and *Cerebellum*, all the way adhering to the internal Eminencies of the *Ossa Petrosa* to the lateral *Sinus's*, by which means not only the *Cerebellum* immediately, as is commonly observed, but consequently all the Parts from the beginning of the fourth *Sinus*, or the *Glandula Pinealis*, to the last *Foramen* of the *Skull*, (*viz.*) the *Caudex Medullaris*, with its Appendices the *Nates* and *Testes*, (which being placed upon the upper part of the *Medulla Oblongata*, make a sort of an *Isthmus* betwixt the *Cerebrum* and *Cerebellum*) together with the Nerves proceeding out of it, are defended from the injurious pressure of the hinder Limbs of the Brain.

CHAP. II.

Of the Pia Mater.

THE Second Integument of the Brain, commonly called *Pia* or *Tenuis Mater*, by *Galen* and many others, *Chorooides*, from its likeness in substance and ramification of Blood-vessels to that Membrane of the Secondines call'd *Chorion*, with much more reason than *Vesalius*, on behalf of the *Plexus Chorooides* it self advances against it; was by all the Ancients look'd upon as its only other Integument, being a very thin and pellucid Membrane, co-extended with the Brain it self, not only in its outward but inward structure too, as likewise through all its Plicatures, Interstices, and Cavities, even over the *Corpus Callosum* it self, tho' loosely, as hath been already observ'd, notwithstanding the great *Vesalius* affirms the contrary: Which Membrane also a chance cut in pareing the top-part of the Brain down to the lateral Ventricles with a Razor, in a *Body* I lately had, gave me an opportunity of

Vesal.
P. 778.
par. 2.

of showing as fair in those Ventricles as the largest Membrane of the whole Body, to several who stood by, notwithstanding *Molinetti*, who laughs *Mol. p. 78.* at all that pretend to have found any such thing, affirms the contrary.

But this is to be enquir'd for either in recent Bodies, or such who have before death been, thro' some Diseases, fill'd with extravasated Serum, as *Dropsies*, *Stoppage of Urine*, some sort of *Apoplexies*, or the like: That way which in want of the other opportunities discovers it best, is the separating the *Septum Lucidum* near to its rise, which is just from the *Fornix*, where it arises from its two Roots, near to which place the *Medulla* of the Brain begins to advance into the *Corpora Striata*; for from thence for above half way of its passage backward toward the hinder limbs of the Brain, it continues hollow, and, I am apt to think, is but a Duplicature of this part, tho' it may be somewhat medullary, and therefore, by reason of its transparency, hath the Name of *Septum Lucidum*.

This Opinion of the Ancients, of its being the only other, and that a single Integument of the Brain, was
equally

equally receiv'd for Truth by the late two learned and curious Anatomists *Willis* and *Vieussenius*, together with all the other modern Writers, except *Bidloo* and *Bohn*, both which affirm, they have found another distinct membranous Integument of the Brain coming betwixt the other outward *Dura*, and inward *Pia Mater*, the one three hours, the other fifteen days after death; and by them both reckoned the original of the second proper Integument of the Spinal Marrow which *Tulpius* first discovered, and *Vieussenius* supposes to be a Duplication of the *Pia Mater* in that part only.

Bid. Tab. 8
f. 5. g.
Bohn p. 333

Talp. cent. 1
obl. 29.
Vieussen.
p. 143.
par. 2.

Now, that there was a middle Membrane in some parts of the Brain, and particularly at the Basis of the *Cerebellum*, from whence it's continued down to the Spinal Marrow, constituting the second proper Integument of that part as afore-mentioned, I had long since observed; but whether it be another absolute distinct Membrane from that other subjacent one, by the aforesaid Authors properly named the *Pia Mater*, and common to the Spinal Marrow with the Brain it self, like as is this other
se-

second middle one too, or only one and the same Membrane double, as consisting of two *Lamina's*, may well be doubted of.

Wherefore, for satisfaction concerning this difficulty, I have lately made the strictest enquiry possible, and that in a subject most likely to afford a decision in such a Controversie, and this was an Human Brain extreamly hydropical, where there was no Cavity or Interstice, without abundance of Water extravasated, insomuch that where ever, according to the natural construction of Parts, there was any larger than ordinary duplicature of this Membrane, as there are at the end of the *Calamus Scriptorius*, betwixt the superincumbent *Cerebellum* and *Medulla Spinalis*, in the *Isthmus* or space betwixt the *Cerebrum* and *Cerebellum*, upon the Processes called *Nates* and *Testes*, in the depressed part also of the Brain, between the beginning of the Annular Process, and the first appearance or coming out of the Olfactory Nerves, by *Vesalius* taken notice of and called a *Process of the Pia Mater*, there was found a great deal of Water distending this Duplicature much beyond its natural limits;

Vesal. p. 794

mits; so that by way of consequence, if these Cavities were only Interstices of two different Membranes distinctly investing the Brain, and not a Duplication only of one and the same, the Water would then probably have insinuated it self betwixt them, and made them to have appear'd far different from what they did, agreeable to what it hath often been found to do in some *Dropsies of the Belly*, where the Water hath been found so to have divided or parted the double Membrane of that Region call'd *Peritoneum*, as to have render'd it capable of containing the quantity of fifteen Gallons of Water, and upon a discharge of the same after death, by cutting the external *Lamina* of that Membrane, the other inward one being yet (unknown to the Dissector) left whole, to have imposed upon the Spectators, and those very sagacious ones, so as that at first sight, till after having recollected themselves, and divided the other second *Lamina* too, they thought the Bowels of this part to have been wanting; but contrary to this Event, in this Subject I found this Membrane entire, and free from any divulsion throughout its whole

Job Meier.
Obl. 52.

cir-

circumference, excepting the places afore taken notice of. However, supposing the like conformation here in this with the Membranes of the other parts, I attempted to divide it, and did so successfully in many parts of it, but most readily in the beginning of the superficial Plicatures of the cortical part of the Brain, where there are naturally small Interstices, betwixt which many of the Blood-vessels creep into and immerge themselves in the cortical and medullary parts thereof: So that I think there cannot remain any further scruple of its being only a double, and not two distinct Membranes of the Brain.

Bidloo very truly observes this first or middle Membrane, by him so called, by me only the first, or one *Lamina* of a double Membrane, to be thinner than the *Dura Mater* above it, and thicker than the other Membrane or *Lamina* under it; which last most properly it is that insinuates it self through all the close Plicatures of the Brain, and that, as by frequent inspection I have often observed, not in a continuous, but rather retiform contexture, and so, by such as love hard words, or terms of Art, may be call'd

called after the same name of that Membrane investing the crystalline Humour of the Eye, *Arachnoeides*.

The Advantages accruing to the whole through such a disposition of this part, as hath already been observed, are very considerable, inasmuch as that thereby first of all it becomes not only an Integument of inclosure, on behalf of the Brain, and the Blood-vessels belonging to it in general, but of expansion for Strength too, where the peculiar structure of Parts, in such places as were before mentioned, require it.

As to the first, the Brain is not only kept more warm, close, and compact, and better defended on its depending part from the asperity of the Bone it lies upon, but the Vessels hereby more strongly supported, and it self secured from being broken or torn, whilst between its duplicature they climb up into the Brain, whose delicate tender Fibres must otherwise of necessity have suffer'd violence by the largeness and pulsation of the Arteries, together with the weight of them, and the other reductory Vessels, from which the *Sinus's* meet them.

Nextly,

• Nextly, as it is an Integument of Expansion in the places before mention'd, that tender small part the *Infundibulum*, where it quits the Brain, in order to its passage into the *Glandula Pituitaria*, by the circumtension of this outward *Lamina*, is fortified upon any violent Accident from disruption, and the Brain and *Medulla Oblongata*, in those places where they are only loosely contiguous, are better preserved in their natural due connexion; all which Advantages, inasmuch as they may more reasonably be ascribed to one double Membrane than two single ones, tho' of the like strength when joyned fast together, may not unreasonably be thought to argue for the duplicature of this Membrane exclusively, to the introduction of a third or new one.

Lastly, as to what concerns the *Glandes* and *Plexus's* which Dr. *Will.* Will. p. 26. col. 1. affirms to be scatter'd all over this Membrane; as to the former, I could never see them, but I have seen the external Superficies of the cortical part of the Brain, in strangled Bodies, appear glandulous very plainly, through this transparent Integument, which upon bare inspection,

C with-

without further enquiry, might easily impose upon the less cautious Spectator.

As to the latter, the *Plexus's*, and distribution of Blood-vessels from them, after a separation of the serous gross part of the Blood in the aforementioned supposed *Glandules*, (according to that learned person's conjecture) into the substance of the Brain, in order to produce the finer Animal Spirits; I cannot but look upon it altogether conjectural, till such time as not only the *Glandes*, but their excretory Ducts also, together with the Emunctories where the supposed excrementitious Juice is eliminated, (lymphatick or reductory *Glandes* (if they could be found) never having been by Nature designed to any such use) be first discovered.

Blood-vessels of the Pia Mater.

This Membrane hath Blood-vessels of two sorts.

Of the first are these properly belonging to the Brain it self, which, as it hath already been observ'd, it doth as it were conduct through its Duplication, in their passage allowing them thereby the opportunity of growing extreamly fine, after many serpentine twinings towards their capillary Extremities,

tremities, before they are protended into the Brain it self, and those are chiefly spread all-along upon the under or second *Lamina* of this Membrane. Bid. Tab. 8. f. 5. 1. M. Ib. 1. G.

The second are those which belong to this part it self, for its own nourishment, and these I found upon diligent inspection, whilst I separated its second *Lamina* spread plentifully upon the inside of the outermost or first *Lamina*, and both these you will find very well delineated in the places quoted in *Bidloo*.

This Duplicature is also very plainly communicated to all the Nerves both within and without the *Cranium*, making by its outward *Lamina* a second Integument under the first from the *Dura Mater* to the whole *Fasciculus* of Nerves, and a third by its inward *Lamina*, which yields an *involutum* or covering to each single *Fibrilla*, which collectively make up the whole Nervous Body it self, thro' the admirable fineness of which Membrane investing those medullary Fibrils, altogether insensible of themselves, it happens there is such a nimble consent betwixt part and part, and betwixt all and the Brain it self.

C H A P. III.

*Of the Vessels belonging to the
Brain in general.*

THE Vessels belonging to this part in common with the rest of the Body, though in reality but one continued Canal variously modified, yet, through the diversity of Fluids they contain, go commonly under the denomination of *Arteries*, *Veins*, *Sinus's*, and *Lymphæducts*, and not without good reason, perhaps, the *Nerves* may be in some sense of the same kind too.

The two first of these may, with relation to their different distribution, be deservedly consider'd in a two-fold respect, either as they belong to the first Integument of the Brain, or the Brain, properly so called, it self.

The Arteries therefore belonging to this part called *Dura Mater*, or *first Integument*, are three fair Branches on each side.

The

FIG. 2. hh.

The first and foremost of which are sent out from the Carotid Artery, whilst it remains in the fourth hole of the *Cranium*, and are propagated chiefly through the foremost part of the bottom of the *Dura Mater*, as in the Figure delineated, but greatly mistaken by Dr. *Willis*, *Willis* p. 2. perhaps taking it upon trust from *col. 2.* *Wepfer*, equally with himself there- *Wepf. p. 105* in mistaken; who describes it for a *par. 2.* small branch of the Carotid Artery, that runs betwixt the two first Lobes of the Brain, which instead of coming out of the Bone of the Forehead, as he would have it, goes into it without lending any branches to this Membrane at all, being truly delineated and described by the aforemention'd accurate *Vieuassenius*. *Vieuass. Tab.*

And that this Artery was not only mistaken by, but unknown to the afore said *Wepfer*, is plain, seeing he *17. del, bb.* *p. 32.* *par. 4.* *Wepf. p. 101* says, that from the very styliform Process, where the Carotid Artery does indeed enter the long Canal, to the place where it perforates the *Dura Mater* to enter the Brain, there is not one Branch sent out from it; which Error, by injecting with Wax, which keeps longer in,

and shews the Vessels much better than small tinged Liquors, had very easily been avoided.

FIG. 2. ii. The second Branch of Arteries ascend into the *Dura Mater* by the sixth hole of the *Cranium*, together with a Branch of the internal Jugular Vein, and are dispersed laterally all over the fore-part of this Membrane, as far as the very *Sinus Longitudinalis*, (which nevertheless it enters not, as there will be occasion to take notice of hereafter) as in the Figure delineated.

The third Branch of Arteries climb into the *Dura Mater* by the eighth hole of the *Calvaria*, together with a small reductory Branch of the Vertebral Vein, where the lateral *Sinus's* enter the internal Jugular (which occasion'd the Ingenious *Higmore* erroneously to believe it enter'd the very lateral *Sinus* it self) and the eighth pair of Nerves pass out of the *Cranium*, which passage of this Artery is not hitherto described by any that I know of; neither have I ever seen it figured, but in *Vieussenius's* first Cut, and there but very faintly.

Higmore,
p. 206.
par. 1.

Vieuss. tab. r
kk.

It

It arises from the external Branches of the Vertebral Artery, according to *Vieussenius*, but *Bartholine* makes it to be a slip of the Carotid Artery, calling it the lesser Branch thereof; wherein he is mistaken.

The Veins
of the Dura
Mater.

As to the Veins, *Riolane*, and after him *Willis*, seems to say this Membrane hath none; for tho' the latter hath this obscure expression of them, *Tam crebris Venarum propaginibus quam Arteriarum nusquam consista est*; speaking of the *Crassa Meninx*, by which we might guess he thought it had some, yet in another place he plainly substitutes the *Sinus's* for the reductory Vessels, as well on behalf of this Membrane as the Brain it self; as appears plain enough in the Page noted.

Vieussenius indeed allows Veins to this part, and says, they all-along accompany the Arteries, and afterward terminate, according to *Veslingus*, in the internal Jugular; yet in another place he says, some of the Venal Branches discharge the Blood into the *Sinus Longitudinalis*. Which last is a flat contradiction to the place foregoing, inasmuch as in that he says, they accompany the Arteries

Vieuss. tab.
8. f. 1. c.
Barthol.
p. 431.
par. ult.

Riol. p. 252
par. 2.
Will. p. 2.
col. 2.
par. 6.

Will. p. 22.
col. 1.
par. 4.

Vieuss. p. 32
par. 3.

Vesling.
p. 210.
Vieuss. p. 4.
par. 2.

all-along after the same manner of distribution or ramification ; which, if so, who sees not that they must needs grow capillary towards the *Sinus*, and consequently be incapable of reducing the Blood into them, all reductory Vessels being always capillary in the place from which, and not to which, they bring that which they contain.

Now therefore, neither what the one nor the other says can possibly be true ; for, as to the former the learned *Dr. Willis*, if his Assertion was good, it must of necessity follow, that all the Arteries dispersed thro' this Membrane must terminate in some of the *Sinus's*, otherwise there will want a reductory Vessel ; the first of which is contrary to ocular demonstration, the last to common reason.

As to *Vieussenius* the latter, besides what hath been already said against him, if what he says in the place aforesaid be true, that the Veins of the *Dura Mater* run concomitantly along with the Arteries, then they must of necessity answer the ends of other Veins throughout the whole Body, in reducing the
Blood

Blood adduced by the Arteries, unless the Arteries they accompany discharge their Blood into the *Sinusses*, (which, as hereafter shall be shown, they plainly do not) for otherwise, seeing they both grow capillary in their ascent from the Basis of the *Cranium*, they must necessarily be both adductory Vessels, than which, by the Laws of Circulation, there can be no greater an Absurdity.

Wepfer not knowing of these Veins, was forced to think, and consequently to affirm, That the Arteries leave the *Dura Mater* in their extremities, and terminate in the *Pia Mater*, and so have their Blood reduced by the Veins there; but this is evidently not so to the Eye of any who heedfully separates this Membrane from the other.

Before therefore I proceed to the description of the Blood-vessels belonging to the Brain it self, which by the exactness of method I ought to do, I hope it may be pardonable, if I make a short enquiry after the unaccustom'd distribution of Blood-vessels Nature hath furnish'd the Brain in general with, and the Reasons of its procedure therein.

The

The Truth then concerning this affair, is, That contrary to what hath hitherto been observed, the Blood-vessels belonging to this part in general, as hath already been observed, are of two sorts, the one belonging to the Brain it self, the other to its outmost Integuments.

Now, as to the first, 'tis observable, that the Veins enter not the Brain, nor run concomitantly, like as in other parts of the Body, with the Arteries, (the carotid entring at the fourth hole in the Basis of the Skull, and the internal Jugular at the eighth; the Vertebral Artery at the last and largest hole of the Skull, and the Vertebral Vein at the ninth (which *Vieussenius* mistakenly calls *Vieussen.*
p. 163.
par. 3. the tenth) thro' which it runs into the internal Jugular, at that Veins entrance into the round hole at the bottom of the Skull, under the Styloform Process, where the *Sinus Lateralis* meets it) where after having advanc'd into certain venous productions called *Sinus's*, they descend from thence in large Trunks, growing capillary all-along in their passage till they meet the Extremities of the Arteries, and are indeed no other than
meer

meer Branches of the *Sinus's*, and consequently I look upon the *Sinus's* themselves no other than large Veins.

The common reason all modern Authors give for this different distribution of Blood-vessels belonging to the Brain, from the other parts of the Body, is, that it may receive an equal warmth at the top as at the bottom, as being thereby very much assisted in the production of Animal Spirits in an equal proportion all over; and that it is so may very well be granted: but, that Nature had yet another provident Intention, will be as evident, if we consider, that if the Veins had ascended with the Arteries thro' the holes in the bottom of the *Cranium*, upon all great Ebullitions of the Blood, the pulsation of the Arteries would in that Stricture of the Vessels made by the Bone, of necessity hinder the freedom of its return by the Veins, and consequently occasion a stagnation of Blood through the whole Brain, to the utter subversion of all its faculties, nothing being more certain, than that upon any considerable abatement of circulation there presently happens
by

by way of restagnation, a secession of the watery and thin from the more gross and red part of the Blood.

The other way of the Veins entering the Brain (*viz.* those appertaining to its outward Integument, one at the sixth hole of the Basis of the *Cranium*, the other at the eighth, as aforesaid) is, their ascent with the Arteries after a quite different manner from the former, even to their capillary Extremities; a manifest indication that they serve for the reduction of so much Blood from the *Dura Mater* as the aforesaid sort of Vessels, the Arteries, have brought thither; and although by reason of their smallness Nature seems not to have been so sollicitous in avoiding the Inconvenience supposed to have follow'd, upon the Artery's entering the same hole with the Veins, taken notice of in the preceding Case, where they are very large, and consequently the Effect might prove much more injurious, yet Nature hath not been wanting in providing a Remedy against it; as will plainly appear in the following Pages.

From

From this manner of their entring the Brain at the same inlet of the Skull with the Arteries, may, for ought I know, be very rationally accounted for that violent troublesome Noise which many, in Distempers arising from the turgescency of the Blood, causing a preternatural beating of the Arteries, do so much complain of; a Symptom happening from the Stricture before mention'd which the unyielding circumference of the Bone occasions upon the different Blood-vessels entring at one and the same Foramen, to which effect also the nearness of the *Os Petrosum*, through which the Hearing Nerves do pass to this hole, which is in that part of the Wedglike Bone that joyns to, or is conterminous with it, does not a little contribute.

To the same cause, in some measure doubtless, may be ascribed the frequent Headachs happening in Feavers, the Artery then so swelling and compressing the Vein against the edges of the Bone, that the Blood cannot be returned back through it in a due proportion, and consequently by its stagnation the Membrane becomes inflamed and painful.

So

So that conformable to what hath already been taken notice of concerning the wise contrivance of Nature, in ordering the different distribution of the Blood-vessels, so as to avoid the Inconveniencies which might accrew. to the Brain by compression of the reductory Vessels, occasion'd through their entrance at one and the same hole with the Arteries; it seems very much worth our observing, that besides the Veins of the *Dura Mater*, which enter the *Cranium* together with the Arteries, as hath before been mention'd, there are also several others belonging to this Membrane, having their rise at, and their descent after a very remarkable manner, from a Vein hereafter to be describ'd on each side of the Longitudinal *Sinus*, as you may see in the Figure, and consequently must grow capillary in their descent down from it, after a quite contrary manner to the other; and these do visibly inosculate with some of the Extremities of the aforesaid capillary Arteries, after the same manner as those larger Veins belonging to the *Pia Mater* do with the Arteries be-

FIG. 4.
ad,nn,&c.

belonging to the Brain and it, by which means it so falls out, that a considerable part of that Blood brought up by the *Meninx Arteries*, is carried back by these Veins, to the end that, especially in all preternatural swelling of the Blood, the inconvenience of Compression and all its ill consequences happening, by reason of an overfulness of these Vessels, may be in a great measure avoided.

CHAP.

C H A P. IV.

Of the Veins belonging to the Brain it self.

AFTER this short digression, by order of Method, the Blood-vessels belonging properly to the Brain it self, fall under consideration.

The curious Anatomist *Malpighius*, Malp. de Cereb. p. 6. par. 2. in his Letter to *Fracassatus*, says, they bear a third proportion to those of the whole Body ; and for what reason, seeing the part it self bears not the same proportion to the whole, it is so, it will be worth our while to enquire hereafter. De Cort. Cereb. p. 81. par. 2.

These are either Arteries or Veins. The former go under the name of *Carotid* and *Vertebral*.

The first of which, after a curved passage (which is very well expressed in a Fig. of Dr. *Willis*) from the place Willis p. 29. Fig. 1. where it begins to enter the Basis of the *Cranium* (which is from the Styli-form Process of the *Os Petrosum*) to the place where, on the inside, they pass through the *Dura Mater*, and ascend into the Brain, (which is at the fore-

foremost internal Process of the *Os Cuneiforme*) there is very near an inch and an half distance. I say, after this crooked passage into the Brain, they are propagated quite through its substance, having first divested themselves of that thick Coat borrowed of the *Dura Mater* during their stay in the passage aforementioned; but not without the mediation or intervention of the *Pia Mater*, which Membrane all the Branches of the aforesaid, as well as the Vertebral Artery, more or less first prop themselves upon, before they enter on and disperse themselves through the substance of the Brain itself, and is very finely expressed in a Cut of *Placentinus*, at the end of *Spigelius*; insomuch that *Molinetti* (with whom also agrees *Marchetti*) looks upon it as only a production of those numerous Vessels; whereas all those little ramifications both of the Carotid and Vertebral Arteries, viz. those from the carotid Artery, which as soon as it gets through the *Dura Mater*, and parts with its borrowed Coat, are sent to the *Infundibulum*, *Olfactory*, and *Optick Nerves*, together with those other of the Vertebral Artery which accom-

Spig. p. 179

Mol. p. 77.

Marchetti,

p. 191.

par. 5.

Vitussen.

p. 35. par. 1.

p. 34 par 6.

Tab. 17.

cc.

Ib. 88.

D pany

pany the ^d third, ^e fourth, ^f fifth, ^g sixth, ^d *Viussen.*
^h seventh, ⁱ eighth, ^k ninth, and ^l tenth ^{p. 35. par. 1.}
 pairs of Nerves, inasmuch as they en- ^e *Ibid.*
 ter not the Brain it self, are altogether ^f *Tab. 17. p.*
 exempt from that Membrane; any of ^g *Tab. 17.*
 which now-mention'd Blood-vessels ^h *Tab. 4.*
 you either find delineated in *Viussen* ^h *h. p. 35.*
nus's 17th Table, or mention'd in ^{par. 1.}
 some other place of his Book, by ^h *Tab. 4. hh.*
 those Directions here placed in the ⁱ *Tab. 17.*
 margin; all which, tho' existent in ^{Fig. 2.}
 Nature, are nevertheless there painted ^{Tab. 4. hh.}
 too stiff and formal (I am afraid by ^h *Tab. 4.*
 guess) inasmuch as that without an
 injection of Mercury (except those
 two which belong to the *Olfactory*
 and *Optick Nerves*) they do rarely
 come to sight in any form at all,
 Wax being over gross a body to en-
 ter such minute Vessels as those are;
 whereas by an injection with Mercu-
 ry I find scarce any Nerves but what
 hath some such small ramifications of
 Blood-vessels in them.

To go about to describe distinctly
 the whole ramification of Arteries
 through this part, which as was be-
 fore noted, is here more remarkable
 for number and size than in any other
 part of the Body, would not only be
 to do what in a great measure hath
 been

been already done by *Vieussenius*, in his sixth Chapter, but seem to have also in it much more of ostentation than use.

I shall therefore only take notice of such propagations of them, as are either remarkable for magnitude, some curiosity of Structure, or useful design of Nature.

And of this sort may well be esteemed the Vertebral Artery, next after the Carotid, which hath already been described, as entering the Brain at the last and largest Foramen of the Skull, contrary to what *Dr. Willis*, Willis, p. 29. col. 1. and before him *Wepfer*, affirms, par. 2. coming thither on each side out of the hole in the transverse Process of Par. 1. ibid. the first *Vertebra* of the Neck, after Wepf. p. 112. Low. Tab. 4. a very remarkable curved manner, as

FIG. 1. EE you see in the Figure, (and by no means like to the delineation and description given by *Dr. Lower* and *Dr. Willis*,) ascending laterally upon the *Medulla Oblongata* as far as the beginning of the *Processus Annularis*, where they meet together in one single Trunk continuing to the length thereof, by *Vieussenius* call'd Vieussen. Tab. 4. bb. *Arteria Cervicalis*, after which they either send forth two Branches, or receive two from the carotid Artery, by

means whereof there is a communication betwixt these two large Blood-vessels, and that of great use and benefit to the Brain, for by this means it happens, that if even three of the four great *Arteries* which furnish this part with Blood, were totally obstructed, there would yet be a way left for a competent supply from the other unobstructed fourth. These I call the *Communicant-branches*, very ill painted in *Bidloo's* ninth Table, but very well in *Vieussenius's* fourth; as may plain-

ly appear here in the Figure taken exactly from Nature it self. *Vieussen. tab. 4. b b.*

The structure and smallness of these *Arteries* seem to suggest two, yet further, provident Intentions of Nature.

The first is the same it hath expressed in several other places, as in the ascent of the Blood by the *Carotid Arteries*, both which enter the Brain in a crooked line, the first at the fourth hole of the Basis of the Skull, the second from the hole in the transverse process of the first *Vertebra* of the Neck, after the manner already in both places described. So in the like manner here, by the narrowness of these Branches, the Blood is in a great measure retarded in its motion

motion to the carotid Artery, and by consequence to the Brain it self, which, for Reasons hereafter to be given in describing the *Sinus's*, would otherwise be in great danger of being overflowed with extravasated and reflagrant Blood.

The second is, a forcing the Blood more plentifully into the Spinal Artery, with which, tho' through the conical structure of the Arteries in common it cannot be altogether unfurnish'd, yet by its perfectly-reflexed position; would have it very scantily, were it not that by reason of the narrowness of the aforesaid *Communicant-branches* betwixt the two great Arteries, the Blood was driven back in a sort of a retrograde motion.

'Tis true, there is a conformation of Arteries something like this, tho' not altogether in the mammary and epigastrick Branches; but 'tis worth noting, that in both these places the main Artery from which these Branches spring is much more taper or conical, and the succeeding exporting Vessels far less both in number and size than those of the carotid Artery here, whose foremost and hinder lateral ramifications between the

Ibid. p. cc

Lobes of the Brain, bear an over-proportion to the Trunks from whence they come, and consequently must, according to the aforesaid observation of *Malpighius*, in his Letter to *Fracassatus*, receive the blood brought thither far more freely and plentifully.

Besides, the Cervical Artery here is so far from being Conical, that being made up of two vertebral Arteries joyning together, it is much wider than either of them single, as appears plainly in the Figure, and consequently would have carried away the Blood forwardly from the Spinal Artery more freely, had not Nature order'd the Structure of Vessels after another manner here than it does in other parts of the Body, where there is not the same necessity of contrivance.

One more Branch I take leave to mention only upon the score of its never hitherto having been taken notice of by any, and that's a small Artery attended with a Vein passing through the lateral part of the *Os Cuneiforme*, (which constitutes the back part of the *Orbite of the Eye*, just under a very little Process of that Bone, (which either by reason of its
size

size hath escaped being seen, or inconsiderable use, was never before, as far as I know, thought worth the mentioning;) and this, upon raising the fore Lobes of the Brain, offers itself to the Eye of any heedful Observer.

CHAP. V.

Of the Sinus's belonging to the Brain.

A Third sort of Vessels offer themselves next to our consideration, under the general name of *Sinus's*.

These formerly were reckon'd only four, to which *Vesalius* added a fifth *Vesal. p. 758* at the bottom of the *Falx*, by him Fig. 3. F. only call'd a *Vein*, which tho' frequently found, yet in some Subjects is wanting. *Bourdon* mentions two *Bourd. p. 195. par. 2.* more at the bottom of each side the second Process of the *Dura Mater*,

D 4

under

under the lateral ones, which I never saw but once, and I am apt to think with *Vieussenius*, are most commonly wanting.

• *Vieussenius* describes four more, which I find long before taken notice of, and exactly describ'd by *Fallopius*, and after him, tho' but rudely, by that laborious Collector *Vidus Vidius*. *Vieuss.*
p. 6. par. 5.
Fall. tom. I.
p. 114.
Vid. Vid.
p. 117.
cap. 10.
p. 310.
cap. 11.

I think I can shew one more, but be their number what it will, I judge it reasonable to look upon them no other than Veins, whether we consider them in respect to either Office or Structure. All the business is, to consider and shew for what end they appear as such large Channels into which all the Veins of the Brain, like so many small Rivulets after an unusual manner do empty themselves; and that I will endeavour to do after having first shown their several respective situations.

Fig. 4. BB. The first two are called *Laterales*, which run within a strong duplicature of the hinder Process of the *Dura Mater*, down upon the *Os Occipitale* over the *Cerebellum*, till in their further descent, after a tortuous manner, upon the lower production of the *Ossa Petrosa*

FIG. 2. CC. *trofa* they wind under them in order to their passage out of the *Cranium* at the eighth hole, common to the eighth pair of Nerves going out, the third Branch of Arteries belonging to the *Dura Mater*, and the internal Jugular coming in, which is through two round bony Cells in the *Os Petroso*, just under the Styloid Processes into the internal Jugular Vein, into which, together with the Vertebral, all the rest of the Veins and *Sinus's* belonging to the Brain discharge the reflux Blood.

FIG. 4. AA, &c.

The next is called the third or longitudinal one, from its rise at the bony Process called *Crista Galli*, and progress the whole length of the Brain to the hinder and somewhat declining part of the occipital Bone, where it seems to be cleft into the two lateral ones.

Into this third *Sinus* not only the internal Veins of the Brain it self are inserted, but also some of those belonging to its outward Integuments, which *Fallop* first, one of the Lu-

Fallop.
tom. 1.
p. 82. par. 3
Vienf. p. 19.
par. 2.
Wepf. p. 42.
par. 2.

minaries of Anatomy, observed; and after him *Vieussenius*, which are by *Wepfer* mistakenly taken for Arteries, who nevertheless, for ought I know, may

may be in the right, in assigning the overcloseness of the Pores of the *Cranium* (by what Accident soever happening) thro' which the reflux Blood is transmitted to the *Sinus*, for a frequent cause of inveterate obstinate Headachs.

FIG. 4. C. The fourth, which from its situation may not improperly be called the *Internal Sinus*, comes from the under part of the falcated Process, at that point where it becomes continuous to the second Process of the
 Ibid. II. *Dura Mater*, and a large double Vein belonging to the *Plexus Choroeides*,
 Ibid. K. together with the fifth *Sinus*, (when there is one) enters it at an Interstice made between the end of the *Corpus Callosum*, the *Nates*, *Testes* and *Cerebellum*, from whence having first passed over the *Cerebellum*, it at last arrives with the other three at that place of union, which from its Author hath ever since retain'd the Name of *Torcular Herophili*.
 Ibid. g.

The four others of *Falloppius* and *Vidus Vidius*, or *Vieuassenius*, by this last called *Superiores* and *Inferiores*, the ^{dd} first two of which being longer and narrower, are call'd *Superiores*, are on the Basis of the Brain *, arise,

ac.

Ibid. EE

according to him, from the *Receptacula Sellæ Equinæ*, by the same Author so named, (hereafter to be described, though more truly, from the ^{cc} circular *Sinus*, as I hope in its place to make appear, running down from thence upon the internal Process of the *Os Petrosum*, and terminating in the *Sinus Laterales*, where they begin to be declive and [^] tortuous in their passage to the internal Jugular.

Ibid. N.

Ibid. cc.

The other two, called ^{cc} *Inferiores*, which are much shorter and wider than the others, descend from the same place as the former, between the *Os Petrosum* and *Occipitale*, down to the aforesaid eighth hole of the *Cranium*, where the Jugulars come up into the Brain, and end there.

Another I discover'd by having first injected the Veins with Wax running round the *Pituitary Gland* on its upper side forwardly within a duplicature of the *Dura Mater*, backwardly between the *Dura Mater* and *Pia Mater*, there somewhat loosely stretched over the subjacent Gland itself, and laterally in a sort of a Canal made up of the *Dura Mater* above, and the carotid Artery on each outside of the Gland, which by being fasten'd

fasten'd to the *Dura Mater* above, and below at the Basis of the Skull too; leaves only a little Interstice betwixt it self and the Gland, thereby constituting a Cavity communicating with the two foremention'd forward and backward ones, from whence the abovemention'd four small *Sinus's* do descend, by a visible continuity, on each side from a little beneath the hinder Process of the *Sella Turcica*: and this from its Figure may not unfitly be called the *Circular Sinus*.

FIG. 2.EE

Vieussenius, it may be, saw some part of this *Sinus* where the other four small ones enter it, which is at the hindermost part of his *Receptacula Sellæ Equinæ lateribus adjacentia*, so called, and from thence thought those Receptacles to communicate with and to be capable of performing the office he assigns them, (*viz.*) of bringing back Blood from the nourishment of the subjacent Bone call'd *Guneiforme*, together with the Water separated from the Pituitary Gland, into these four inferiour *Sinus's*.

Now, as concerning these Receptacles of his, 'tis certain that they are not any where existent in Human Brains, (according to the description
he

he gives of them in the place here noted) seeing both the third, fourth, Pag. 16.
two foremost Branches of the fifth,
as well as its third hindermost one,
together with the sixth pair of Nerves,
do not only run out of the Brain enclosed in so many distinct little *Capsula's* or Coverings made of the *Dura Mater*, during their passage through that part of the Basis of the *Cranium* by him call'd *Receptacula*, &c. but even the whole *Dura Mater*, together with its Membranous Productions constituting the aforesaid Coverings of those Nerves, in that place sticks close to the Basis of the subjacent Bone, (*viz.*) the External Process of the *Os Cuneiforme*, on its under side, and to the Carotid Artery (which also both above and below (as was before noted) by its borrow'd coat sticks close to the *Dura Mater*,) on that side towards the aforesaid Gland, leaving no room at all for either Blood or *Serum* to be contain'd there, as he would have it; tho' in the same place which he describes for his Receptacles I have in several injected Bodies observ'd two very fair and large Veins, one coming into the *Cranium* at the second *Foramen* from
the

the Orbit of the Eye, (and possibly may be a Reductory Vessel to that part) and so climbs up on the side of the lateral Process of the Wedglike Bone, almost up to the *Circular Sinus*; the other at the fifth *Foramen*, which climbs up upon the same Bone till it meet and joyns with the other, from whence they make one short Branch, which enters the *Circular Sinus* very near the place where the two other inferiour ones on each side descend down from it; which if they should chance to be cut by accident in any enquiry made into that part, might cause an appearance of Blood, and thereby become an occasion of the aforesaid erroneous Hypothesis.

Neither is it possible (granting there were any such Receptacles as he mentions) they should serve to the end he assigns, seeing the *Glandula Pituitaria* is on all sides enclosed by both the *Dura* and *Pia Mater*; which first (notwithstanding what he says to the contrary) is on all sides of this Gland of a very strong and equal thickness; yea, in that very part where (as hath been before taken notice of) there is a kind of a Chase made by a certain duplicature of
of

of the *Dura Mater*, constituting the foremost part of the *Circular Sinus*.

And if this also was granted, yet would the manner he describes of the *Serum* or Water getting into these Receptacles (which is by transcolation) render his Supposition very unprobable, seeing 'tis by no means conformable to the Custom of Nature in all other parts of the Body that Arteries should depose a *Serum*, or any thing else but Blood, (except what goes for Nourishment to the Part it self) in any Part, without being furnish'd either with its Excretory or Secretory Ductus, neither of which was ever pretended to have been found here.

And as a thorow confirmation of all this, said in opposition to the aforesaid Hypothesis, I shall only add this, and conclude, that in several Injections made use of in order to find out the use of Parts, I never found one drop of the tinged Liquors on that side of the Carotid Artery, where he hath made the situation of these Receptacles.

The use of this *Circular Sinus* is in common with the rest to reduce Blood returning from all the adjacent parts, as the Pituitary Gland, the
Wedg-

Wedglike Bone also, and it may be from the *Rete Mirabile*, which in Brutes is very large, and therefore seems to require the Service of this *Sinus*, either mediately or immediately, for reducing a share of its Blood, seeing the *Glandula Pituitaria* appears no where furnish'd with Veins terminating any where else sufficient to carry off the reflux Blood from this *Plexus*, notwithstanding *Vieuassenius* saith on the contrary it hath no Veins, and therefore is forc'd to have recourse to those small Branches of Veins which accompany the Branches sent out by the carotid Artery, before it perforate the *Dura Mater*, with the Optick Nerves, or those which go to the *Gangliforme Plexus* of the fifth Nerve, or those coming out of the Wedglike Bone, for reductory Vessels to this Part ; but with what probability I know not.

CHAP. VI.

Of the Motion of the Brain and
Sinus's.

TO these *Sinus's*, especially the *Longitudinalis*, and by way of consequence to the *Lateralis* also, most if not all the Ancients, as well as Moderns too, particularly *Willis* and *Vieussenius*, have unanimously ascrib'd Pulsation, after the manner of Arteries, by reason of some Arteries (as they thought) from the *Dura Mater* terminating in them: of the truth whereof being somewhat doubtful, I resolv'd to make use of such an Experiment as might remove all future Scruples, and most satisfactorily put an end to the Controversie; which was as follows.

I took off the upper part of the Skull of a Dog alive, by which means the *Dura Mater* with its third *Longitudinal Sinus* lay bare to the Eye and Touch, to neither of which Senses, at first, either any beating of
E the

the Membrane in general, or of the *Sinus*, was the least discernable. After some pause, by chance the *Sinus* it self, which I design'd to have open'd with a Lancet, being touch'd with a cauterizing Iron (which in making the Experiment there was occasion to make use of) pour'd out the Blood very violently, and at first without any very remarkable pulsation, but after some time discernable enough, both as to the Blood and Membrane too.

I cut this *Sinus* through almost the length of it, to see whether any Arteries (whereof many, according to *Vieussenius*, which was also long afore affirm'd, and that upon Experience too, by the learned *Wepfer*, did terminate in it, and so occasion its beating,) would discover themselves by throwing out their salient Blood, but no such Sign appear'd. *Wepf. p. 116*
par. 1.

After all which 'tis manifest the *Sinus's* themselves have no pulsation, other than what is communicated to them from the subjacent Brain, which contrary to what *Bourdon* affirms, hath an evident pulsation through the multitude of Arteries dispersed thro' it. *Bourd.*
p. 196.
par. 2.

it so forcible as to create a sensible *Systole* and *Diaſtole* in its outward coverings.

'Tis worth noting, that while the Blood-veſſels are all full, ſo as to keep the *Dura Mater* upon its full ſtretch, the pulſation is not viſible at all, or at leaſt very faintly; but after a depletion of the Veſſels, ſo, as that grows ſomewhat more lax, the beating becomes very viſible, equally in the *Sinus* and Membrane too.

After having made this Experiment I found one Author of the ſame opinion, and that is *Falloppius*, who in vindication of *Galen* againſt *Veſalius*, his Contemporary, ſays, all I have ſaid upon the foregoing Experiment, and all the great *Veſalius* was able to answer in his own vindication in his ingenious Book call'd *Anatomicam Gabr. Falloppi Obſervat. Examen*, falls very ſhort of its aim.

As to the Tranſverſe Ligaments which are in ſome places * round, cordal, and in others † broad or membranous, in the Longitudinal *Sinus* chiefly, both ſerving for Strength and (in concurrence with the cruciform ligamentous Fibres, taken notice

* Fig. 4 r.

† Ibid. x.

tice of by *Vieussenius*, on the under and outside of this *Sinus*, from whence the Fibres belonging to the falcated Process aforementioned seem to have their original,) Elasticity to this part for its more vigorous reduction of the Blood passing through it, together with its blind Cavities or Diverticula serving to moderate the over-swift or violent motion of the Blood; seeing I find them so exactly describ'd by *Vieussenius*, to whom the Reader may have recourse, I think their description need take up no room here.

But as to the manner of the Veins entering this *Sinus*, I find it far different from that which is describ'd by *Lower* first, and afterwards by *Vieuss.* Low. fig. 4. h h. Vieuss. tab. 2 D D, &c. *senius*, both whom make them enter with their Orifices from behind forwards, (two or three only excepted by *Vieussenius*) and that for some other useful purposes than what have hitherto been taken notice of.

And this is as follows, (*viz.*) About Fig. 4. dd, &c. one half of them (tho' intermixedly) (but all, after having first upon their arrival at the *Sinus* insinuated themselves for some space after the manner of the

the Pancreatick Duct or Ureters first
ib. dd, &c. taken notice of by *Lower*, betwixt the
 Duplicature of the *Dura Mater*) from
 behind forwards, the other half from
 before backwards, as in the Figure.

Now, by this contrivance 'tis plain,
 that first of all there are made two
 contrary Torrents in one and the
 same Channel, by which means the
 reflux Blood, made poor by the vast
 quantity of its richest parts drawn off
 as it were into Animal Spirits, thro'
 a collision of Parts, which by this
 contrivance must needs fall out, is
 preserv'd in its due mixture, which
 when at any time lost through the
 languishing of its intestine motion or
 elasticity, retards even its circular or
 progressive motion, which when it
 happens but in some degree, is the
 cause of many Distempers; and when
 altogether, of Death it self.

In the next place the circulation is
 at all times not only somewhat re-
 tarded, and the Blood hinder'd, (to-
 gether with the help of the bony Cell
 at which the internal Jugular Veins
 enter the *Sinus's*) especially in an
 erect posture, from descending with
 that rapidness and weight it would

otherwise have done upon the descending *Cava* to the Heart; but also much more so retarded in a supine position of the Head, a posture most natural and ordinary for Mankind to take their rest in, through which contrivance, in concurrence with that of the Lateral *Sinus*'s, (whose structure is such, that in the aforesaid posture the Blood is forced to climb upwards before it can arrive at the place of its descent into the Jugular Vein) there is made a more plentiful generation of Animal Spirits, one chief Cause of the great refreshment and vigorous disposition of the whole Body we find after Sleeping.

As to the other manner of the Veins entering this *Sinus*, (*viz.* from before backwards) it from thence happens, that in a prone Position of the Brain, a posture not uncommon amongst Men, the Blood is help'd forward in its circulation through the *Sinus*; the truth and design whereof are at once both evident and pointed at by Nature from the Structure of this part (and which therefore shews the great usefulness of Comparative Anatomy) in Brutes, who by reason of
such

such a Position, which the necessity of Feeding almost always keeps them in, have always such a disposition of this Part, to assist the Blood in its heavy circulation.

The design of Nature in making these Channels so wide on a sudden, in respect to the Branches of Veins lately treated of terminating in them, seems to correspond with the conformation of the Parts just now treated of, and with that it had in making the Ramifications of Arteries afore taken notice of so large and unproportionable to the Trunks from which they spring, which is a slower than ordinary circulation of Blood through the Brain, in order to make a still more copious production of the Animal Spirits so called. Which profitable Design and End of Nature had nevertheless been attended with a very great Inconvenience, (*viz.*) an extravasation of too much *Serum*, the usual effect or consequence of a slacken'd Circulation, had it not been for another provident Contrivance of Nature in the two Communicant-branches, betwixt the Carotid and Vertebral Arteries aforemention'd,

p. 36. by the narrowness of whose Channel the influent Blood is in some measure repress'd in its motion, and an overcharging the Vessels with Blood prevented.

These *Sinus's* differ in structure one from another, the Longitudinal and Lateral ones having many transverse Ligaments which the other have not, and the Longitudinal having many small Cavities or blind Diverticula, as aforesaid, which the Lateral have not; the use of them all being for strengthening and defending them from giving way to the violent irruption of Blood into them, against which sometimes notwithstanding they are not able to defend themselves; as I have seen in many Skulls in which the Blood hath burst open the sides of the *Sinus's*, and found its way between the Duplicature of it, so as even to have made a *Fovea* or Cavity in the *Cranium* it self, as was before noted, one of which I have now by me.

CHAP. VII.

Of the Plexus Choroeides.

THIS *Plexus* is an aggregate Body made up of *Arteries*, *Veins*, *Membrane*, and *Glands*, double on each side, (which hath not before been taken notice of) and consequently having two Originals.

FIG. 1. cc. The first Original is from the foremost Branch of the Communicant Artery, which running backward up betwixt the hinder Lobes of the Brain, (in which for some part of the way it is immerged, and to which it gives many large Branches) and the *Medulla Oblongata* at length arrives at the Lateral Ventricles, and makes one part of the *Plexus* on each side.

FIG. 1. second cc. The second Original is from the hindermost Branch of that Communicant Artery, which running more backwardly, ascends betwixt the hinder Limbs of the Brain and the *Cerebellum*, till it comes to the *Isthmus*, where

where communicating with the first Branch abovemention'd, they make a reticular broad Expansion, which covers both *Nates*, *Testes*, and *Glandula Pinealis*, and constitutes the second or other part of the *Plexus Chorooides*.

FIG. 5. GG

Ibid. 5.

The first Branch begins to divide it self into divers Network Fouldings, interspersed with Glands somewhat before it enters the Ventricles, and continues such to its Extremity on each side, where they both under the *Fornix* wind cross the third Ventricle into a mutual inosculation.

The second begins to assume the same shape or contexture as soon as it begins to enter the *Isthmus*, continuing such throughout its entire abovemention'd Expansion.

These two on each side are joined together by a twofold connexion, the first is by an Artery running under the *Bombyces*, intervening betwixt them, which could not be here inserted so as to come in view.

The second is by a production of the *Pia Mater*, which is extended all over these parts of the Lateral Ventricles, and the third Ventricle which lyes

lyes betwixt the first two parts of the *Plexus* forwardly, and down to the other two hinder parts of the *Plexus* backwardly under the *Fornix* and *Septum Lucidum*; so that whatsoever Water is transmitted out of these Ventricles, must slip down not only under the *Fornix*, but that Membranous Production it self; from which kind of structure and position of this Membrane may probably be understood how there might happen such an *Hydrocephalus* as the learned *Tul-*^{Tulp. lib. 1. cap. 24}
pius mentions, in which there was found above two pounds of Water in one Ventricle, without any at all in the other: and such another as *Wepfer* mentions, where the Water^{Wepf. p. 69} causing the *Hydrocephalus* in an Heifer, was found contain'd in a *Cystis*, and that only in the left Ventricle too: for, supposing this membranous production of the *Pia Mater* to be double here, as it certainly is in all other places, 'tis not difficult to conceive, that the Water which is extravasated must needs insinuate it self betwixt the two *Lamina's*, till by a continual encrease it extends them into the shape of a large Bladder,
such

such a one as the latter found there and drew out with his Fingers ; and that which seems to put out of all Controversie that it was so, is, that in those places, both above towards the *Corpus Callosum*, and below on the Basis of the Ventricle, he found some sort of Asperities as though the Bladder fill'd with Water had been covered with some small Protuberances not much unlike to White Poppy-seed, in those places where it was contiguous to them ; which Protuberances doubtless were the small Glands interspersed quite through this *Plexus*.

How this Distemper came to be on one side only, though sometimes it is on both, as you may see in another place of the aforesaid *Tulpius*, may likely enough be from an Adnascency of both the *Lamina's* of this Membranous Production, in that place where the *Septum Lucidum* sinks down from the *Fornix*, occasion'd by some small sort of pressure of the superincumbent Brain. Besides these Veins, which are very truly describ'd by *Willis*, I have always found two more meeting the fore-

Willis p. 18
col. 2.
par. 1.

foremost Extremities of this *Plexus*, from between the two first Lobes of the Brain, where it seems to end under the foremost part of the *Corpora Striata*, by which it is there fixed and as it were kept in its due situation: and from these Branches are on each side sent forth many more little ones to the *Corpora Striata*, and several other parts adjacent.

FIG. 5. hh. To this *Plexus* belong also Veins, which from the Extremities of that part of it in the Lateral Ventricles begin to come into two distinct pretty large Trunks, running down thro' the middle of the third Ventricle, as far as the fourth *Sinus*, and there receiving some Branches from the other hinder part of the *Plexus* spread over the *Isthmus*, discharge the reflux Blood into that *Sinus*.

Ibid. qq. But besides this sort of Reductory Vessels, it hath also another, (*viz.*) *Lymphæducts*, which I first discover'd in the Brain of a strangled Body, and shew'd to several then present, running in different ramifications amongst the reticulated Vessels and Glands of this part: Which Observation being added to that of the great Anatomist
An-

Anthony Nuck, who in that curious Piece call'd *Adenogrophia* says, he *Nuc. p. 150.*
saw one coming from the *Glandula Pinealis*, and that his Friend another Anatomist, whose Name he mentions not, (but I know it was one *Bodivol*, whom I had the Happiness to be very well acquainted withal, now dead) sent him word, he saw another not far from the aforesaid place; may be of sufficient authority to evince the real Existence of these Vessels hitherto so much enquir'd after, in the Brain as well as in other parts of the Body.

The Glands belonging to this *Plexus* are very many, but very small, and their Use, according to all the Moderns, especially *Willis*, *Duncan*, and *Vieussenius*, to carry off the redundant watery part of the Blood, but that without ever shewing by what rational contrivance of Structure it can be done, seeing none of them ascribe a Secretory Duct, which must always be in readiness when any unprofitable part is to be discharg'd.

Since therefore this part is found furnish'd with *Lymphæducts*, 'twill be no hard matter to conceive the genuine use of the Glands, which is, to
sepa-

separate a rich nutritious Juice from the influent Blood, and by the *Lymphæducts* to refund it to the refluent, after the loss of its noblest parts left behind in the Brain, in its passage to the Heart again.

It may also, for ought I know, according to the Opinion of *Willis*, serve to warm its neighbouring parts the Internal Superficies of the Brain, which being purely medullary, hath not so plentiful a share of Blood-vessels dispersed through it as the rest, and consequently, to maintain an equality of warmth conducing so much to the conserving the Spirits in their due vigour and exercise, must borrow an additional supply from hence. It is situated upon the middle of the *Thalami Nervorum Opticorum*, all-along them length way, and, contrary to what *Willis* says, is, by vertue of several Blood-vessels, join'd to that medullary part of the Brain so call'd, immediately lying under it.

CHAP.

C H A P. VIII.

Of the Rete Mirabile.

Notwithstanding the Opinions of the late *Wepfer*, *Willis*, and *Vieussenius* too, (which two last indeed, tho' but now and then, are willing to allow it an existence only in Men, (who nevertheless, if the Supposition of *Willis* be true, *viz.* That such cannot but be Fools) had better be without it,) together with almost all the Ancients, as *Vesalius*, *Columbus*, &c. *Willis* p. 27. col. 2. to the contrary, I have never found this *Rete* wanting, or with any difficulty discoverable in Men, springing from and lying on the inside of each Carotid Artery, in that place of the Circular *Sinus* chiefly which looks into the four abovemention'd inferiour and superiour *Sinus's* in the Basis of the Brain, and in some measure also the whole length of the *Sella Turcica*, on each side, between the Gland and the Carotid Artery.

And that it is so small in them with respect to what it is in Brutes of several kinds, is no way surprizing, when consideration is had to the Use and Service of it in those Creatures, who,

who, by reason of their prone Position, would otherwise be in danger of having their Brains deluged as it were with an over-great quantity of the Influent Blood, and of a Rupture of the Vessels, by its violent ingress, and this Danger so much the more threatned by how much the same Cause which brings it into the Brain with that force is equally as great and effectual to hinder its proportionable return; for the relief of which Inconveniency Nature hath contriv'd a means of its more easie and safe descent into the Brain, by turning that one large Stream of Blood, (which through its being penn'd in one Channel, becomes so rapid) into many more, (by which means the Carotid Trunk above the *Dura Mater* in those Creatures is very small to what it is beneath, whereas that Artery in Men, &c. hath the same bigness on both sides that Membrane,) and they not only reticulated and contorted for the more slow and laborious (which Contrivance the Ancients thought was only for a more exact preparation of the Blood for Animal Spirits) descent of the Blood, but also many of them by their insertion into the *Glandula Pituitaria*

tuitaria, attended with small Veins
issuing thence, to take off some part
of the burden too.

This last contrivance of Nature
methinks may be sufficient to render
that Controversie of *Vieussenius* with *Willis* (which, before them, was be-
twixt *Waleus* and *Rolfincius*) the two
latter on each side denying this *Rete*
to have any Veins, very needless;
seeing that if the Pituitary Gland have
any, which I am confident it hath,
(notwithstanding the positive Affir-
mation of *Diemerbroeke*, in order to serve
his own most unprobable Hypothesis,
to the contrary) as having seen them
plain injected with Wax; then this
part of the Blood in some of the Bran-
ches of the said *Rete*, which are
plainly inserted into the Gland, is
equally capable of being reduced by
those Veins without any necessi-
ty of having recourse to those re-
mote Branches *Vieussenius* hath been
forced to seek for, as if it had had
them of its own.

Vieuss. p. 46
par. 2.

Diemerbr.
p. 364.
par. 3.

Vieuss. p. 46
par. 2.

And that to the aforesaid Position
of different Creatures ought chiefly
to be ascrib'd the variety of Magni-
tude of this *Rete* in several of them,
its size in *Dogs* seems highly to evince;

in

in which, by reason of their Horizontal Position, being neither so prone as several Brutes who feed on Grass, nor so erect as Man, that *Rete* is found smaller than in the first, and larger than in the last.

Another Use it hath been thought to have, is, to carry off a considerable quantity of a dull watery part of the Blood, in order to the production of the finer Animal Spirits; and this it is thought to effect by means and help of the Pituitary Gland, betwixt which and it self there is constantly observ'd a great affinity, the one being either greater or lesser in proportion as the other is so, and betwixt which there are in all Creatures, but more remarkably in those where they are both large, a distribution of several Branches coming from the aforesaid *Rete*. And this is look'd upon by *Vieussenius* so considerable an office of the *Glandula Pituitaria*, that in those Creatures where it is but small, as in Men, Horses, Dogs, &c. he hath substituted many, but particularly two Cavities, for that use in the Wedglike Bone, just under the *Sella Turcica*, in which he supposes that

Vieuss.p.102
par. 3.

part of the aforesaid *Serum*, which by the smallness of the *Rete* cannot be return'd that way, is remitted by several little Arteries slip off from the Carotid, whilst under the *Sella Turcica*, terminating in the two abovenamed Cavities, there either depositing a part of the *Serum* to be carried off by a strange way he there mentions, (*viz.*) by two holes, into the Nostrils, and thence into the Fauces; or else by certain Veins meeting them in that place, as their proper Reductory Vessels, to the Heart. *Viouff. p. 9. par. 2.*

Now, as to this office of the *Glandula Pituitaria*, I cannot easily be perswaded it is either design'd for, or capable of it, till such time the Abettors of this Opinion can be able to show me it furnish'd with an Excretory Duct for this purpose.

And if they offer, that the Veins are such, I reply, That (besides its being very improbable that so vast a quantity of Blood as continually is brought by the Carotid Arteries to the Brain, should be able to get rid of any considerable quantity of its Serosity, by so small a part as the *Glandula Pituitaria* is;) 'tis not the usual

usual way of Nature to part with any Share of its Juices out of its Vessels, when so unactive and unprofitable as this is, and immediately to receive it in again, seeing it is provided of Emunctories enough to convey it away by.

Moreover, granting (which by no reasonable means is to be granted) it were so as they would have it, yet nevertheless, in conformity to Nature's proceedings in all such-like cases, there ought to be an intermediate passage by way of a Secretory Duct, which none hath been able hitherto to discover.

And so far as *Vieussenius* seems to *Vieuss. p. 102*
be of this opinion, which in one place *par. 3.*
he plainly is, making it of so gross and viscid a nature, as is only fit to be discharg'd at the Emunctory of the Nose; the same Reply is satisfactory: But when by way of flat contradiction to himself he comes to make the same gross Humour a perfect fine *Lympha*, the Answer is then, *Vieuss. p. 54.*
That there is no need of parting *par. 1.*
with it beforehand, seeing we find that Liquor only separated by the *Lymphæducts* of the Brain afterwards.

Seeing therefore there is such an affinity as before mention'd, between the *Rete Mirabile* and *Glandula Pituitaria*, and taking it for granted, that the office of the *Glandula Pituitaria* is not what it hath generally hitherto been believ'd, to the end we may attain a more exact knowledge of what it really is; it seemeth not altogether immethodical to take that part into consideration in the next place, together with the *Infundibulum*, which last hath not only as near a relation to the Gland as the Gland hath to the *Rete*, but such a close communication with it, that it seems in a manner almost impossible to treat of one independently on the other.

C H A P. IX.

Of the Glandula Pituitaria, and
Infundibulum.

THIS Gland is seated in and fills up in a manner all that space contain'd within the *Sella Turcica* (Vessels only excepted).

'Tis cover'd on all sides with the *Pia* and *Dura Mater*, excepting that part on its upper Superficies, in which there is a little round hole, by which the *Infundibulum* descends slopingly into it, being at its entrance environ'd with a Production of the *Pia Mater*, for its more firm connexion with that part, as was before noted.

But as to the *Dura Mater*, it encompasses it after a far different manner than what *Vieussenius* hath describ'd, not suspending it in Man as it doth in Brutes, so as to hinder it from touching the bottom of the *Sella*, and that forasmuch as there is not the same reason for its so doing in one as there is in the other, for in

Brutes the *Rete Mirabile* is not only situate on each side this Gland, but runs quite under its hinder part, by which one side of the *Rete* communicates with the other, a Disposition of this Part which *Vieussenius* was altogether unacquainted with; whereas in Man, inasmuch as there is not that sort of Structure in the one (*i. e.* the *Rete*) 'tis not necessary it should be requir'd in the other.

However, in neither one nor the other is the Reason which *Vieussenius* gives for Nature's contrivance of this affair of any weight, seeing neither the *Rete Mirabile*, much less the few *Vieuss. p. 50* small Veins belonging to the Bone par 1. beneath, could possibly any way be compressed by this Gland, though superincumbent, because it is so firmly knit to the *Dura Mater*, lying above and upon it, which is supported by the two foremost and hindermost Processes of the *Sella Turcica*, in such a manner as is sufficient to sustain and keep from pressing upon any subjacent part ten times a greater weight than the *Glandula Pituitaria* is.

Moreover, the *Dura Mater* is so far from suspending it from that Bone,

Bone, that it is, together with the Gland, fixed to that very Bone it self.

The substance of this *Gland* is far differing from that of all the rest, which I have often upon this account particularly examin'd; in consistence indeed 'tis the same with most of the Conglobate kind, if not somewhat harder, but then being pressed or squeezed, it emits much more Water than any of them.

As to the Conglomerate sort, it hath not the least resemblance to any of them, and consequently cannot be suppos'd, as it hath hitherto been by all, to carry off any excrementitious or unprofitable part of the Blood.

Now, if we consider this part, together with the appended *Infundibulum*, we shall certainly find a conformation far different from any other part in the whole Body of Man, inasmuch as that which this Gland receives by the *Infundibulum*, or which is the same, what this *Infundibulum* conveys to it, is not separated from the mass of Fluids by any visible Secretory Duct, which in its ordinary method Nature is observ'd constantly to make use of, whensoever it

it parts with any part of the Blood, whether excrementitious or reductitious, throughout the whole compages of the Body.

Nor hath the manner of Nature in transmitting a certain Liquor to the Gland been less abstruse in carrying it off from that part again, the reductory Vessels from the Gland being equally conceal'd, as the adductory to the *Infundibulum*; that way of Transudation, according to the invention of *Vieussenius*, being to the greatest degree improbable, as having no resemblance to the course of Nature throughout the whole Body.

Nay, even a possibility it self seems hardly allowable, if we take but notice of that part in Brutes in whom its Integuments are extraordinary dense, the *Dura Mater*, as he truly observes, investing it close on every side, (and which he perceiving, and consequently foreseeing what might from thence unanswerably be objected against him) was forced to make them much more than in Men; in which last indeed there is seemingly some reason for its being so, inasmuch as the *Rete* lies in a Duplication as it were of the *Dura Mater*, on each

*Vieuss. p. 52
par. 2.*

each side of the hindermost part of the *Sella Turcica*, as tho' one *Lamina* of it was spread upon the subjacent Bone, and the other over the *Pituitary Gland*, (a disposition contrary to that in Brutes, as hath already been taken notice of) but nevertheless there is no necessity that it should be so divided in this place, nor doth the said Author ever offer a Reason for its being so, (which looks as though his Assertion was only a Guess) seeing this Membrane can send out new Productions as well double as single, as we find in its two eminent Processes before describ'd, and *Sinus's*; agreeable to what it also therefore may and does do here, where the Integuments of this part appear plainly to be of too thick a consistence to admit of his imaginary way of transudation, which is manifest not only by sight and section, but in that by the greatest force made use of in compressing and squeezing it between ones Fingers, we find it impossible to force out the least appearance of Humidity through its aforesaid Inclosure or Integuments.

Being therefore very inquisitive after the true use of this part, and despair-

despairing of ever attaining to such a Knowledge without first knowing the exact Structure thereof, besides all other means commonly made use of in all Anatomical Enquiries, I made use of all sorts of Injections serviceable to such an end, as of tinged Liquors, Wax, and Mercury, but all with little, if any, success according to my expectation, the Wax not penetrating its Texture at all, the tinged Liquors but very superficially, and the Mercury, (where my chief Hopes were) always by its weight (do what I could to the contrary) either breaking through the sides of the *Infundibulum*, where it leaves the Brain, or else falling down in greater *Globuli* than the extream narrow Passages were capable of admitting, and by this means became altogether useless.

Being compelled therefore for the present to leave off a little while a further enquiry into the Structure of this part, by reason of the great mist it is involved in, and to gain a little more Light for our Guidance in searching after Truth, (which like many other things of greatest value lyes deep, and is
with

with great difficulty accessible) it may not be amiss to see what Assistance can be had, by making diligent Scrutiny into the Structure of its Appendix the *Infundibulum*.

The Infundibulum.

This is a thin medullary Duct, covered with the *Pia Mater*, descending from the internal Concave Superficies of the Brain, to which, by reason of its wideness towards one end, and narrowness towards the other, in resemblance to a Tunnel, as well as by reason also of the parity of their Uses, the Ancients gave the Name of *Infundibulum*.

In Man it is closely invested with the *Pia Mater* at its very entrance into the Gland, and from that place hath not any manifest Cavity I could discover by blast or style, but is altogether of a medullary substance, contrary to what it is in Sheep or Calves, in which last Creature, where the Parts are larger, by inserting a Blow-pipe into that part of the *Infundibulum*, next to the Gland, I have seen its further Tract or Passage on the upper part thereof a little puffed up, and a considerable

siderable quantity of Water regurgitate, as though it had lain contain'd either in some Pipes or Porulous Substance of that Gland.

This Difference is not taken notice of by *Vieussenius*, and therefore what he says of this part seems chiefly in this respect, if not altogether, applicable to the Structure it hath in Men.

Those two Divisions or Ramifications of this part the said Author mentions, one forwardly, and the other backwardly, in Sheep, Calves, &c. *Vieussen. P. 49. par. 3.* I have always found correspondent to the Descriptions he there gives of them; but whether the first be protended so, and terminate after the manner he there describes I somewhat scruple, seeing I have always observ'd the Extremity of that part in Brutes, towards the foremost part of the Gland, sinking as it were into the very Substance thereof, and afterwards becoming presently altogether imperceptible, and in Man the termination thereof just after the same manner, save only that in the last it happens forthwith upon its approach to the Gland, with-

without being protended either backwardly or forwardly.

The Use of this part is certainly to convey some sort of Humidity from that great concamerated Cavity within the Brain, resulting from its inward complication of parts, to the Pituitary Gland, and the office of it is to receive and carry off this transmitted Humidity; but as to how either this Humidity is collected in the aforesaid Cavity, or how, when convey'd into the Gland, it is carried off, we are still as much in the dark as ever.

I know very well there is nothing more easie with the Visionary Philosophers than such a Knack as this; and now I think on't, the great *Willis* makes nothing of turning a Vein Will. p. 46. into a *Lymphæduct* in the *Glandula Pinealis* and *Plexus Choroeides*, no less than which does also the accurate *Vieussenius*, in the *Plexus* belong- Vieus. p. 110 ing to the fourth Ventricle; but how par. 3. consonant this is to the rational structure or mechanism of parts, neither the one or the other have been so kind as to explain.

Now

Now, as to the *Plexus* and *Glands* before mention'd, 'tis evident by what hath been already discover'd and accordingly given an account of in the preceding Pages, they are furnish'd with *Lymphæducts*, as proper reductory Vessels; so that so far the Prophecy is vanish'd.

But as to the remaining Gland, I am not so fond of guessing to say it hath any, and consequently all I can say is, that as I look upon the *Infundibulum* to be no more than a large *Lymphæduct* variously ramified through the *Glandula Pituitaria*, discharging its Liquor by those many small Branches into the Veins dispersed through that part to be reduced after the manner 'tis in all other Secretory Glands back to the Blood again.

And that which seems most to favour this Conjecture, is the extraordinary humidity of this Gland, especially in Brutes, above the rest of the whole Body, as serving not only to export what *Lympha* is separated from several Arteries dispersed thro' it, but that also which it is charged with from the Brain it self.

And

And to this twofold manner or double office of Secretion is owing the two distinct Substances it seems to consist of, the one being accommodated to that part of the *Lympha* coming from the Brain, and is therefore whitish, the other to that separated immediately out of the Blood, and is therefore reddish.

Lastly, As to the manner how the *Lympha* passes down thro' the *Infundibulum* from the Brain to the *Glandula Pituitaria*, I look upon it to be in the form of condensed Vapours arising from the Arteries of the *Plexus Chorooides*, emitted thence for the keeping moist and in good order that inward Production of the *Pia Mater*; spread all over its *Parietes*, which being a membranous dry part of it self, might otherwise become injurious to that fine medullary part lying under and being contiguous to it; in which there is a continual motion of Animal Spirits, whose Tracts, and consequently they themselves, through any the least intemperance of this Membrane, would be in great danger of either some obstruction or disorder.

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And

And that this *Lympha* is only the result of the aforesaid Vapours, I am the more readily enclin'd to believe, because I never saw Water in that part of any sound Brain, nor unsound neither, where the *Plexus Choroeides* was firm; and there was no reasonable ground, by the extravasation of *Serum* in some other remote parts of the Brain, to believe it had its rise from thence.

CHAP.

CHAP. X.

Of the Glandula Pinealis.

THE Gland call'd *Pinealis*, from its Figure, is about the bigness of an ordinary Pea, prefix'd to the two Prominencies call'd *Nates*, hereafter to be describ'd, at the end of the third Ventricle, immediately under the broad and hinder part of the *Fornix*, (with which nevertheless it hath no connexion, as *Vieussenius* *Vicuss.* p. 71. saith it hath) and over that part of the *Rima* in the third Ventricle call'd *Anus*.

'Tis joyn'd to the *Nates* by several Fibrous Roots, and becomes a support to that part of the *Plexus Chorooides* there situate.

In an hydropical Brain of a strumous Boy, I have seen it swelled to a size of three times its ordinary magnitude, and by reason of the abundance of stagnate gelatinous *Lympha* contain'd in it, perfectly transparent.

Hence it most plainly appears that this part is a meer Gland, and, by what was said before conformable to what hath been observ'd in this hydropick Brain, of the Conglobate or Lymphatick kind, and by consequence a very unfit part to be made a Receptacle for Animal Spirits, as *Vieussenius* makes it, and much more a place of residence for the Soul, according to *Des Chartes*. *Vieuss. p. 71.*

'Tis true, there are two fair medullary Tracts arising seemingly from the two Roots of the *Fornix*, stretching length-way upon the *Thalami Nervorum Opticorum*, as far back as this Gland, (by *Vieussenius* called *Tractatus Medullaris Nervorum opticorum Thalamis interjectus*, as though it was only one, and accordingly is so delineated by him, *Tab. 7. GG*, but indeed is two, one on each side) about which place they turn in, and by a transverse bending kind of a Process (by the same Author call'd *Tractus medullaris natibus antepositus*) unite, as he hath exactly observ'd: And this, doubtless, gave occasion to the Error of *Des Chartes*, as *Willis* truly thought, (whose sublime and most de- *Willis, p. 9. col. 1. par. 1.*

deservedly-admir'd Philosophy had doubtless been much more useful, had he convers'd more with Dissections, and less with Invisibilty) and *Vieussenius* too, (with whom in the same Mistake doth agree *Mural.* p. 508. *Will.* p. 102. col. 1. par. 3 *raltus* and *Willis*) for upon a more heedful inspection (as was most evident in the Brain aforementioned) it will be found that no part of the Process aforesaid, however near it comes to this Gland, does in any wise become continuous to it.

Dr. *Wharton* also stum'led upon these medullary Tracts, placing them amongst the Nerves themselves, and ascribes the same unreasonable use to them as he does to the Nerves in many other Parts of the Body, (*viz.*) of separating a superfluous Humour from the *Cruca Medulla Oblongata*, or *Thalami Nervorum Opticorum*, (being the same Part, and only on the other side or upper part of the Brain, under another denomination) which he supposes to be the *Commune Sensorium*.

It hath Arteries and Veins in common with other Glands, the Veins ending in the fourth or inward *Sinus*; as may the *Lymphæducts* too, when they are conspicuous.

CHAP.

CHAP. XI.

Of the Brain in general.

THAT part of this Treatise relating to the Vessels, being dispatch'd, I shall in the next place proceed to an account of the Brain it self, under which term are generally comprehended the *Cerebrum* and *Cerebellum*, and *Medulla Oblongata*, which Parts being in many respects so different one from another, may justly challenge a distinct and orderly description.

The *Brain* then, in the first place, as distinct from the other two, is that large and almost spherical Body which comes first to sight in the old way of Dissection, filling the greatest part of all that space contain'd in the *Cranium*, consisting of two different Substances (first taken notice of by *Archangelus Piccolominius*) both in Colour, Consistence, and Office, the one being more compact,

*Piccolom.
P. 252.*

packt, white, medullary, or fibrous, the other softer, greyish, and glandulous.

The utmost *Malpighius* (by virtue of his Microscopes) could do, was to discover the Cortical part to consist of Glands of an oval depressed Figure, and in his Opinion, of the Conglomerate kind, (but that how properly, as also his calling the Nerves their Excretory Ducts, I leave to the Judgment of others) and the Medullary part to consist of various Fibres immersed in and having their original from the aforesaid Glands, deriving from them a certain Liquor call'd *Nervous Juice*, concerning the Existence of which, in the usual sense 'tis taken in, as a fluid body, contain'd and running continually in the Channel of the Nerves, as Water in Wooden or Leaden Pipes, for either Nutrition or Censation, is a thing somewhat improbable, it being not only possible, but very easie to resolve those two *Phænomena's*, the first from the Blood, and the other from the Natural Tenseness of Sensible Parts maintain'd by the supply of a proper Liquor from the
Blood,

*Malp. de
Cereb. Cort.
p. 78, 81.
par. 3.*

Blood, both in their Originals and continued or elongated Productions; inasmuch as it doth as certainly circulate in them as in any other parts of the Body. And as to the manner how this is done, it will appear very plain and intelligible, after the innate Structure of the Part hath been more accurately enquired into.

The Curious *Lewenhoeck* made a far deeper scrutiny into these two Parts, being very probably assisted by better Glasses, and from what occur'd to his view, called the cortical part a *pellucid Vitrious Oily Substance*, (the seeming oiliness of which Substance I attribute only to the stagnating of the pure Liquor, growing cold after death of the Creature,) from such a close and regular Position of the *Globuli* swimming therein, as allows the Rays of Light to pass them without refraction, contrary to what they do in the other or medullary part of the Brain, in which they are so dispos'd that the Light cannot pass them in right lines, and consequently being a little distorted, makes them appear white,

*Lewenh.
de Struct.
Cereb. p.37.*

white, notwithstanding *Malpighius* Malpig. de Cereb. p. 2. on the contrary neither allows the Parts of the Brain to be diaphanous, nor the Animal Spirits to be any thing a-kin to Light.

'Tis true, even by his own confession, that his most nice and diligent Inspections could not free him from many Scruples about what he saw; yet some things to our purpose were plain enough, as Reticular Bodies of a red colour, which being larger in the Cortical Parts than Medullary, helps to give it that greyish or *subrunneous* colour, as he calls it.

Nextly, a transparent Vitreous-colour'd Substance contain'd in most minute Vessels; whence 'tis plain there are two sorts of Liquors in this Cortical Part, one of a red colour, or Blood, contain'd in larger Vessels, whose *Globuli*, which give it its redness, either by reason of their size or figure, cannot enter those small Vessels which with the Fluid contained in them constitute this transparent, cineritious, or cortical part of the *Brain*.

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The other a transparent Liquor, contained in most minute Vessels, as aforementioned ; from whence I am induced to believe this Cortical part to be only an Aggregate of different Vessels, (as also I do of all the rest of the Parts of the Body) containing different sorts of Fluids.

Of these Vessels some contain a more compound Liquor, commonly call'd Blood, which whilst in that state, by reason of the *Globuli* swimming on it, looks red, and by reason of a tubulous Pore of a proper size and figure so continued to the Vessel we call a *Vein*, that it undergoes a continual quick circulation.

Another sort of Vessels there is which receive and contain a more simple fluid body, of a thin transparent nature, which when in some parts of the Body, gives the name of *Lymphæducts* to the Vessels that it runs in ; but when in these Vessels, which are discover'd to make up the great Substance of the Brain, whether Cortical or Medullary, may be allow'd the name of *Fluidum Animale*.
And

And this last sort of Vessels I look upon to be either a certain Protension of an Artery, by its smallness render'd capable of holding such a sort of Liquor only as the last spoken of, or else such a tubulous production of the Artery as by its Orifice or Pore answers to the figure and size of the Fluid it is by Nature intended to receive.

Upon the same exact Enquiry made by a Microscope, the medullary part of the Brain appears to be of the very same constitutive parts, ranged only after a somewhat different manner, which makes this part appear more white, as was before observ'd. But over-and-above (if it may be allowable to make a Conjecture) I am inclin'd to think the Whiteness of this part may be owing in some, if not the greatest part, to such a narrowness of the Vessels discover'd here, containing the pellucid Substance aforementioned as will not entertain any Fluid whatsoever, without its being first reduc'd into very minute Particles, or *Septometry* so called : Which last Vessels I therefore suppose to be
only

only yet more Capillary Productions of the aforesaid Cortical Vessels, as they are of the red or Blood-vessels indu'd with such a Pore as fits them only for the reception of a most subtile, fine, soft Liquor, which I esteem the true Medullary and Nervous Juice, which being contained in its proper *Cap-sula*, and many of them collected into one *Fasciculus*, at its egress out of the Brain, being there wrapped up in more thick and strong Coverings made of the two outward Membranes of the Brain, do constitute that part we call a *Nerve*, which having all its Integuments or Membranous Inclosures always kept turbid and tense by its contain'd Fluid, after a slow and leisurely manner continually dispensed from the Fountain, and by its growing more taper towards the place of its termination, by which means it acquires a greater streightness or narrowness of its Pores ordinarily call'd *Fibrille*, it so falls out that all inward Impressions, upon all occasions, are the more easily and speedily transmitted through it.

The

The very same notion also concerning Nutrition (which in the truest sense is only an apposition of Parts nourishing to Parts pre-existent to be nourished) in the rest of the Parts of the Body, I have thought reasonable to entertain ever since, by assistance of the Microscope I have plainly discern'd the Veins to be only continuations of Arteries, and the Blood to run in the same Channel variously modified, without the least suspicion of Extravasation, (*viz.*) a continual transmission of Nutritive Juice out of the Pores of Arteries, after many windings like Tindrils of Vines (*Analogus* to which the red Reticular Bodies of *Lewenhoeck* seem to be in the Brain,) grown very capillary into certain *Tabuli's* or Pores of a corresponding bigness and figure, making up the whole fleshy part of the Body, whose Substance, when 'tis freed by washing or injection of Water, we see to consist only of large and small Blood-vessels and Fibres; which last, whether Nervous or Membranous, or such as relate to Muscular Motion, commonly called *Carnous*, I
sup.

suppose to be full of minute distinct Vessels for the communicating and receiving their proper Liquors or Fluids after the manner already express'd, which as contain'd in the said *Tubuli* or Pores, whilst they retain their Natural Constitution and Proportion, I presume it is which keeps the Habit of the Body plump and vigorous, the more thin and languid being perpetually carried back by the Lymphatick Vessels, and a great part wholly exterminated by meer simple Transpiration; which I adventure to think is not only superficial from the Sudorifick Glands in the Skin, but also through the whole Substance of inward parts, through small *Canaliculi's* or *Meatus's* in even the *Viscera* themselves; by which, not unlikely, we may guess at the Meaning of *Hippocrates*, when he said, *All things were conspirable and transpirable.*

The minuteness of Vessels is that which hath so embroil'd the Thoughts of Naturalists upon this Subject, and set Realities so remote from the Understanding, otherwise 'tis no Paradox to affirm the Existence of *Vasa*
Vaso.

Vasorum almost to *Infinitem*, some containing Liquids in a continual more nimble circulation, others in a gentle protrusion only : Which will appear altogether unsurprizing, if it be consider'd that the aforementioned Ingenious Author hath computed, that even the 64th part of a Miriad (*i. e.*) of a Ten hundred thousandth part of any Substance but as big as a small grain of Sand, cannot, especially if of a rigid or inflexible nature, enter those little Vessels, which are seen in a retiform manner distributed amongst, and fixed to the aforesaid pellucid *Globules*, which swimming in those little Vessels, are discover'd to make up both the Cortical and Medullary part of the Brain. As also further, that even the tender Coats of the smallest of those Vessels which contain the aforesaid most minute Globular Fluid Bodies, are also full of yet far more minute Vessels than they themselves are. Lewenh. p. 46.

Nay, I am so far from being surpriz'd at this kind of Vascular Constitution of Parts, that I apprehend not how Nature could otherwise have acted Lewenh. ib.

acted without the consequence of a boundless Accretion, inasmuch as that when any parts of a Fluid become extravasate, they necessarily lose much of their progressive motion, and if of a gross consistence, are either proscrib'd by the wider passages, or of a finer, through those more straight and elaborate (*viz.*) by Transpiration; so that what Particles of Matter forever continually arrive, for either the augmentation or reparation of the Parts, must (unless the ruine of the Subject do not first happen, as we see it often does in Diseases proceeding from such Causes) needs (if not confin'd in Vessels) advance into a monstrous preternatural accumulation, as being, by reason of their gross consistence, altogether incapable of being carried off proportionably to the measure of their aggestion, in the form of subtile Steams or Exhalations.

Besides a rational explication of the natural Functions which this Hypothesis furnisheth us with it also, seems to clear a great many Difficulties which have hitherto puzzel'd the most refined Physiologists relating to

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the Animal Faculty, such as are *Sensation* and *Muscular Motion*; of which last here in the next place, the other being reserv'd for the last Chapter, which treats of *Sensation* and *Motion* in general.

TO recite the Opinion of others upon this Subject would be a thing altogether useless here, seeing an Abstract of them is already extant in the *Philosophia veteris & novae* by Mr. Celsus; and besides, the most correct of them are not only very unprobable, but absolutely repugnant to plain Reason and Matter of Fact too; an Instance whereof we may have in Dr. Willis's *Tentamen Reservatores of Animal Spirits*, p. 32. in Dr. Mayer's *Twisting or Fiddling Fibres*, with whom of late Mr. Rayn agrees, by which the Muscle must needs lose a great deal of its thickness, than which nothing is more contrary to Experiment; in Darcourt's first and second Element of the Chapter, which he makes the Animal Spirits to consist of contrary even to the very Principles of that Great Man's Philosophy, which follows

CHAP.

CHAP. XII.

Of Muscular Motion.

TO recite the Opinion of others upon this Subject would be a thing altogether useless here, seeing an Abstract of them is already extant in the *Philosophia vetus & nova* by Mr. *Colbert*; and besides, the most correct of them are not only very unprobable, but absolutely repugnant to plain Reason and Matter of Fact too; an Instance whereof you may have in Dr. *Willis's* Tendinous Reservatories of Animal Spirits, in Dr. *Mayow's* Twisting or Fiddling Fibres, with whom of late Mr. *Regis* agrees, by which the Muscle must needs lose a great deal of its thickness, than which nothing is more contrary to Experiment; in *Duncan's* first and second Element of *Des Chartes*, which he makes the Animal Spirits to consist of, contrary even to the very Principles of that great Man's Philosophy, which al-

*Willis de
Mot. Musc.*

*p. 35.
Mayow de
mot. musc.
p. 73.*

DUNC. p. 90

lows no Elasticity to those Bodies themselves, though the Authors of it in all others; likewise in Dr. Croon's making the Blood it self, as well as the Animal Spirits, to be mov'd by the power of the Soul to any Muscles; as likewise the extravasation of those two Liquors first into the spaces betwixt the Fibres, and then their introvasation into the Fibres themselves again, in order to make inflation, an Error incident to the Immortal Borellus also, whose imaginary Discourse upon this Subject seems of a very different Thread from the rest of his Excellent Works.

Croon,
p. 23, 24,
25, 33.
Philos. Cell.
p. 23.

Borel. de
mot. Anim.
p. ult. prop.
23. & plu-
ribus aliis
locis.

If therefore what hath been already said about the Structure of Parts be remembred, (*viz.*) That the Medullary Part of the Brain is only a Contexture of Vessels; that its Nervous Propagation or Nerve is also a Compages of Vessels, formerly call'd Filaments, much more narrow than those of the Brain it self; and, that these Nerves produce, or at least terminate in the Fibres of all sorts of sensible Parts whatsoever, though of a different texture, as well

well as those carnous ones of Muscles, which last are tubulous, 'twill not be in the least unreasonable to infer, That these Bodies being kept continually turgid with the contained Fluid; are equally capable of transmitting or receiving Impressions of the Object, as if they were stretched longitudinally like a Bow-string from each Extremity, according as *Borellus* hath observed.

And as to *Muscular Motion*, allowing only what may directly be inferred from what hath previously been said, (*viz.*) That the Nervous and Carnous Fibres are only a congeries of Fluids contained in certain Vessels communicating with each other, that by reason of a Plenitude in the aforesaid Fibres, the whole Machine is in a constant *Equilibrium*, it will necessarily follow, upon the common *Postulatum*, (to which all Mankind must be beholden upon all such Explications as these to the World's end) *viz.* that the Sensative or Rational Soul can command the Animal Spirits (which I call only a Nervous Fluid) into a

Primus Impetus, or local motion, that a part of that Liquor, whenever a Muscle contracted is transmitted through the Vessels which contain it from the great Reservoir thereof, the Brain, to its Carnous Fibres, into whose Vessels, being so much narrower than those of the Nerves, even by vertue of the same force which moves it from the Brain, that Liquor is driven after a most rapid manner, (which Effect, to any acquainted with the nature of Fluids and mechanical Laws of Motion by Projection, needs not any demonstration) causing the Intumescence or Inflation of the Muscle, the same Liquor at the same time being driven back again with an equal speed from the Antagonist Muscle into the room of the first, which was transmitted from the Brain to the contracted one, in order to maintain the same Plenitude or (which is the same thing in the sense of the old Philosophers) to avoid a *Vacuum*. And if any object the wideness of the Passage it is to come back by from the *reflexed* *relaxed* Muscle, as an impediment to an equivalent

equivalent speed in that Liquors retrocession, I have to answer, that the Emptiness being made first, is a sufficient recompence for that.

And here I cannot but take notice, that all they who contend for Animal Spirits, analogous to those we see produc'd from various Subjects by Fire, as the only adequate *medium* for all sorts of *Muscular Motion*, have been forced to have recourse either to certain Tracts or Interstices betwixt the Filaments of the Nerves continued from the Brain, or the Original of the Nerves through their whole Productions to the Muscle, of which sort are the *Cartesians*, or else to a certain Nervous Juice, for their place of residence, of which sort are most of the *Moderas*, and particularly *Vienf-senius*, by which Passages, or out of which Juice these fine invisible things are either voluntarily, by the command of the Soul, or inadvertently, from several either inward or outward impressions, transmitted, in order to produce Motion: which if true, and the only ways of producing *Muscular Motion*, I beg leave to ask, how it comes to pass, by

either of these ways, that when another person bends my Arm, and that against my Will too, the bending Muscles of the Arm become as tumid as when voluntarily or inadvertently contracted at any other time; which hath been truly observ'd tho' not satisfactorily accounted for, by Dr. Croone, or any other I know of.

Croone, p. 7.

But how this or any other sort of contraction of a Muscle happens, does by the other afore-mention'd Hypothesis become explicable, without any manner of difficulty at all: For when the Cause of Contraction is from the Command of the Soul, the pressure is first from the Fluid in the Brain, by which all the inter-jacent or continued Fluid flows towards the Part to be moved, the same proportion of Fluid being at the same instant transferred into its room from the relaxed Muscle; and when the contraction of the Muscle is from the above-mention'd external force bending the Arm against my will, then the Liquor contained in the relaxed carnosus Fibres or *Vascula* is transmitted through the whole continuity of Fluids, to that which is contracted, and all this without being be-

beholden to the wild Conceits of a dry and moist part of the Nervous Juice, blind Passages, invisible *Tubuli* betwixt the Antagonist Muscles or Valves in the Nerves, by a meer *Equilibrium* of the Fluids contained in the Vessels the Parts consist of.

At the same time I am not insensible of the Solution some have given this Instance of Involuntary Motion upon another Hypothesis, (*viz.*) by supposing an equality of Tension or Elasticity in all the Muscles of the whole Body; by which means it falls out, that when any new additional force (though never so small) is added to the Fibres of any Muscle, as in voluntary motion, or the power of Elasticity in the Antagonist Muscle, overcome by outward force, as in the aforementioned Instance of Involuntary Motion, the other Muscle then becomes contracted.

Now, that this is one concurrent Cause in both sorts of Instances, as being confirm'd by the Experiment of cutting a Muscle through, either towards the Extrems or in the middle, by which the Fibres, by their

natural Elasticity, are found to contract either to one or the other, or to both Extrems, is allow'd to be true; but to be the only Cause, is altogether as false.

For, in the first place, as to the case of voluntary Contractions, it is allow'd to proceed from a transmission of Spirits from the Brain into the carnous Fibres, (that Hypothesis of *Steno* to the contrary having been convicted long since by *Borellus*, in his Book *De Motu Animalium*) though not without the concurrence or sympraxis of the natural Elasticity of the Fibres belonging to the Muscle to be contracted.

So likewise, without the transmission of Animal Spirits from some force or another, I deny even the possibility of that stiffness or hardness which is easily preserved in all contracted Muscles, feeling and seeming as though they were indurated and swelled out, as really they are, whether it be in the case of voluntary or involutary motion; in confirmation of which, I affirm, that though by the cutting of the carnous Fibres of any Muscle through, which way so ever

ever it be, the contracted part may, and doubtless does, grow thicker by the shortning of its Fibres, yet by that means only it does not become stiffer and harder, so as we find Muscles do when contracted by any natural Cause, nor is there any necessity it should do so, according to any Rules of Mechanism, seeing the Fibres shortning only by their own elastick force, when they find the circumambient space give way have no necessity of subintration of parts, which is always requisite to procure a stiffness or hardness to a part altering its dimensions as Muscles do, from a longer and thinner to a shorter and thicker circumference; and upon this it must needs follow, that in a Muscle contracted by involuntary force (in which Action the Brain is altogether unconcern'd) that stiffness or hardness then perceivable in it, must needs be owing to the Fluid or Spirits in the antagonist Muscle, after the manner already explained, transmitted to it.

Now,

Now, to define what sort of thing this Animal Fluid (so called) is, I see no occasion to frame any other Idea of it than what we ordinarily have of the purest Liquors, seeing the Nerves are a Substance which (to the Senses of either Smell or Taste discovers very little else than what is insipid) are always reckon'd amongst the least hot parts of the Body, and doubtless far less warm in Fishes than us, who yet have as great a stock of Animal Spirits as any other Creatures. And this Consideration may be it was that occasion'd an Author to give the Animal Spirits the Epithite of *Frigidiusculi*.

Du Ham.

T. 1. P. 753

'Tis plain enough, that the Vessels which contains this Fluid are extream minute, and consequently the Content must needs be of a very fine and depurate consistence, though without much resemblance to either the aforesaid nimble, saline, or sulphurous Productions of the Fire.

'Tis in a continual, gentle, direct motion, though perhaps contained in curved or reticulated Vessels, from its original source to the ends of the carnous Fibres, from whence it

it is convey'd into the Membranous or Tendinous Productions, according as the Fibres terminate, and it may be by filtration only ; in which, as in other, and particularly in Glandulous Parts, not subservient to Muscular Motion, where Nervous Ramifications are very copious, whether it be of any other use than to keep the Parts in their proper tone, in order to their regular discharge of the office of Secretion, must still remain a Controversie, notwithstanding all that hath been yet advanced against it, inasmuch as wastings and numbnesses of Parts, the common Symptoms of obstructed or divided Nerves, (which doubtless by their hastening through such Causes to Muscular Parts, gave the first rise to that Conjecture about the Existence and Use of that Juice throughout the whole Body) are equally explicable by the want of Tone, as of that supposed Liquor.

To the proof of all this an Experiment frequently made does not a little contribute, and that is the injecting the Arteries of a Dog, or any such Creature, when dead, upon which there immediately happens

pens a contraction of the Muscles, according to the different strength of them, (*viz.*) of the Extenders in the hinder Legs, and of the Benders in the fore Legs, though the Injection be only of cold Water, the reason of which effect in particular, if it be remembred what hath been before observed, (*viz.*) that the Blood-vessels do most certainly enter the composition of the Nerves themselves, will not only become very easily explicable, but the whole Hypothesis at least very highly probable.

If it be said, That this speedy instantaneous reflux of the Animal Fluid is opposed by the aforementioned constant direct motion it hath from its Source to the parts to be moved, 'tis easie to reply, That its slow direct motion that way is easily overcome and repelled by the violent impulse of the forcibly-relaxed Muscle the other way.

If further it be demanded, by what means it so happens that in the Instance before us of an Arm bent by force, that the refluent Animal
mal

mal Fluid is rather towards the Muscle, which by that means then proves contracted, than towards any other whatsoever, to all which it may indifferently have access, I think the Solution seems not difficult, if it be consider'd, that at the same time that the one Muscle is forced from, the other is forced into a contraction; from whence it so falls out, that the carnous tubulous Fibres of the last, which by being extended under the state of relaxation, did lose their cavity, must needs by their natural elasticity, when freed from the preponderant force of its Antagonist, acquire it again, by which means a space being made, the repelled Fluid, by the Laws of Libration, (to say nothing of the habitual motion of the Animal Spirits, or Liquor, by most Authors, especially *Borellus*, urged as a Reason for this effect) must needs be driven thither.

In fine, though I am not averse to think most of the *Phænomena* relating to Sensation and Motion may be solved by this Theory, tho' of so small an *apparatus*, yet I am so
far

far from being fond of it, that I have reserved a far greater share of Friendship for any other that may seem but of never so little more a kin to Truth, and submitting all I have said on this Subject to the candid Sentiments of the more judicious Proceedee in describing the other parts of the Brain as they offer themselves in the usual modern way of Dissection.

CHAP.

CHAP. XIII.

Of the Brain in particular.

THIS Part being already describ'd and consider'd in general, as consisting of two different Substances commonly called its Similar Parts, and the Source of all Sense and Motion, comes now to be taken notice of in a more particular manner, with respect to its dissimilar parts or conformation; and this I think may best be done first according to its outward, and next to its inward appearance.

Outwardly 'tis convex and cortical, exactly divided into two Hemispheres by the first Process of the *Dura Mater* called *Falx*, from the bony Process called *Crista Galli* forwardly to the very hindermost part of the *Cranium*, where these two Divisions are stretched over the *Cerebellum*, from which part also 'tis perfectly separated by the second Process of the *Dura Mater*, to the end it

I may

may not cause any prejudicial compression upon that part, either by its weight or pulsation.

The foremost Division is made only as deep as the *Corpus Callosum*, the latter to the very *Medulla Oblongata* it self.

'Tis further imperfectly divided into four Lobes, two whereof (which being the less) are forwardly, and two (which are much bigger) backwardly.

These Divisions appear best in the inverted or *Varolian* Dissection, being marked out as it were by four Branches of the Carotid Artery, two before, and one on each side.

These I call *Imperfect Divisions of the Brain*, because though the *Pia Mater* runs betwixt them, together with the aforesaid Branches of the great Artery, yet they adhere by several Fibres, both of that Membrane and the Blood-vessels themselves.

'Tis also imperfectly divided thro' all its external cortical part by the *Pia Mater*, though not so profoundly, to the end the Blood-vessels may penetrate this part in more fine and reticular Ramifications; and that by the

the pulsation of the Arteries the interjacent cortical Glands, (or rather Vessels) may more freely make their proper Secretions.

Nextly, it may be consider'd in its inward appearance, which is concave and medullary, taking its original from the Extremities or *Apices* of the *Medulla Oblongata*, (or rather a little more forwardly from the foremost part of *Vieussenius's* oval Center) commonly called *Processus Lentiformes*, or according to *Dr. Willis*, *Corpora Striata*.

From hence 'tis presently reflected back on each side in the form of a Vault, very near as far as the *Nates* and *Testes*, a little below which on each side 'tis joyn'd with the *Crura Medulla Oblongata* on their under side, being continuous there to those Parts commonly call'd the *Crura Fornicis*.

The middle and uppermost part of this Medullary Substance, by the Ancients always called *Corpus Callosum*, is therefore by *Vieussenius* called *Fornix Vera*, in his Opinion sustaining that Office (though I see not that it does, or for the Reasons

*Vieuss. p. 61
par. 1.*

before given in the description of the *Dura Mater* and its Processes, needs to do any such thing.)

This is that part which, as was before noted, was thought (but mistakenly) by *Vesalius* and others to escape the covering of the *Pia Mater* and in it are not visible any bloody Specks, as in most other parts of the *Medulla Cerebri*.

'Tis the *medium* uniting the medullary part of each Hemisphere or Division of the Brain, famous for the transverse *Stria* running through it from each side of the aforesaid Hemispheres, the *Septum Lucidum* only coming between.

In this large or principal Cavity are contained the three *Ventricles*, the *Fornix*, the *Septum Lucidum*, *Corpora Striata*, *Thalami Nervorum Opticorum*, the *Roots of the Fornix*, the *Tractus Intermedius* of the *Corpora Striata*, the *Tractus Medullaris Thalami Nervorum Opticorum Interjectus*, (which last has bin already described) the *Vulva*, *Anus*, and *Rima* or Passage to the *Glandula Pituitaria* by the *Infundibulum*, and *Glandula Pinealis*, (which also hath already been described) of all which briefly in their order.

The

FIG. 5. AA

The three
Ventricles.

The three Ventricles, by cutting afunder the *Fornix* near to its Roots, and turning it backwards over the *Nates, Testes, and Glandula Pinealis*, appear to be but one, those on each side it being called the *Laterales*, in which are the *Corpora Striata Thalami Nervorum Opticorum* and *Crura Medulla Oblongata*, that *Rima*, so far as 'tis covered with the *Fornix* and parts the *Crura Medulla Oblongata*, being the third.

Centrum
Ovale.

From the extream Limits of these two side Ventricles, from before to behind, does arise that medullary space called by *Vieussenius*, *Centrum Ovale*, in his Opinion the great Dispensatory of Animal Spirits, the fore part whereof *Willis* calls *Limbus anterior corporis striati*.

Vieuss. T. 10
AA, &c.

Will. de An.
Brut. p. 42.
T. 8. E.

The *Fornix*.

FIG. 5. AA,
bb.

The *Fornix* is a medullary part arising from two Roots in the foremost part of the *Basis* of the *Brain*, lying betwixt and upon the uppermost parts of the *Thalami Nervorum Opticorum*, which Roots come out of the foremost part of the *Geminum Centrum semicirculari*, so called by *Vieussenius*, like two large Nerves,

Nerves, and afterwards joyn together, constituting a broadish medullary Body, which after having first projected it self for some space forwardly betwixt the *Corpora Striata*, and afterwards run the length of the third Ventricle, growing all the way broader and broader, and towards its edges (by *Vieussenius* called *Fimbriae*) Vieussen. Tab. 6. D. thinner; and being reflected backward towards the hinder part of the lateral Ventricles, like two Arms, commonly called *Crura Fornicis*, the beginnings whereof on each side are by *Aurantius* called *Hippocampi* and *Bombyces*, Aurant. Anat. Obs. p. 45. (from whence, I know, he had chiefly observ'd this part in Brutes, in which, by vertue of the hinder part of the *Fornix*, in that place growing somewhat thicker, and running over the hinder and upper parts of the *Th. Nerv. Opticorum*, which are more prominent in them, as in *Sheep*, *Calves*, &c. than in Men) it is made to appear on each side like the bending Crest of the *Sea-horse*, and is in colour much like the *Silk-worm*, certain minute *Stria's*, which *Malpighius* calls *Fimbriae*, crossing them like Rings obliquely, contrary to what the same Malp. de Cereb. p. 5.

Au-

Author's Account is of them, who says those *Fibræ* or *Striæ* run upon them otherwise, viz. as they do on the *Septum Lucidum* (i. e. longitudinally) and embracing the *Tb. Ner. Opt.* on their upper part on both sides, but adhering close to them as one continued Substance on their under part, (in which place they are called, by *Vieussenius*, *Posteriores veri fornicis* *Vituf. p. 61.* (viz. *Corporis Callosi*) *Columnæ*) becomes there continuous with the hinder part of the *Corpus Callosum*, where it winds down upon the sides of the *Crura Medulla Oblongata*, and ^{*Ibid.*} makes up that undermost space or cavity of the two side Ventricles, by the said *Aurantius* called *Ventriculi Hippocampi* or *Bombycini*, and *Vieussenius* called the hinder part of the *Centrum Ovale*, which by that kind of curved passage loses something of its oval figure.

The Septum Lucidum.

The *Septum Lucidum* some of the Moderns think to arise from the *Fornix*, thence ascending to the internal Superficies of the *Corpus Callosum*; others from this last descending down to the *Fornix*, but most

likely from this last, where towards its foremost part I have always found it double, (first taken notice of by *Sylvius de le Boe*) and as *Vieuassenius* truly says, often with Water in its duplicature.

Sylv. de le
Boe Diss.
Med. p. 19.
par. 1.
Thes. 13.

'Tis a very thin, medullary, transparent Body, intermediate to the *Corpus Callosum* and subjacent *Fornix*, by means whereof the two lateral Ventricles are in that place separated one from another.

The Corpora
Striata,
FIG. 5.
I 1, &c.

The *Corpora Striata*, or *Processus Lentiformes*, are two Prominencies situated something higher than, and in Men a great part of them on each side (though Dr. *Willis* says, where the *Corpora Striata* ends the *Thalami Nervorum Opticorum* begins, which is only so in Brutes) of the *Thalami Nervorum Opticorum*, or *Fuga Crurum Medullæ Oblongatæ*, and are so called from the many white Streaks appearing in them, descending obliquely to the *Medulla Oblongata*, with Cineritious Substance coming betwixt them when they are cut horizontally.

They

They run down on each side the *Thalami Nervorum Opticorum* as far as till the *Corpus Callosum* begins to wind back upon the *Crura Medulla Oblongata*, towards the hindermost part thereof.

I have got them delineated here exactly true, (tho' by neglect without the *Striæ*) finding all the Cuts of them in *Willis* to be from Brutes, except one, which is done very ill, and those in *Vieussenius* very false, unless in Figure the 8th, which also wants the *Striæ*.

The Thalami Nervorum Opticorum.

The *Thalami Nervorum Opticorum* are two prominent Bodies, more purely medullary on their outward Superficies than within, which meeting together like the two topmost strokes of a Y inverted, constitute the uppermost part only of the *Crura Medulla Oblongata* in that form, the other or undermost side being quite of another figure; and seeing they are the immediate continued Productions of the *Medulla Globosa Cerebri*, (which contrary to the old Opinion of *Praxagoras* and *Philotimus*, asserting the Brain to be only a Germination

mination of the *Dorsal Marrow*, of late reviv'd by *Bartholine*, (if any prece-^{causab. in} dency of Parts as to time may be al-^{Athan.} low'd) I look upon to be rather the original than the production of the *Medulla Oblongata* and *Spinalis* too) and may more properly be called *Capita* than *Crura* of the *Medulla Oblongata*.^{p. 137.}

Fig. 5. cc. The Tops or *Juga* do, as already observed, encline close, yea, joyn together, as *Vieussenius* hath rightly observed contrary to *Willis*, (whose Figures of that part are utterly false) unless where the *Rima ad Infundibulum* parts them, leaving like the *Corpora Striata* an obtuse angle between them.

Betwixt these two last mention'd Bodies there is a medullary space on each side, which in a bending manner encompasses the *Thalami* themselves, and receive the Extremities of the *Striæ* in the *Corpora Striata*, as they descend from the afore-mention'd *Centrum Ovale*, and is therefore by *Vieussenius* called *Geminum Centrum Semicirculare*, by *Willis*^{Vieuss. p. 67. par. 2.} *Limbi Posteriores Corporum Stria-*^{Willis de}
torum^{An. Brut.}
^{p. 42. T. 8.}
^{H.}

The

The reason why they are called *Thalami Nervorum Opticorum*, is from certain Fibres supposed to be in them, arising both from their true medullary Superficies (by *Vieussenius* call'd a *Medullary Membrane*) and some from within their own Substance, which at last, towards their foremost part meeting together, make up the Bodies of the *Optick Nerves*.

Willis says nothing of these Fibres, though in his Opinion *Galen* did not improperly give them that name. *Vieussenius* paints them very strong.

As for my part, I never could find any Fibres at all appearing in their external medullary part, those within are very small at best, and scarce discernable.

On the outside of these I have always found and often showed a very fair medullary Tract, here described, running all-along betwixt the *Corpora Striata*, & from the very hindermost extent of the *Corpora Striata* forwardly, down to the very Roots of the *Fornix*, to which they seem to be continuous.

A Medul-
lary Tract.
Tab. 5. mm

With-

The Passage
into the In-
fundibulum

The Vulva.

The Anus.

Tria Fo-
ramina.

Within this Cavity of the Brain are likewise two passages into the *Infundibulum*, and so on to the *Glandula Pituitaria*, the foremost of which is called by the odd Name of *Vulva*, and the hindermost of *Anus*, from their situation, which with the *Rima* betwixt them, is called, as was before noted, the *third Ventricle*.

The places whence all this Water issues are commonly by the latter Anatomists described under the name of *Tria Foramina*, situated so as to give passage from all the eminent Regions of the Brain, from whence there can be access had to them for the Water (or rather the *Lympha*, properly so called) to fall into the aforesaid *Infundibulum*, the first whereof is behind the *Testes*, under the *Valvula major*, (hereafter to be described) the other just under the *Pineal Gland*, or the beginning of the *Rima*, which two meet in an Aperture, under the *Nates* and *Testes*, by *Vicus senius* call'd *Aqua Emissarium*, having a steep descent into the *Infundibulum*; and the last at the end of the *Rima*,

Vicus. p. 73.
par. 3.

Rima, or just under the Roots of the *Fornix*, and all ending at length (tho' by two different passages) in the *Infundibulum*.

The Nates
and Testes
Tab. 7. CC

It may not be unreasonable in the next place to take notice of two remarkable very fair Processes, called *Nates* and *Testes*, by former Anatomists so named from the resemblance they had to those parts; but it is plain from thence they were only used to dissect Brutes, in which they have such a proportion as is betwixt them; whereas in Men 'tis plain they are very near of the same size, and not very different in form, being oblong and acuminate towards their Extremities; but in *Sheep*, *Calves*, and most other Creatures the *Nates* are round and large, and the *Testes* oblong, somewhat acuminate, and very small.

Before these Natiform Processes, under the *Glandula Pinealis*, runs a transverse Process before taken notice of Pag. 84, by *Vieussenius* called *Processus Natibus Antepositus*, and *Nervuli Æmulus*, which upon further enquiry, by drawing the *Thalamus*

Vieussen.
Tab. 8. f

mi

mi Nervorum Opticorum still wider, appears to be rather *Nervi* than *Nervuli Æmulus*, being as thick as that behind the Roots of the *Fornix*, to which in situation 'tis just opposite, and seems to joyn the *Thalami Nervorum Opticorum* together, as that does the *Corpora Striata*.

In what rank to place them 'tis hard to say, as being neither proper Appendices to either the Brain or *Cerebellum*, properly so called, and being divided from the *Medulla Oblongata* in some measure by an Interstice commonly called *Ductus ad Infundibulum* by the Moderns, but by the Ancients a Passage for the Animal Spirits to the fourth or noble Ventricle.

The Isthmus.

They are situated upon that part of the *Medulla Oblongata* which is between the *Cerebrum* and *Cerebellum*, which space was before called *Isthmus*, opposite to that part called from its Author *Pons Varolii*, and by many Authors, as *Bartholine*, *Spigelius*, *Higmore*, &c. thought to be the two hindermost Roots of the *Spinalis Medulla*, which much more likely *Riolanus* makes the Processes of the
Ce-

Cerebellum to be, and with him *Vesalius*
the great *Vesalius*, who paints them *p. 766, 767.*
fig. 10. AA,
fo. I, K. &

From this intermediate situation *fig. 11. GG.*
Dr. Willis thought fit to make them
as it were an *Intelligence Office* be-
twixt the *Cerebrum* and *Cerebellum*,
how rightly, I refer to the Judgment
of others.

'Tis certain they are medullary
Bodies, and contribute to the ma-
king the Animal Fluid or Spirits so
called after the same manner as the
rest of the Brain does; for in cutting
them through, (after having taken
the reticular expansion of Blood-
vessels off from them, which is very
large here, and eminently conspicu-
ous in injected Brains) I find them
of the very same substance with the
Processus Annularis and the *Thalami*
Nervorum optici, partly cineritious,
and partly medullary, and in fresh
Brains somewhat, but very faintly,
striated.

I know not of any part within the
Brain, properly so called, that is not
already described, except a certain
Medullary Chord at the end of the
third Ventricle, and the *Valvula*
major. The

Commis-
sura Cra-
ssioris Ner-
vi Æmula
of Vieuss-
senius.

The first of these is a Medullary *Willis* p. 43
Process, which joyns the *Corpora* col. 2.
Striata together, according to Dr. *Vieuss.* p. 83.
Willis, by *Vieussenius* called *Comissu-
ra Crassioris Nervi æmula*; and ac-
cording to him is the *Medium* or
Commissura by which his *Geminum
centrum semicirculare* intervening be-
tween the two *Corpora Striata supe-
riora anteriora & posteriora*, and his
*Tractus medullaris transversus & ob-
liquus* intervening between his two
Corpora Striata inferiora anteriora and
posteriora, have a communication
with each other.

Dr. *Willis* places this *Chord* or *Willis*, p. 6.
Commissure under the Roots of the col. 1.
Fornix, but it is always behind it, tho'
contiguous to it.

The Valvu-
la major.

The second is the *Valvula ma-
jor*, so called by *Vieussenius*, but *Vieuss.* p. 76.
plainly enough discovered by Dr. *Wil-* *Willis*, p. 49
lis long before, and its proper use col. 2. par. 2
described.

It is a thick (especially in Men)
medullary Membrane, adhering for-
wardly to the inferiour part of
the *Testiforme Process*, a little be-
hind that transverse medullary
Process from whence the pathe-
tick

tick or fourth Pair of Nerves arise, laterally to the Process ascending from the *Nates* to the *Cerebellum*, on its hindermost Expansion, to the foremost *Vermicular* Process of the *Cerebellum*, and no where that I know of to any part of the *Pons Varolii*, as *Vieussenius* will have it, (who seems to have mistaken another part for that Process) unless just where the second Process of the *Cerebellum* comes out from thence, which jointly with its fellow Process on the other side, when they meet together, after their transverse descent on the back-part of the *Medulla oblongata*, do really make up that part which by *Willis* is call'd (and that no doubt from *Varolius*) *Protuberantia Annularis*, and by others, from its true Author, *Pons Varolii*.

Vieussen.

p. 76.

Id. p. 73.

par. 3.

By raising up the foremost above-mention'd *Vermicular* Process of the *Cerebellum* with the Finger, it rarely fails to come in sight; but if not so, 'tis easily shown, by blowing into the *Foramen* situated under the *Pineal* Gland.

Its use, according to *Vieussenius*, *vius. p. 110* is to hinder any part of that Water *par. 2.* which falls into the hindermost *Fo-*

K

ramen

ramen behind the *Testes*, from running into the fourth Ventricle, or *Vice versa* from the fourth Ventricle into it, or from getting out on each side of the *Medulla oblongata*, over the afore-mention'd Processes, so as to fall down upon the Nerves arising thereabouts below from the *Medulla oblongata*: Which last use is evidently most true, (whether it be understood of Water preternaturally or accidentally collected there, for I must needs confess I could never find any there, any more than I could in the third Ventricle in Subjects free from those Diseases incident to that part, as hath before already been remarked p. 82) but as to that relating to the passage from the *Cerebellum* to the last or third *Foramen*, I much doubt the Truth of it, for many Reasons, of which this is one, *viz.*

That the *Plexus Choroideus* in the fourth Ventricle, together with the adjacent Parts, being of the same Texture as the other are in and about the two lateral ones of the Brain, renders it as reasonable to suppose that Water may be collected there as in other parts of the Brain, (nay, that it is so, he himself also allows as Matter of Fact) and consequently as necessary

cessary to have a place of vent for the Water whenever it happens to gather there, as it was for that which was at any time got into the other Ventricles. And consequently,

In the next place, I do not see how this tender Film can be able to intercept a passage of so searching a body as Water at any time forced against it (notwithstanding the supposed declivity of this Part, which in Man, by reason of the largeness of the subjacent prominent annular Process, is very inconsiderable) which by Pulsation must needs happen whenever we suppose that Cavity filled with it.

And, in the last place, notwithstanding all the Contrivance the afore-said Author hath shewn in conveying the gross part of the Water (which, as was before noted, he grants may be, may, constantly is deposed there from the Glands of the *Plexus Chorooides* here situate) by the Extremities of Veins, out of this Ventricle, I am suspicious, if there was no speedier reductory passage found out, there would frequently happen very great Mischiefs to the *Medulla Spinalis* it self, and the Nerves springing from it, seeing the Extremity of that Ventricle called the *Calamus Scriptorius* is there

Vituf. p. III

parted from the Spinal Marrow behind it, but only by the *Pia Mater*, which notwithstanding it is there double, as it is also quite down the whole *Spine*, lest perhaps the Water should fall down upon the Nerves which arise from it too readily, yet upon such an occasion may be easily suppos'd subject to violation. Not to say any thing of the high improbability of any such Conveyance at all by the Veins, seeing that in a natural state they are always, as hath been already observ'd, continuations only of Arteries.

'Tis true, this may hinder the fall of Water into the fourth Ventricle, by reason of a Passage under the *Nates* before mention'd, by *Vienſſenius* call'd *Aquæ Emissarium*, so near at hand to receive it when it finds its further passage that way obstructed by the interposition and resistance of this Valve. And for the same reason doubtless it was, that in *Vienſſenius's* Experiment which he brings for a Proof of his Opinion, no Water was found in the fourth Ventricle, it having got a passage immediately, upon its non-admittance by that Valve, to convey it another way, which by reason of the steepness thereof, is done much more readily.

*Vienſſ. p. 110
par. 2.*

CHAP.

CHAP. XIV.

Of the Cerebellum.

THE *Cerebellum* falls next in order to our consideration, in describing of which I hope a great deal of pains may reasonably be spared, seeing all that hath been already spoken of the cortical or cineritious part of the Brain, as also of its medullary part, is equally applicable to the *Cerebellum*. Nor is what hath been said already of the *Plexus Choroeides* in the Ventricle of the one part less applicable to that *Plexus* in this.

The Plexus
Choroeides
of the Cere-
bellum.

This *Plexus Choroeides* in the fourth Ventricle begins to be glandulous just under the Eighth Pair of Nerves, from whence it runs up on the side of the *Caudex Medullaris* to the chordal or third Process of the *Cerebellum*, and from it enters the fourth Ventricle, by *Aurantius* called

K 3

Cisterna

Aurant.
Anatom.
Obs. p. 48.

Cisterna Spirituum, (which Ventricle, conformably to what that Author hath in the aforesaid place observed, I always find broader than long, and double, though not divided by any intervening Body, as the two lateral ones of the Brain are;) not lying loose therein, nor at the bottom of it, as the *Plexus* does in the Ventricles of the Brain, but quite contrariwise, (and which hath not heretofore, as I know of, been taken notice of) adhering close to the top of this Ventricle, or the bottom of the superincumbent *Cerebellum*, then running transverse just at the end of the *Calamus Scriptorius*, there becomes continuous to the *Plexus* of the other side; as hath been observ'd of the *Plexus* in the lateral Ventricles of the Brain.

This *Plexus* arises from a ramification of the second or backwardest Branch of the Cervical Artery, as one part of the other *Plexus* of the Brain mention'd in that Chapter where the said *Plexus* is treated of, doth) and another smaller Branch of the said Artery about the place where it ascends from the Vertebrales,

FIG. 1. q

brals, which last Branch turns into a reticular Expansion first, and then a little space further meeting with the other, constitutes this *Plexus*.

This part differs from the Brain in its cortical structure, inasmuch as its Interstices are here elliptical or pieces of imperfect Circles, growing shorter towards those two Productions of the *Cerebellum*, before and behind, (which by reason of certain annular depressions occasion'd by Bloodvessels there embracing them, seem as tho' they were wrinkled like Worms, and therefore called *Processus Vermiculares*) as Parallels upon the Globe do towards each Pole.

The three
Processes of
the Cerebellum.

It hath three Processes, which joyned together on each side, make up as it were two fair Roots, according to the Ancients called the hinder Roots of the *Oblongata Medulla*, by the Moderns *Peduncles* or *Stalks*, by which this part grows to the *Medulla Oblongata*.

FIG. 7. gg

The first of these ascend from the *Cerebellum* to the *Nates*, the se-

FIG. 6. BB.

cond from the *Cerebellum* to the *Medulla Oblongata*, which meeting together on the under side thereof,

as was before noted, make up that large Protuberance by *Willis* called *Processus Annularis*, by others from the first Author *Pons Varolii*.

Var. Anat.
p. 26.

This I find full of *Stria's* or medullary Tracts, much stronger and larger than those of the *Corpora Striata*, running transverse on each side the length of the whole Process, and terminating in a medullary long Tract, dividing that Process into two equal parts, as you see in the Figure, the use whereof, as having never been before observed, will be hereafter taken notice of.

FIG. 6. cc

Ib. cc

The third descends from this part backwards, upon the upper side of the *Medulla Oblongata*, like two longish thick Chords on each side, making the *Medulla* look somewhat thicker and broader in that place, and not untruly stiled the *Chordal Process*.

Ib. ff
FIG. 7. hh

These *Stalks*, when they joyn together at the other end, make up the *Meditallium* or *Corpus Callosum* of the *Cerebellum*.

The transverse Process of the fourth Ventricle.

There are two or three fair medullary Processes close to, and sometimes

ri

riding one over another, a little on this side the fourth Ventricle, or about the beginning of the *Calamus Scriptorius*, which joyn the two cesses together that descend from the *Cerebellum* to the *Medulla Oblongata*; and there are two more descending length-way from that other transverse Process behind the *Testes*, down to these.

New Processes on the inside of the Medulla Oblongata:

These long medullary Processes I never find wanting, though in different numbers, sometimes having seen three, sometimes two, and once I could find but one, (though larger than ordinary) and constantly, in what number soever, ending in the transverse Processes at the afore-mentioned beginning of the fourth Ventricle.

These long descending Processes are just over-against the *Corpora Pyramidalia*, on the other or under side of the *Medulla Oblongata*, and the transverse Processes at the beginning of the fourth Ventricle last mentioned, are a little above the original of the Eighth Pair of Nerves, insomuch that without being very circumspect one may

Willis Cereb. Anat. p. 12. col. 2. par. 3.

may mistake them for the original of that Nerve, whereas in reality I find them to be the original of the soft or hindermost Branch of the Seventh, as will be more particularly taken notice of hereafter, in the description of those Nerves; and therefore cannot but wonder how Dr. Willis (who speaks in one place as though he had seen them) came to assign them for the Root of the ninth Pair, beneath which and this Process I have always observed the space of half an inch.

CHAP.

CHAP. XV.

Of the Medulla Oblongata.

Crura Me-
dulla Ob-
longata.

THE third part of the Brain, in its general acceptation, according to the foregoing method, is called the *Medulla Oblongata*, all whose parts on its foreside having already been spoken of, it remains in the next place that we take notice of it on its other side, where are most considerable its *Crura*, so called, which *Crura* are only the under part of the *Thalami Nervorum Opticorum* before described, which in their Extremities becoming continuous to the under side of the medullary hinder part of the Brain, occasion'd the Ancients to think the *Medulla Oblongata* had its foremost Roots immediately from the Brain there, as it had its hindermost from the Processes of the *Cerebellum*; but upon a more diligent enquiry it appears, that these

Crura

Crura are more deeply immersed in and knit to the *Medulla Globosa* of the Brain forwardly, by virtue of the *Corpora Striata*, as also by the very medullary part of the Brain itself, which there, from the back or undermost winding part of the *Corpus Callosum* is perfectly mingled with it.

Where these two *Crura* begin to come close together, the *Protuberantia Annularis*, or *Pons Varolii*, made up of the second Process of the *Cerebellum* aforementioned, begins to cover the *Medulla Oblongata* for about the space of an inch and an half, after which this *Medulla Oblongata* in one large Trunk is continued to the first *Vertebra* of the *Spine*, and so quite down to the end thereof.

The two
white Bodies
behind
the Infundibulum.
Fig. 1. bb

Whilst the *Brain* is in this position it may not be unseasonable to take notice of two fair white Bodies on this side of the *Infundibulum*, in that depressed part of the Brain, where the *Pia Mater* (as hath before been taken notice of) is so remarkably double.

There

The Cor-
pora Pyra-
midalia.
FIG. I. D.

There are also two white long medullary Processes called *Corpora Pyramidalia* both by *Willis* and *Vieussenius*, which arise just at the ending of the Annular Process running down upon the *Med. Oblongata* the space of an inch, ending a good space below the place where the Eighth Pair of Nerves begin, which have their original between the *Corpora Olivaria* and the *Chordal Processes* partly on the other side thereof, contrary to the account we have of them by Dr. *Willis*, who describes them as ending in pointed Extremities, just where *those Nerves* have their original.

Willis, p. 13.
col. 1. par. 1
p. 61. col. 2.
par. 3.

The Cor-
pora Oli-
varia.
Ibid. o.

On each side of these appear plainly the *Corpora Olivaria*, so called from their Figure, as the former were by *Vieussenius*, which with the *Corpora Pyramidalia* and two white Bodies behind the *Infundibulum*, he calls *Conceptacula Spirituum Animalium*, or places containing Animal Spirits upon several occasions of use to the Brain, both in its natural and intellectual Faculties.

CHAP.

CHAP. XVI.

Of the Nerves.

IN the same position of the Brain we also have a fit time of taking a view of the Nerves, which are still medullary Productions of the Brain dispersed to all the parts of the Body, which have need of either Sense or Motion, and these are in number ten Pairs or Conjugations, having their Names and Originals as follows.

The first is the *Olfactory Pair*, which after they leave the former Lobes of the Brain, and begin to run to the Bone called *Ethmoides*, take the name of *Processus Mammillares*; but this is chiefly in Brutes, where through their largeness they have that appearance, and are manifestly hollow.

By the utmost Scrutiny I have been able to make, they have but one Original, and that is from the undermost and foremost part of the

Crura

Crura Medulla Oblongata, where they advance on each side into the Globous medullary part of the Brain, from whence running concealed betwixt its foremost and hinder Lobes obliquely, for a good space, at last they come in sight, as you see them in the Figure: And by what means *Vienssenius* comes to find such diffused Originals for them as he speaks of, I know not.

Their Use is known to most, and a particular account thereof, as of the rest, together with the manner of Sensation, with relation to the external Organs of Sense, is much more fit for a Physiological Tract than one of this kind.

I shall therefore only at this time give a general description of the Nerves belonging to the Brain, how and where they arise, the difference or variety whereof serve very well to inform us, according to several late Theories, concerning the different Reservatories of the Animal Fluid or Spirits, and the different dispensation of the same to several parts of the Body.

The

The Second
Pair.
Ibid. 2 2.

The second Pair are called the Optick or Seeing Nerves, of which I find no more Originals than of the former, and that is from those medullary parts called *Thalami Nervorum Opticorum*, tho' *Vieussenius* says they are from several parts; and *Willis* in general terms from the afore-said *Thalami Nervorum Opticorum*, behind the *Corpora Striata*: which description is more exact in *Quadrupeds*, where the *Thalami Nervorum Opticorum* are altogether in situation behind the *Corpora Striata*, than in Men, where a great part of the *Corpora Striata* are situated on the out-sides of the *Thalami Nervorum Opticorum*, and only their Heads or Extremities before them.

The Blood vessels mention'd both by *Willis* and *Vieussenius* belonging to these Nerves, I have seen to run not only upon or with them, but also in injected Bodies exactly quite thro' the medullary substance of them, into the reticular Coat of the Eye, wherein they end in an infinite number of the most capillary Ramifications, which by an injection of that Artery
made

made with Mercury, become very delightfully conspicuous to the Eye.

The Nervous Fibres also, from the fifth and third Pair of Nerves, do twine about the Bodies of these Nerves, as the two above-mention'd Authors do truly affirm, but how rightly they both assign to them the office of dilating and contracting them subserviently to the visory faculty, and preternaturally in Convulsions of the Eye, as though these Fibres were truly Muscles, or of the carnous kind, I refer to the Judgment of others.

These go out of the Skull at its first *Foramen*.

The Third
Pair.

FIG. 1st 33

The third Pair arise out of the forward and upper part of the Annular Process, where 'tis contiguous to, and covered with the under part of the *Thalami Nervorum Opticorum*, coming out into sight from between them, just where that Process terminates forwardly, which is where the *Crura Medulla Oblongata* come together into one body, constituting the *Caudex Medullæ Oblongatæ*.

L

These

These running through a duplicature of the *Dura Mater*, on the outside of the *Circular Sinus*, go out of the second hole of the Skull to the Eyes, and are therefore called *Par Oculorum Motorium*, to the voluntary motion of which only they are granted to be subservient, which, seeing they have their original from the *Cerebellum*, afford us no weak Argument against the Hypothesis of Dr. *Willis*, who hath reserv'd that part in Nerves subservient to involuntary motions only.

The Fourth
Pair.
Ibid. 44.

The fourth Pair is very small, coming from the transverse Process on the foreside of the *Medulla Oblongata* behind the *Testes*, first coming in sight between the undermost part of the hinder Lobe of the Brain and the *Cerebellum* laterally, crossing that part where the Annular Process ends towards the *Crura Medulla Oblongata*, from whence they pass into a duplicature of the *Dura Mater*, and afterwards, a little more outwardly than the former, goes through the same second hole to the *Trochlear Muscle* of the Eye, and are called from their mo-

moving of that according to the passions of the Mind, the Pathetick Pair.

The Fifth
Pair.
Ibid. 5 5.

The fifth Pair is broad and large, made up of many thick Fibres continuous to each other, some softer than others, arising from the uppermost part of the *Processus Annularis*, which is backward laterally, where 'tis broadest, by reason of the second Process of the *Cerebellum* there entering it.

The several
Branches of
the fifth
Pair.

FIG. 3. B

This Nerve, after having first climb'd over the inner Process of the *Os Petrosum* into a kind of a Cavity made of a duplicature of the *Dura Mater* in that place, immediately swells into a kind of a thickness, called a *Ganglion*, from whence several Branches are propagated, lying betwixt the *Dura Mater* and the *Cranium*, on each side the *Sella Turcica*, without any *Fovea* or Cavity at all, going out of the Skull at three several places, its superiour small Branch at the second hole with the third and fourth Pair of Nerves, its inferiour smaller Branch at the third hole, and its posteriour or largest Branch at the fifth.

FIG. 3.
C, D, E

L 2

From

FIG. 2. y.

From the inside of the foremost Branch two little ones turn back, and meeting with another small Branch a little lower turned back also from the sixth Pair, where that Nerve is fasten'd to the outmost or borrowed Coat of the Carotid Artery, make up a small Trunk of a reddish or fleshy colour, like to that which 'tis of when pass'd out of the *Cranium*, (as *Veslingius* hath truly observed, who calls it *The Internal Branch of the Sixth pair*) which descending obliquely, and creeping under that Artery, betwixt its external, proper, and borrowed Coat, goes out with the Carotid Artery at the fourth hole of the Skull, which is in a manner double between the *Os Petrosus* and *Cuneiforme*, and from its passage through the *Thorax*, near the Roots of the Ribs, (all-along which, it receives a Branch from the Intercostal Nerves) is call'd, *The Intercostal Pair*.

*The sixth
Pair.*
FIG. 1st.
66.

The sixth are about the bigness of the third, arising from the hinder part of the Annular Process over-against, and not far off from the beginning or head of the *Corpora Py-*

Pyramidalia. It sends out sometimes one (in this Subject very short) sometimes two slips, as was afore said, for the making up the Trunk of the Intercostal Nerve, and after that (with the foremost Branch of the fifth Pair, in one and the same duplicature of the *Dura Mater*, together with the preceding third and fourth Pair of Nerves) goes out at the second hole of the Skull, and terminates in the abductory Muscles of the Eye.

The seventh
Pair.
FIG. 1st,
77.

The seventh Pair, or Hearing Nerve is large, and comes out almost just over-against the original of the fifth Pair, on the lower or under side of the second Process of the *Cerebellum*, where it first appears coming out from the *Cerebellum* to make the aforesaid *Protuberantia Annularis* between the *Corpus Olivare* and that Protuberance, as though it crept out betwixt them, and had (as it really hath) a more remote extraction.

It consists of two distinct Processes, the first of which is more round, hard, and less than the second, that being for Motion,

L 3 this

this for Sense, but tho' they seem as though they had the same original, being seemingly continuous at their rise from the Brain, (which Dr. *Willis* affirms they have, tho' sometimes he makes it in one place, and sometimes in another) yet upon a further enquiry it does appear otherwise, the first or hardest having its original from the *Caudex Medullaris*, not far from the place where it comes first in view; the second very remote from the transverse Process or Processes in the passage to the fourth Ventricle before described, (which in another place the same Author seems plainly to have observ'd, taking it for the Original of the other Process of this Nerve;) from whence it ascends all-along on the sides of the *Medulla Oblongata* till it arrives at the afore-mention'd place, where it first, together with the other Branch, leaves the *Medulla*, to pass out of it at the seventh hole in the Bone called *Petrosum*.

Willis, p. 12
col. 2 par. 3
& p. 56.
col. 1 par. 4.

Willis, p. 78
col. 1 par. 1

FIG. 7. 11

The eighth
Pair.

FIG. 1188

The eighth, or *Par Vagum*, arises a very little beneath the seventh, but yet not from any part of the An-

Annular Protuberance, but exactly in that somewhat hollow place betwixt the *Corpus Olivare* and third or Chordal Process, having numerous (I have counted ten or twelve) Fibres, but all continuous at their first rise, for its original.

This in a multitude of Ramifications is spent upon the Bowels, and goes out at the eighth hole with the Spinal Accessory Nerve, where the great lateral and the inferiour little *Sinus's* in the Basis of the Skull go out into the Internal Jugular.

To this eighth Pair about half an inch from its first rise, whilst it climbs upon or sticks to the *Pia Mater* upon the Basis of the *Cerebellum*, ascends a Nerve called *Spinalis Accessorius* by *Willis*, but long before him taken notice of, nay, painted and described, by *Vidus Vidius*, the original whereof I find to be as far as the seventh Vertebral Pair, from the foremost and hindermost beginnings of that Nerve, notwithstanding *Vieussenius* confines its

Ibid. * *

Vidus Vidius, p. 93.
T. 18.
Fig. 2. *

original to the fourth Pair of that part only.

This Nerve runs under the Vertebral Artery near half an inch on the side of the *Medulla Oblongata*, at length, about half an inch from the beginning of the eighth Pair, leaves the aforesaid *Medulla Oblongata*, running obliquely upon the *Pia Mater* of the *Cerebellum*, to joyn with the aforesaid Pair, which it really does in that very place, though it part with it afterwards again.

*The ninth
Pair.
Ibid. 9 9.*

The ninth hath several (in one Body I counted seven or eight) pretty large Fibres for its original, very distant one from another, the first of them coming higher, from the very top of the *Corp. Olivare*; the next, and several others, are much less, a quarter of an inch lower; and the last much lower yet, about the ending of the *Corpus Olivare*, or beginning of the tenth Pair, with several others between the *Pia Mater* and subjacent *Medulla Oblongata*; but after all, its Trunk is very little, about the bigness of the Accessory Pair.

Thro'

FIG. I. k.

Thro' the Fibres of this Nerve there runs commonly a small but very visible Branch of the Vertebral Artery, at its original; as you see in the Figure expressed by the Letter *k* on the right side, going out at the ninth hole, together with this Nerve and the Vertebral Vein, which Vein *Vienſſenius* mistakenly makes to go out at a tenth hole, forasmuch as that is never found in Nature, neither need be, seeing the tenth Pair goes out at the last or great *Foramen*, by which the *Medulla Oblongata* passes into the *Spine*. Vieuſ. p. 163

The tenth
Pair.
Ibid. 10 10

The tenth Pair, (which had it a double Original from each side of the *Spinal Marrow*, (as all the rest of the *Spinal Nerves* have) might much more properly be called the *first Vertebral*, inasmuch as that both a great part of its rise and egress is quite out of the bounds of the *Cranium*) serving chiefly the Muscles of the Neck, it begins with three, and sometimes more, small Fibres lower a great deal, out of the *Medulla Oblongata*, almost an inch below the Trunk of the ninth Pair, and is about the size thereof.

It

It goes out of the *Cranium* betwixt the first and second *Vertebra* of the Neck, making its passage through the *Dura Mater* from the *Medulla Oblongata*, about half an inch below the place where the said Artery comes in.

The Structure of these Nerves is consistent of many *Fibrilla's* or *Stria's*, a certain number whereof being first enclosed in a production of that delicate inward *Lamina* of the *Pia Mater* afore described and spoken of, makes up a *Fasciculus* or Bundle, and many of these collectively the Body of a Nerve.

In these *Fibrilla's* or *Stria's* (betubulous and always turgid, as in so many Rivulets springing from the main Fountain the Brain, and from thence distributed to every respective part of the Body) is contain'd the Animal Fluid, by means whereof there is maintain'd a constant intercourse betwixt it and the Soul, and reciprocal acts of Friendship betwixt one part and another.

This Animal Fluid I look upon only as a Body consisting of very minute and flexile Particles, contain'd

tain'd in such a space as allows them a capacity of being agitated on all sides by vertue of the subtile matter, or *Æthereal Globuli* they swim in, by which means they are render'd capable of pervading the narrowest Channels of the whole Machine, provided its Orifice or Pore be adapt thereto, in contradistinction to those other sort of grosser Particles of Matter, which by reason of the narrowness and figure of the space they are to enter, do approximate so close, as to become contiguous in all their Superficies, whereby they become deprived of their former expansive agitation, which is always necessary to make a Body fluid, and like so many small Filaments orderly disposed, do constitute the Inclosures or Coats of those Vessels the Fluids are contained in.

This Animal Fluid I conceive to be in a continual state of Transpiration, proportionable to the measure of its leisurely production, seeing no more necessity of ascribing any further Uses to it, besides those afore-mention'd, than I do to
the

the watery Humour of the Eye,
besides its service to Vision, which
is always in a state of fresh produ-
ction, as by the Excellent *Nuck's* Nuck de
Saliv. &
Duc. Aqu.
Oculor.
P. 109.
Experiment is plainly manifest; and
yet, by vertue of Transpiration,
some way or other, though to us
not visible, without any incon-
veniency to that noble Organ.

CHAP.

CHAP. XVII.

*Of Sensation and Motion in
general.*

THE Nerves thus constituted, become accommodated for Use in relation to their several and distinct Functions, in some consisting of Sense only, such as are those appertaining to the particular Sensories, (*viz.*) the Smelling and Seeing Nerves, as also the soft Process of the Hearing Nerve, some Branches of the fifth, and it may be of the ninth Pair, for Tasting; in short, all the Nerves belonging to those external Sensories, by way of eminency, and in a less eminent or general way all the Nerves of the whole Body, which are distributed to such Parts as by reason of their structure are capable of Sensation only, any of which, as furnish'd with the Nervous Fibrils, but more eminently the *Cuticula*, may properly be call'd
an

an Organ or Sensory of *Feeling* ; in others of *Motion* chiefly, such as are all the whole Syſtem of Nerves, (excepting them only afore-mention'd) ſes, which though in a leſs eminent manner, are nevertheless ſenſitive Nerves alſo : In others of both, in all reſpects (*viz.*) either in a more eminent or leſs eminent Senſation, and Motion too, with relation to the different Fibres they conſiſt of in their Originals, as the fifth and ninth Pairs.

Theſe two different Functions of Senſation and Motion are executed after two as different manners.

The firſt of which, being occaſion'd from external Objects, is diſcharged by a preſſure thereof made on the Inſtrument of Senſe, ſo that the Motion is backward from one Extreame of the Organ to the other, where it terminates in the *Commune Sensorium*, commonly ſo called, and is therefore ſtil'd *Perception, Paſſion, or Affection*.

The other is diſcharged by ſome manner of impulſe upon the Organ from within outwardly, with a tendency either to acquire ſome Good,
or

or avoid some Evil; by which Impulse, when carried on so far, either in a natural or moral sense, as to terminate in, or to be executed upon its proper Object; the Object then may be said to suffer as before in the other case it might be said to act, and the perceptive Faculty now to act as before it might be said to suffer, and this Action is commonly called *Local Motion*.

For whose sake, seeing 'tis of different kinds, learned Men have thought fit to organize or divide the Brain into two distinct Provinces invested with several Rights and Jurisdictions abating the Power of the Sensitive Soul, which before was looked upon universal over the whole Brain, allowing it only a principal, but no absolute Empire there: And this they have done upon no weak or unreasonable grounds, seeing that *Local Motion* is not only in many respects performed without its assistance, but even against its power of resistance; as in the Pulsation of the Heart, vermicular Motion of the Bowels, and in a great measure the Act of Respiration.

Now,

Now, that which hath been taken from the Brain hath been conferr'd on the *Cerebellum*, to which, though some Power in this Affair may justly be allowed, as was before observed, yet possibly not altogether so much as there hath been.

Dr. *Willis*, who is Chief in this Cause, having distinguish'd *Motion* into voluntary and involuntary only, hath made the *Cerebrum* accountable for the one, and the *Cerebellum* chiefly for the other; and to that end hath furnish'd it with the like number of Nerves, as in his own words is expressed, *Ut divisum cum ipso (i. e.) Cerebro, imperium Cerebellum habeat*; nay, considering the Intercostal Pair, derived from the fifth and sixth Pair, which belong to the *Cerebellum*, he hath made it exceed.

Willis c. 18.

I am apt to think that Learned Person too soon fell in love with his first Thoughts, the ordinary reason of either ones seeing false, or not far enough.

No.

Nothing being more apparent, than that most of those Actions or Animal Motions he calls *Involuntary*, and of which he gives so many Instances, are equally found in Brutes and rational Creatures too, whilst in the state of Infancy, as well as when grownup, with *this* only difference, that all of them in the last are under the controuling power of the Soul, and consequently may be suspended upon a reflex'd Act of the Understanding; whereas in Brutes and Infants they are necessary, and do as naturally ensue upon the impulse of the Object, as Water, when unconfin'd, runs towards a Plain.

Now, if all these were supposed to be under the power of the *Cerebellum* only in Brutes and Infants, the Brain it self must necessarily be thought altogether useless in them.

It will be necessary therefore to take notice, that there are two sorts of Animal Motion in Brutes, as in Rational Creatures, the one purely natural, such as is Pulsation of the Heart, and various contraction of the *Viscera*, proceeding from a certain por-
M tion

tion of the Animal Fluid continually dispensed to the Nerves in an equal proportion, and so may be said to have their cause originally co-existent with the Creature, and always present : And this kind we find by a most convincing Experiment hereafter to be mentioned, to be from the *Cerebellum*, and absolutely free from the dominion of the Brain, in its ordinary way of acting or influx.

The other is that of *Instinct*, relating to the Sensative Soul, or an aptitude of the Nervous Structure, to act according to the Impressions made upon the Nerves, either from within, or from without, and so may be said to depend on the presence of such Causes as are supervenient and extraneous to Nature, suitable to the impressions whereof the *Animal* either pursues or avoids the Object, obeys, or resists the Impulse.

Now, I take it for granted, that nobody will deny but that the Nerves (by vertue whereof these last actions of *Instinct* are performed) whether they arise from the *Cerebrum* or *Cerebellum*,

bellum, are equally under the command of the Soul; or else, as I said before, the Brain in those Creatures is to no purpose.

And of this sort I reckon all those actions in rational creatures of *Instinct* before they have attain'd to the use of their *Understanding*, from any sort of Impressions, or inadvertent and inconsulted, when he hath the controuling power of Reason allow'd him and makes no use of it, such as are called *Habitual*, which at first were produced by command of the Rational Part only, but through frequent repetitions at last, without any command from that, out of a blind obedience to a bare impulse from the Object; or lastly, such as happen when he hath altogether lost the use of it, as in Sleep or Distraction; in which last Cases 'twill be very difficult to distinguish him from a meer Machine or *Automaton*.

Now, from what hath been said, I cannot but think it plain, that many of the Actions before spoken of in Dr. Willis's sence, by him called *Involuntary*, as proceeding

from the dominion of the *Cerebellum* only, such as he calls the various Configuration of the Face, from some Impulse or Provocations in the *Viscera* or elsewhere, erecting the Ears, turning the Neck and Eyes about, sudden Shrieks and Outcries upon some extraordinary frightful Object surprizingly affecting one Sense or another, furnished with either such Nerves as he supposes to be altogether under the command of the *Cerebellum*, as the fifth and seventh, or else to have a very near correspondence with that part by vertue of Vicinity, as the ninth, do more truly proceed from that perceptive faculty, or (to use his own words) that part of the Soul, he hath confin'd to that part of the Medullary System called the *Cerebrum*, inasmuch as in reasonable Creatures they may and commonly are suspended, as well as the Nerves they flow from, sometimes made use of as Instruments of Voluntary Motion by it also; and to think the contrary, is as much as

as to say, that when any body happens to express any of the aforementioned involuntary Acts, or but hit his Bedfellow a box of the Ear, whilst asleep, all these must be allow'd to proceed only from the Organ of Involuntary Motions called the *Cerebellum*.

And of this kind also in a great measure I reckon Respiration, concerning which I cannot easily be brought to think it satisfactorily explain'd by Dr. *Willis*, from the Energy of those Animal Spirits which flow only from the *Cerebellum* in the *Par Vagum*, after the same manner they do to the Heart by the Intercostal and that Pair for its pulsation, and as only under the command of the Soul, to be stop't now and then, as it pleases, by vertue of some Nerves communicated to the Intercostal Muscles and Diaphragm, the chief Instruments of breathing, from the *Spina Dorfi*.

I am therefore rather inclin'd to be-
 think this Motion is of the other or
 different kind before spoken of, un-
 der the Title of *Instinct*, proceeding
 from an extraneous supervenient
 Cause, acting conformably to
 the course of Nature in some
 other Cases of the same kind, as in
 Hunger and Thirst, and the like, where
 the obtaining the designed
 End or Effect renders the part from
 whence comes the Motion for some
 time insensible of the impression,
 and where, after the ceasing of the
 Effect or Motion, the sense of the
 impression revives again, whence
 there happens an equal reciproca-
 tion between the Sense and Fruition,
 or Sense and Motion.

To apply this account of the
 manner and reason of the Spirits
 acting upon the Stomach and Pa-
 late in relation to Hunger and
 Thirst, to that of the *Systole* and *Diastole*
 of the Lungs or Respiration, 'twill
 be needful to take notice, that in an
 Infant unborn there is no Respira-
 tion, but yet there is a *Cerebellum*,
 and that if this sort of Motion cal-

led *Instinct*, which I make to differ from purely *Natural Motions*, such as are contemporary with even the first living Rudiments of the Individual, was altogether and solely owing to the *Cerebellum*, after the manner of that of the Heart; then of necessity the Child in the Womb ought to respire. But being satisfied of the contrary, it remains that we account for its respiration another way, which is as afore noted, through the presence or absence of the first moving Cause or Impulse, which I make or suppose to be any thing impressing the Nerves, propagated through the Organs of Breathing, so as to transmit the impression from within to the perceptive Faculty, presiding both over the *Cerebrum* and *Cerebellum* too, to the end the Spirits may from thence forthwith be commanded into such other Nerves as act those Muscles which serve for enlarging the whole Cavity of the *Thorax*, in order to let the Air into the Lungs more plentifully, which was the thing aimed at by Nature; and these

are the Intercoſtal Muſcles and Dia-
phragm.

Now 'tis eaſie to conceive, that
whiſt the Child is enclosed in its
Mothers Belly, there is not that
occasion for Reſpiration as when
'tis born, the main Stream of Blood
all that while finding no paſſage thro'
them, and that which does by the
Ruſſian Artery made of Juices
much more mild and cooler, the
native heat being little, and the
Aliment meer Chyle or Milk, from
whence it falls out that the Pulmo-
nick Nerves go altogether unpro-
voked, which after birth are conti-
nually otherwiſe impreſſed or pro-
voked by the hot *Effluvia* of
Blood, now bred of ſtronger Food,
and by a ſtronger native heat, and
wholly flowing through them, which
heat continually, as the Child ac-
quires a greater maturity, *Tencrea-*
ſing, may, for ought I know, not
a little contribute, by way of natural
impulſe, to its excluſion.

The truth of this will the more
clearly appear to any who will
take the pains to conſider well of
the ſtructure of Parts in Children
un-

Unborn, in whom the usual circuit of Blood through the Lungs, which are designed for purifying and perfecting the mixture of Blood and Chyle, is denied; as also through the Liver, serving chiefly for separating that gross Excrement the Gall, not bred (at least in any proportion) in an Infant, unborn, and in lieu of these, other Passages, (which become altogether unnecessary after birth) provided by Nature after a shorter and more compendious way, (*viz.*) by the *Foramen Ovale* betwixt the *Vena Cava* and *Vena Pulmon.* and *Tubulus Arteriosus* between the *Art. Pulm.* and *Aorta* in the Lungs, and the *Tubulus Venosus* between the *Sinus* of the *Porta* and the *Cava* in the Liver; as hath been most sagaciously observ'd by the late Learned Dr. *Walter Needham*.

'Tis true, That in several Creatures there are some Nerves very much depending on the *Cerebellum*, as are they which minister (though in a different manner, as hath already been taken notice of, and will be hereafter further explained) to the Natural and Vital Functions, (*viz.*)
the

the *Par Vagum* and Intercostal Pairs, and therefore the aforefaid Author, who is in this as in many other of his Discoveries very fortunate, and highly commendable, made a very good guess when he brought these Faculties into subjection to that part, inasmuch as by several others, as well as by my own Experience upon living Bodies, we find, that notwithstanding most part of the Brain be pared off with a Razor, yea, even after the *Medulla Oblongata* be divided betwixt the *Cerebrum* and *Cerebellum*, and taken wholly out of the *Cranium*, the Heart will beat, when at the same time if the *Cerebellum* it self be but cut in pieces, though all the rest of the Brain be kept entire, the Creature expires presently.

Yea, I have seen Respiration (which only in part depends on the *Cerebellum*) totally to cease upon only a sudden violent compression of that part by a blow, and, after its being wounded, the Heart to cease beating immediately.

But first

All

All which must of natural consequence fall out upon the Hypothesis, That those Functions of Nature do depend on the *Cerebellum* for their source and influence, which is constant, uninterrupted, and out of the arbitrary jurisdiction of the Brain; yet with this difference, that in Motions purely natural, and either contemporary with the *Embryo*, as the first signs of its vitality, such as is Pulsation of the Heart, during its enclosure within the Mother, or supervenient upon its further growth and more visible organisation of Parts, as the natural contraction of the other *Viscera* subservient to the offices of Protrusion of the Chyle, separation of the Glandular Juices, and proscription of the Excrements, the Animal Fluid or Spirits do altogether flow from the *Cerebellum*, the Nerves there both descending from the *Cerebellum*, and terminating in those parts afore-mentioned; whereas in Respiration, which I call a Motion of Supervenient Instinct,

(if I may be allowed to use the word

Instinct

Instinct in that sence) the Nerves descending from the *Cerebellum*, and propagated through the Lungs from the *Par Vagum*, serve only to convey the first Impulse or Impression of the Object to those parts which are by Nature framed and qualified to produce Respiratory Motion, and those are the Nerves of the Spinal Marrow, receiving the impression from the *Cerebellum*, seeing that by the aforesaid Experiment it appears plain, that after the whole *Cerebrum* was divided from the *Cerebellum* and *Medulla Oblongata*, the act of Respiration continued for a considerable time entire, which Motion is dependent on the Sensative Faculty presiding in the *Cerebellum*, transmitting the first Impulse produced by the eighth Pair or *Par Vagum* (as before observ'd) and communicated thence to those Spinal Nerves which act the Inter-costal Muscles and Diaphragm.

So that all the office of the *Par Vagum*, which is propagated thro' the Lungs, is to convey the Impression from thence to the *Cerebellum*, which by vertue of its connexion

nexion with the *Caudex Medullaris* (from whence the Ancients rightly thought that part had its hindermost Roots from the *Cerebellum*, as before taken notice of) it is able to transmit it further, as the Sensative Faculty presiding there shall direct, and that too by the common way, the *Medulla Oblongata* and *Spinal Nerves*.

And further; That this part is as capable thereof as the *Cerebrum*, and is not wholly and only deputed for the service of such Nerves or Organs as are employed by the involuntary part or portion of the Soul, (as Dr. *Willis* would have it) appears in that the third Pair of Nerves, by him allowed to be amongst the number of the other kind of Nerves, (*viz.*) those commanded by the Will, from hence (as hath been already shewn) hath its original. And here also furthermore give me leave to add, by way of conjecture, that the reason why the Soul hath not an equal command over those afore-mention'd Nerves dedicated to the vital and natural Motions, is, the early date

or

or commencement of the office of those Nerves, by which means they contract an habitual irresistible Influx, much less so in those belonging to the Respiratory Functions, the exercise whereof is of a later date; and lastly, the Influx is not in the least so habitual in those other subservient to the Organical Functions of the Limbs, inasmuch as they are not capable of being exercised till a much longer time after, and then not so uninterruptedly as either the first or the second, but gradually, and with intermissions.

So that the only reason why upon cutting the *Cerebellum* Respiration ceases, is, that by that means its structure is discomposed, and render'd unfit either to receive or transmit the impression further to the aforesaid Nerves, which are subservient to the Instruments of Respiration.

'Tis true, there are reciprocal communications betwixt the Nerves of the *Intercostal Pair*, *Vertebræ*, and *Diaphragm*, yet seeing they terminate not immediately in the Parts of

of each others particular distinct jurisdictions, there is no interchangeable act or office from thence produced betwixt them.

For as, notwithstanding there are so many Branches of Nerves communicated from the Spinal Nerves subservient to voluntary motion, to the Intercostal Pair, on their descent to the *Viscera*, and yet by reason of their not terminating in those parts, they are not in the least able to bring these Nerves under the commands of the Rational Soul, by which provident Care of Nature it so falls out, that 'tis not in the power of any, by misguided Reason, to act injuriously to themselves: So by vertue of several Branches reciprocally communicated from the Intercostal Pair in its passage down to the *Viscera*, to the Spinal Nerves, there is no power given to them of moving the Muscles to which they are subservient uninterruptedly, after the meer manner of the *Viscera*.

But

But now, to return to where we left off, in some Creatures it's very plain, that Nature hath extended this imperial residence of the Soul beyond the *Cerebellum*, even as far as the *Spinalis Medulla*, having not only put this last motion, but that of Pulsation too, under the jurisdiction of that elongation of the Brain; as appears in the famous Experiment of the Industrious *Caldeſi* upon the Tortoise, which after the Head was cut off lived, and carried its Shell about, the space of six Months.

Besides which, 'tis remarkable, (by way of digression) according to another Experiment by the aforesaid Author made upon that Creature, that after even the Heart and all the *Viscera* besides, were taken out, except the Lungs, that Creature (to use his own Expression) was found so to resist Death, as to turn it self from the inverted or supine position it had been placed in, in order to make the Experiment, to its prone or natural one, and to live and move six hours after. From
whence

whence it appears, that *Muscular Motion* is capable of being performed by the Animal Fluid alone, without the concurrence of the Blood, by most Authors constantly hitherto made to go a share therewith in the performance of that action.

Caldeſi.
p. 75, 76.

So that we find Nature hath not stinted it self to one place for the Seat of the Sensative Soul, or Reservatories of the Animal Spirits so called, in order to the discharge of the afore-mention'd Functions, no more than it is at a loss about the maintaining them in their Integrity by other ways, when it hath so fallen out that the natural structure of the Organs, destin'd by Nature to that end, have utterly been destroy'd, of which we have many Instances in the *Anatomical History*, those Functions in several Creatures remaining perfect, where after death there have been found neither any *Cerebrum* or *Cerebellum* at all, or at least such as by their constitution was utterly render'd useless to any such end.

N

Of

Of the first is an Instance of the Learned *Wepfer*, in a Child living sixteen hours after it was born, and discharging all the Duties of Nature that one of its age was capable of, and by the by (which all the patrons of a nutritious Juice by the Nerves may do well to take notice of) of a very strong and good habit of Body, whose Brain, after death, was found to be only an heap of Watery Bladders or *Hydatides*, except a small part at the bottom of the Skull, lying in a *Sinus* made in the Wedglike Bone, where the Pituitary Gland is commonly found consisting only of three Medullary Bodies, two of which being each of the bigness of a Kidney Bean, and the third behind them of a Pea only, from which indeed there did proceed some, but very inconsiderable Nerves, or Nervous Fibrils, but such as none can judge of a due proportion requisite to satisfy the Exigencies of the common natural, and vital Functions.

Misc. Curios.
An. 3. p. 120

The

The truth of which is still more plain, and without exception, in another Instance in the *Miscell. Med. Physic. Gallic.* of a Child living five days after it was born, whose Head had nothing but Water contained within the inclosures of the *Dura* and *Pia Mater*, without the least footsteps of any medullary part at all.

*Misc. Med.
Phys. Gall.
An. 3. p. 54.*

Parallel to which two last Instances, I had one communicated to me by that curious Anatomist and learned Person Dr. *Zyfon*, in a Child born alive, with no more Brain in the Skull than what might lye in a Filbird-shell, the *Medulla Spinalis* being much larger than ordinary, as though part of the absent Brain had been squeez'd down thither.

Of the last (*viz.* where the natural conformation hath been depraved) there is extant an Instance in two several places of the *Miscell. Curios.* in a fat Ox, in which while living there were observed but very little signs of any such thing, whose Brain was nevertheless after death found wholly petrified.

*Misc. Cur.
Obl. 26.
& 130.
An. 1.*

From all these 'tis manifest the Sensative Faculty is able to answer its internal or external Impressions, by one part as well as another, and that the Medullary System of the *Spinalis Medulla* may become as adequate a Sensory, in relation to the aforesaid Functions sometimes, as either *Cerebrum* or *Cerebellum*.

And as to the power or influence the Soul in general exercises over the Nerves, howsoever different in their original, seeing we have already observed what a provident care Nature hath taken for the preserving Creatures from their own violence, in that it hath not only constituted the chief Fountain from whence the great current of Spirits is derived, for the service of the vital and natural parts, by the Eighth and Intercostal Nerves, which is the *Cerebellum*, so as to be free from the commands of the Rational Will in its ordinary way of acting, but hath also taken care that not any of those Branches which have their originals from Trunks, which are under the power of voluntary dictates of the Soul, should

should terminate in such Organs by which those Functions are discharg'd, (abare communication between Nerves of different Provinces not being sufficient to such ends or offices, as hath been observed in those afore-mention'd additional subsidiary smaller Streams of Spirits flowing to the parts consecrate to the natural and vital Functions by Branches propagated from the Spinal Marrow, to the Inter-costal Nerve, all the way of its descent to the lower *Venter*.)

So we may further also remark, that as there are some manner of Impressions made upon the perceptive Faculty, after such sort of a manner as that it even loses its power over its own Subjects, (*viz.*) the Nerves, which are subservient to its voluntary commands, as in *Laughing, Sneezing, and libidinous Erections*, the Organs by which these Actions are produc'd, being altogether under the power of those Nerves subservient to the voluntary dictates of the Soul, and acted after the very same manner as those of Respiration, as often as proportionable objects present, and (notwithstanding the assertion of Dr. *Wil-*

Is to the contrary, who makes Laughing proper to Man only, and, by the authority of *Aristotle*, Sneezing an Affection proper but to few, if any other Creature, besides Man) might also produce the same effects in Brutes, provided their stupid Souls were capable of being equally impressed by such Objects as are proper for exciting a rational Laughter, as we see they are by those producing the aforementioned *venereous actions*, seeing the want of the *Plexus Cervicalis*, of the Intercoastal Nerves, and two or three small Branches propagated from thence to the Nerve of the Diaphragm (which he calls a Disposition peculiar to Man, and consequently in his opinion the cause of that Affection in him) might be in a great measure supplied not only by that nervous Branch we find propagated from the inferior *Plexus* of the *Par Vagum* (which Nerve is equally dependent on the *Cerebellum*, as the Intercoastal) to the third Brachial Nerve, from which the Nerve of the Diaphragm hath one of its originals, but also by that other propagated from the *Thoracick Plexus* of the Intercoastal

Will p 106

costal Nerve it self, to the same
aforesaid Brachial Nerve, into which
the Nerve of the Diaphragm is inserted.

So, on the contrary, there are
some Impressions made upon the
Soul sometimes, through which
it acquires a power over those Nerves
at other times in no wise subject to
it, and those are the impressions either
of great Joy or great Grief, suitable
to which the Vital and Natural Fa-
culties are made either much more
or else so much less vigorous than
ordinary, as even quite to languish.

How this comes to pass, accord-
ing to Dr. *Willis* in favour of his
own Hypothesis, and particularly in
relation to the first, (which allows of
no Involuntary Motions, but what
come from the Province of the
Cerebellum) is explained by suppo-
sing an undulating or rowling mo-
tion of the first impression upon
the Brain out of it again, through
the Natisform Processes into the *Ce-
rebellum*, and from thence by the
Annular Process into the Intercostal
Pair of Nerves, and so to the Nerve
of the Diaphragm, (and he should,
to make this way of explication

entire, have taken in also all those Vertebral Branches inserted into the Intercostal Nerve, in order to the moving of the Intercostal Muscles, without which that action cannot be performed) by a correspondence between which Nerves and those of the Face, being all of one family, the aforesaid Gesture of Laughing is performed.

Now, besides the needless of bringing the Conceptions or Impressions of the Brain under a necessity of being executed by the inferior Province of the *Cerebellum*, till such time as 'tis proved, that such motions of the Spirits, upon extraordinary occasions, may rationally be granted, without supposing a regular motion of the same through such supposed Passages leading from one Part to the other at all other times, (the allowing whereof does necessarily imply a capacity of the Soul to alter the course of the Spirits influencing the vital and natural Organs, at least in some measure, at its pleasure, which is plainly contrary to Experience;) I shall hardly look upon that Hypothesis

pothesis to be any more than meerly precarious.

And further, to shew, that such Effects or Alterations of the Vital Organs happening upon violent Passions of the Mind, are no way owing to such a transmission of the Animal Fluid from the *Cerebrum* to the *Cerebellum*, as the aforesaid Author supposeth, I ask, how it should come to pass that in the contrary Passion of Grief, especially when occasion'd by surprizing frightful Accidents, the Heart should so languish, as sometimes wholly to cease beating, seeing in the aforesaid Experiment we find that Motion self-sufficient, by vertue of a constant irradiation or influence of the *Cerebellum* only, and consequently could not be thought so to languish upon such occasions for want of those Spirits it never stood in need of.

Without therefore being forc'd to have recourse to that other Hypothesis clogg'd with so many difficulties, I think the aforesaid case may admit of another manner of explication, consistent with what I have all-along advanc'd upon this Subject
rela-

relating to the true source of voluntary and involuntary Actions: if we suppose, that from such Impressions upon the Soul as are either extremely more or less welcome to it, (in which case the Object is said to act unproportionably upon the Subject) it may not only act accordingly, above its usual irradiation and force over the *Cerebellum*, and by that means, as sending the Spirits either more or less copiously to the Vital Organs, particularly the Heart, the nearest way, (*viz.*) by the *Par Vagum* and Intercostal Pair, for that time render them more vigorous, or more languid in their operations, in proportion to the difference of the Passions, just after the manner it happens in cases of Alienation of Mind or Distraction, where by the Strength of the Impression, or *Idea* upon the Mind, it drives the Spirits with such an *impetus* into the Limbs, as makes them act with a vast greater force than what they were wont to do, even above the resistance of Chains or Bars of Iron; but also it may transmit the Spirits more or less copiously

piously, to the Vital and Natural Faculties, the other way freed from the subsidiary Nerves of the *Spina* aforementioned, to the Intercostal Pair, which sends forth ramifications to the Heart (in Men especially) equally with, if not more plentifully than the *Par Vagum*, and from the Vertebral and Brachial to the Nerve of the Diaphragm and Intercostal Muscles, by which means it so falls out, upon such impressions, that the Organs of Respiration to the *sight*, and that of Pulsation to the *touch*, are very remarkably affected.

By this means I have endeavour'd to restore the Brain to a capacity of putting its own Conceptions or Impressions made upon it into execution, without being beholden to its neighbour the *Cerebellum*, and that either in relation to its voluntary, inadvertent, or involuntary Acts; where, note, I make a distinction between Acts involuntary and those of inadvertency, inasmuch as these last, though they are not with, yet they are not contrary to the actual consent of the Will, after the manner of the natural actions of the *Viscera*,
such

such as are out of the power of the Will to hinder ; besides which, I look upon no other in Rational Creatures (in a strict sence consider'd) to be involuntary, forasmuch as 'tis a contradiction to say a Voluntary Agent does any thing against his Rational Will (though it may be against his Approbation) by which he is only distinguish'd from a Brute : Though Dr. *Willis* hath all-along used the word *involuntario* in another sence, confounding it with acts of meer Ignorance under the term of *Insciè*, and those also done only inadvertently, or without consideration, under the term of *Inconsulto* ; and doubtless upon this notion of Involuntary Motions built his Hypothesis, which makes all those Actions which are perform'd at any time without the notice of the Intellectual Faculty, notwithstanding at other times they are altogether under its command, equally depending on the *Cerebellum* as those purely natural, which are always free from the power of the first, and also absolutely subject to the last.

These

These Actions I have therefore called by the term of *Supervient Instinct*, and being the meer Effect of external or internal Impressions upon Sensative Bodies, as Ecchoes are to those upon such as are only natural, are equally competent to Rational and Irrational Creatures, and capable of being exerted by the influence of the very same Nerves which minister to the Sensative Faculty, whether it act advertently or inadvertently in the one, or *spontaneously* in the other, (where, by the way, it may not be altogether unworthy of our taking notice, the genuine sense of that word in Actions performed by those Creatures, is much nearer a-kin to the term *Inconsulto* than *Involuntario* in Men) without the supposed rambling Motions of Impressions made upon it, (through Passages only at some times or upon extraordinary occasions made use of) out of the *Cerebrum* into the *Cerebellum*.

Now, as to the organisation of this Part, made to consist of various Medullary Prominencies, Appendixes, and Tracts, by Nature contrived for and adjusted to the various functions of

of the Soul, and dispensation of the Animal Spirits thro' the whole System of the Nerves, which first are confin'd to, or made to reside in such and such places as so many distinct apartments, viz. the *Commune Sensorium* in one place, the Imagination and Judgment in another, and the Memory in a third; of which there is such a large and formal *apparatus* and description (tho' with great discrepancy of opinion) in *Willis* and *Vieussenius*, the one placing the *Commune Sensorium* in his *Corpora Striata* only, the other in the *superiour* and *middle Corpora Striata*, jointly with the *Centrum Ovale*; from both whom *Des Cartes* and several others, and with much more shew of Reason, particularly *Malpighius*, differ, placing it in the extreme limits of the medullary part of the Brain, where 'tis continuous with the cineritious circumaffused Part; I must confess, that as I have not been able, by the best enquiry I could make either into Brains dissected whilst fresh, or when boiled in Oyl, to discover any such actual configuration or disposition of Parts, as we find so formally delineated by either

Malpigh. de
Cereb. p. 11.
par. 2.

ther of them, but especially the last.

So neither do I see any necessity thereof, seeing we may much more easily, and to the self-same ends and advantages, look upon the Soul as one internal principal Sensative Faculty. and the whole medullary part of the Brain, as consisting of such Fibrils or *Vascula's* as in some places more nearly in others more remotely communicate with the Nerves propagated thence to all the external Sensories, one adequate *Common Sensory*, by which that principal Faculty both receives all its impressions, and accordingly, as by so many gradations of one and the same power, executes or performs those different Functions commonly going under the aforesaid Names of *The Common Sense*, or *Simple Apprehension*, *Imagination*, *Judgment*, and *Memory*.

And as to the second, (*viz.*) the Medullary Tracts, by which the Animal Fluid, as by so many Rivulets, is derived from the great Pond or Magazine into many Rivers, furnishing the whole Body therewith, all I could find by the most diligent search,

search, were only those which have already in the preceding Sheets been remark'd, of which, in the first place, are those in the *Corpora Striata*, very large and discernable.

Those in the inward or concave Superficies of the *Corpus Callosum* running transversely by the *Septum Lucidum* into the *Fornix*, and from that longitudinally into its hinder Thighs or Pillars formerly called *Bombyces*, over which they run in a wreathed manner, as was before observed, terminating in the back part of the Lateral Ventricles, enclosed in the hinder Limbs of the Brain, which Ventricles at length terminate in, and are continuous to the subjacent fore-part of the *Crura Medulla Oblongata*.

Those in the *Thalami Nervorum Opticorum* running obliquely down to part of the subjacent *Crura* and *Caudex Medullaris*.

Those of the *Nates* and *Testes* running after the same manner, and terminating so too, only something lower.

Those

Those in the Annular Process, which forasmuch as they have never before been taken notice of, I have caused to be engraved in a Figure by themselves, whose Medullary Tracts or *Striae*, furnished with Spirits both from the continuous medullary *Caudex*, and Productions of the *Cerebellum* too, of which the Annular Process is made, (by means whereof the Nerves appertaining thereto may be rationally supposed to be under the influence of both those Parts, conformable to what hath all-along been asserted;) are as visible, being more thick, and of a far harder consistence, than that of the *Corpora Striata* themselves, (tho' upon every attempt of cutting that Process, they may not appear so) and most of them terminating in a middle Medullary Tract, by means whereof there is the same inconvenience prevented, at least in some measure, as there is by that *sepimentum* of the *Pia Mater*, continued from the joyning together of the *Crura Medulla Oblongata*, down quite thro' the *Medulla Spinalis*. (*viz.*) that at the same time the Nerves on one side

O may

may, (as *Molinetti*, tho' in another place of the Brain, hath truly observed) by any morbid cause, be injured, those on the other may escape. Mol. p. 104

Concerning these, seeing they seem to have a particular aspect or relation to those Nerves, whose originals we find nearest them, it may not be unreasonable to think they are particular Conduits, from whence the said Nerves are furnished with Animal Fluid, though at the same time we must allow a very free communication betwixt them all.

And consequently, we may suppose the first of those to convey Spirits from the globous medullary part of the Brain next to it, by *Vicussenius* called the Superior Part of the *Centrum Ovale*, down to the subjacent medullary part of the Brain, to augment those which are produced lower, and particularly for the service of the *Olfactory* and *Visory Nerves*, which last hath more eminently its Supply from the *Thalami Nervorum Opticorum*.

The

The second sort, or the transverse *Striæ's* of the *Corpus Callosum*, to convey an additional Supplement by way of the wreathed Tracts in the hinder Columns of the *Fornix*, to the *Crura Medulla Oblongata*, where they become continuous to the reflex'd part of the Lateral Ventricles backwardly, for the service also of the aforesaid two Pair of Nerves, but more particularly to those arising lower either on the Annular Process or *Caudex Medullaris*.

Those of the *Thalami Nervorum Opticorum* and Natisform Processes, the first of which lies upon, and is continuous to the subjacent medullary part of the *Crura Medulla Oblongata*, the other to the *Caudex Medullaris*, may be supposed to derive Spirits on the behalf of those Nerves which spring from any adjacent parts, whether on this or the other side of the Annular Process or *Caudex Medullaris*.

And of this sort are the *Optick Nerves*, which are supplied immediately from the first of those Medullary Prominencies, and not unlikely from those fair Medullary Tracts afore-mentioned, running from the Root of the *Fornix*, extending themselves all the way between the *Corpora Striata* and *Thalami Nervorum Opticorum*, in which last at length they are obliterate. The Third, Fifth, Sixth, and First or hard Branch of the Auditory Nerves, mediate by continuity of them with the Annular Protuberance, to all which the other or lesser Medullary Prominencies called *Nates*, by vertue of their continuity with the subjacent parts, may be supposed to contribute something also; and these seems to be better provided for than the rest of the Nerves, inasmuch as besides this way of being supplied from the *Cerebrum*, they have also another very visible, and much larger, from the Second Process of the *Cerebellum*, of which the Annular Protuberance

tubérance is made, and this seemingly not without a provident Design of Nature, seeing the Nerves which are derived thence are much larger, and have a greater Task of service layed upon them than any others of the whole Brain, as hath also the *Par Vagum*, or eighth Pair, which therefore, by vertue of its insertion between the Chordal or third Process of the *Cerebellum* and *Corpus Olivare* (and not according to Dr. Willis, from the points or extremities of the *Corpora Pyramidalia*) hath a double tribute of Spirits, one from the *Caudex Medullaris* or *Cerebrum*, the other from the *Cerebellum*.

And to this End or great Service it looks as though this Process was furnished with such a Texture as it appears to have, of strong, large, medullary *Striæ's*, capable of receiving and containing a Supply from both Fountains.

Whence

Whence it may not be unseasonable to remark, That not without shew of good Reason I have all along asserted the Propriety of the Brain to those Nerves in part, allowed by Dr. Willis to be no further affected by any Impressions of the Brain, than as first conveyed from it into the Province of the *Cerebellum*, and consequently to depend immediately on this last for influence entirely in order to convey Animal Spirits to those parts wherein they are inserted.

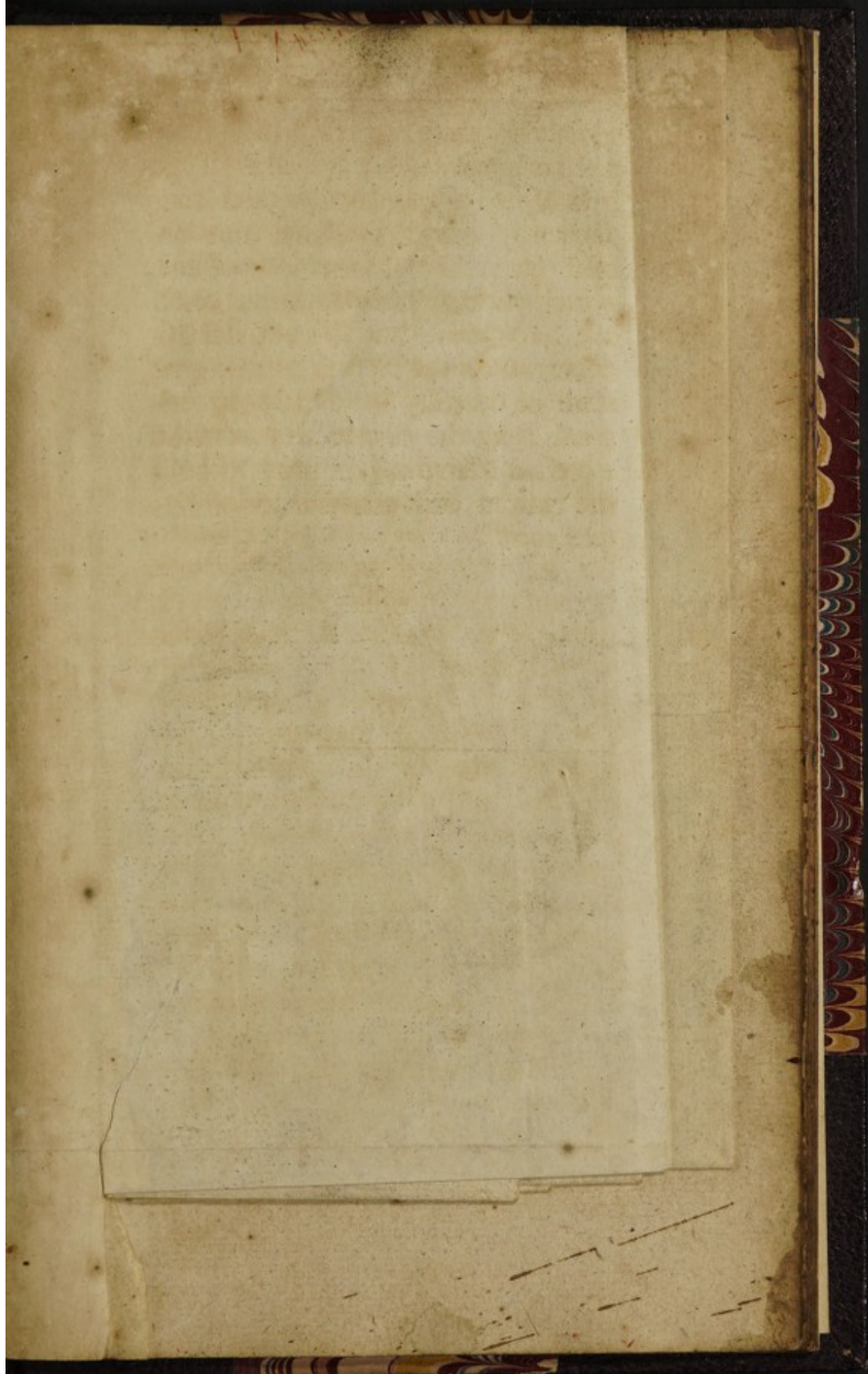
Upon the *Caudex Medullaris*, on its under side contiguous to the hinder Extremities of the Annular Process, are situate the *Corpora Pyramidalia* and *Olivaria*, over-against which are the two long Medullary Tracts lately taken notice of, seeming to come from the transverse Medullary Process behind the *Testes*, and terminating in those other transverse Medullary Processes before the entrance into the Fourth Ventricle on the other side,

side, by which there may be conveyed a considerable Portion of the Animal Fluid to the Pathetick Nerve, which hath its rise from the first transverse Process, and to the soft or second Branch of the Auditory Nerve, which hath its rise from the second on that side, and also to the Ninth and Tenth Pair on the other side.

And to conclude, From all these taken together, with the rest of the whole medullary part of the Brain, the *Overplus* of what is not spent upon the inmate Nerves of the Brain may truly be supposed to be promiscuously dispensed to all those other extraneous ones produced from the elongation of the Brain, call'd the *Spinal Marrow*. In which last there is this conformation or disposition of Parts differing from that of the Brain, that whereas in that the cineritious part is external, 'tis here internal; and this for very good reason, and by a provident contrivance of Nature, seeing that not only the cineritious part of the Brain serves for

supplying those Nerves which have their original thence, as well as all the rest of the *Spinal Marrow*; and consequently ought to have the largest space and dimensions possible, which without this situation could not have been; but also without this contrivance the Nerves of this part must of necessity have had their originals from the cineritious part of the afore said Marrow, contrary to both the custom and convenience of Nature too.

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Fig: VII.

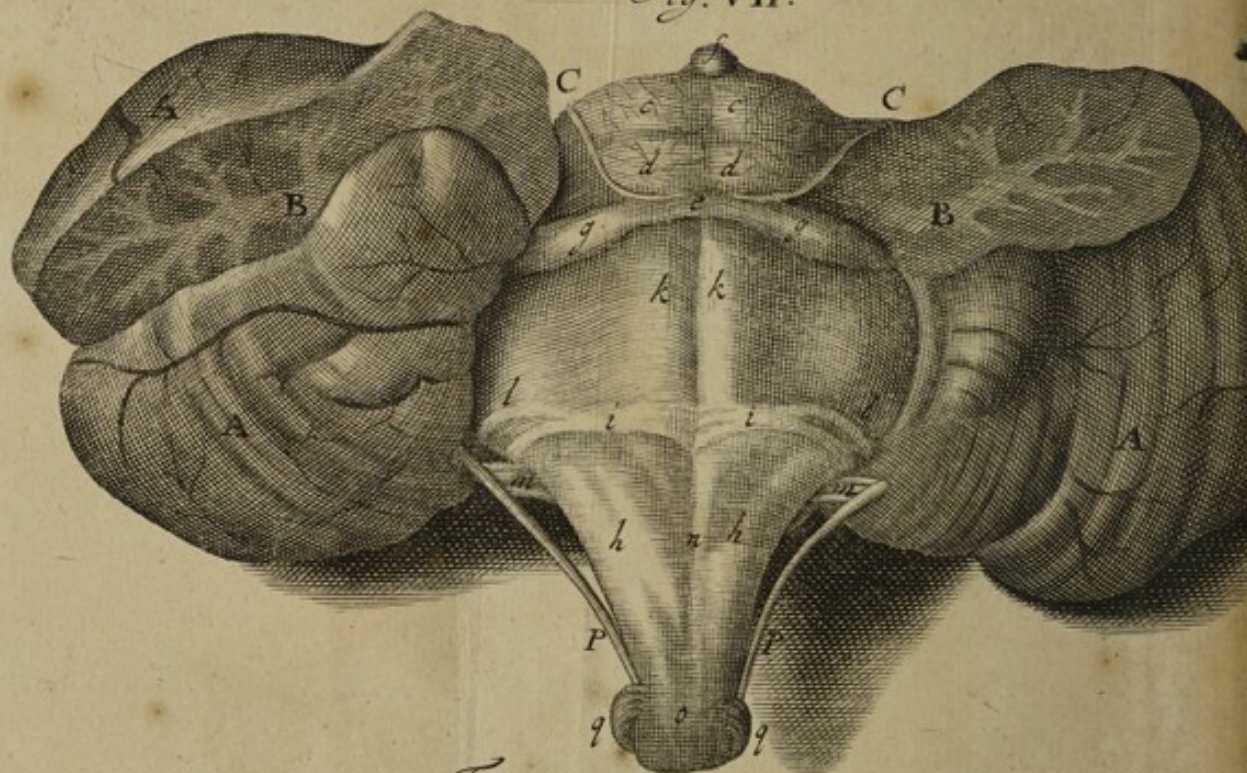
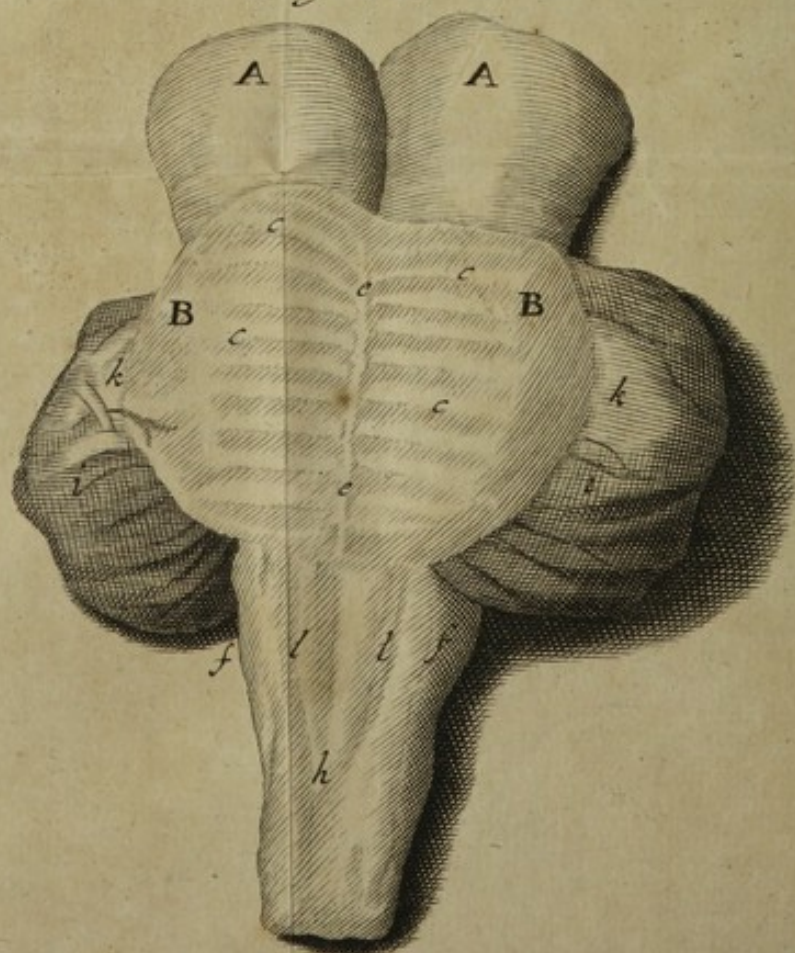


Fig: VI.



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Fig. 5.



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Fig: IV.



M. Vander Gucht Sculp:

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Fig: II.

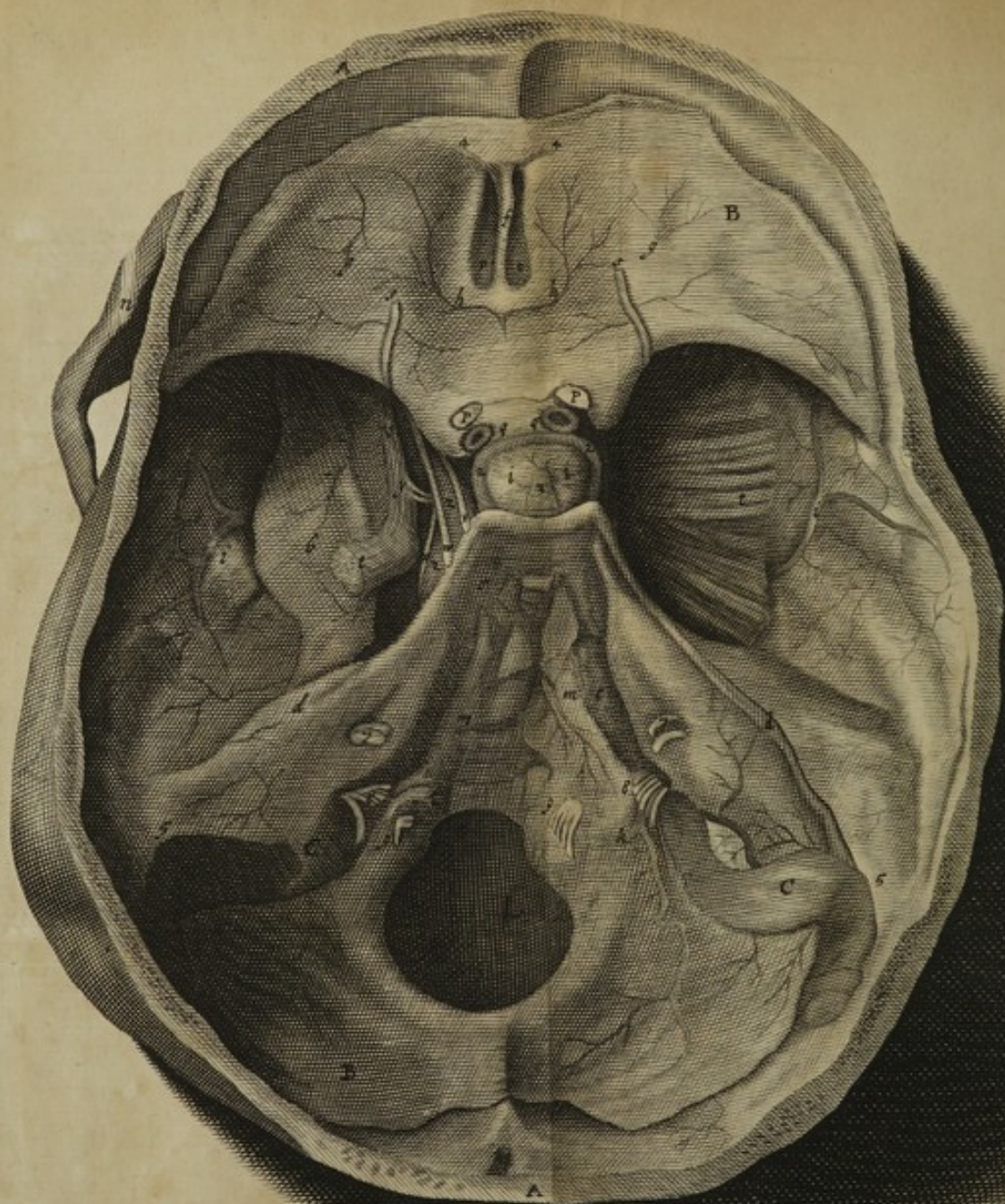


Fig: III.



M. Vander Gucht. Sculp.

The Explanation of the Figure.

F I G. I.

*Exhibits the Basis of the Brain, with part of the Medulla Ob-
longata, the Blood-vessels being injected with Wax.*

- A A The fore Lobes of the Brain.
- B B The hinder Lobes.
- C C The Cerebellum.
- D D The lateral Sinus's.
- E E The Vertebral Arteries as they pass between the first
Vertebra and the Bone of the Occiput.
- F The Vertebral Sinus.
- G, &c The Dura Mater on the right side taken off from
the Spinal Marrow, and remaining on the left.
- 1, 2, 3 The ten pair of Nerves belonging to the Brain,
4, &c. with seven of the Spinal Marrow.
- a The Foramen that opens into the Pituitary Gland
from the Infundibulum.
- b b The two white Protuberances behind the Infundi-
bulum.
- c c The two Trunks of the Carotid Artery cut off where
they begin to run betwixt the fore and hinder
Lobes of the Brain.
- d d The two Arteries joyning the Carotids with the Cer-
vical Artery, called the Communicant Branches.
- e e Two large Branches of the Cervical Artery, some-
times seeming as tho' they came from the Com-
municant Branch on each side, from the first of
which the *Plexus Chorooides* hath its original in
chief, and from the last the *Plexus Chorooides* of
the 4th Ventricle.
- f Several little Branches arising from the Carotid
Artery.
- g The Cervical Artery composed of the two Trunks
of the Vertebral Artery within the Cranium.

The Explanation of the Figure.

- h h The two Trunks of the Vertebral Artery.
i i i The Spinal Artery.
k A small Branch of an Artery running through the
9th pair, broken off from its other part thro' inad-
vertency of the Graver.
l l The *Crura* of the *Medulla Oblongata*.
m m The Annular Protuberance, or *Pons Varolii*.
n That part of the *Caudex Medullaris* on the right side
called by *Willis* and *Vieussenius* *Corpora Pyra-*
midalia.
o That part on the same side called *Corpus Olivare*.
p The foremost Branch of the Carotid Artery, divi-
ding the fore Lobes of the Brain, consisting of
two Branches, one of them only appearing here.
q q Little Branches of Arteries helping to make the
Plexus chorooides in the 4th Ventricle.
r r r Branches of Arteries dispersed from the Cervical
Artery upon and thro' the Annular Protuberance.
s s Part of the 2d Process, or *Podunculi*, of the *Cerebellum*.
* * The Spinal Accessory Nerve.

The Explanation of the Figure.

F I G. II.

*Shewing the internal Basis of the Cranium, the Sinus's
being injected with Wax.*

- AA The Edges of the Skull.
- BB The *Dura Mater* upon the bottom of the Skull.
- CC The lateral Sinus's
- dd The superiour, longer and narrower Sinus's.
- ee The inferiour, shorter and wider Sinus's.
- f The Proceſs of the Bone *Cribriforme*, called *Criſta Galli*.
- gg Some ſmall deſcending Branches of Veins upon the bottom of the *Dura Mater*.
- hh The firſt Branch of Arteries proper to the *D. Mater*.
- ii The ſecond Branch of Arteries belonging to the *Dura Mater*.
- k The third Branch belonging to the *Dura Mater*.
- L The laſt hole of the Skull.
- mm Several Veins communicating with the inferiour ſhort Sinus's.
- n Part of the *Os Fugale*.
- oo The *Os Ethmoid*, where the firſt pair of Nerves or mammillary Proceſſes go forth.
- pp The Optick Nerves cut off.
- qq The Carotid Arteries cut off.
- r The third pair of Nerves viſible only on one ſide.
- SS The fourth pair of Nerves turned up.
- tt The fifth pair of Nerves on one ſide expanded before it is divided into its three Branches, on the other ſide whole; which Nerves, with its three Branches, are expreſſed in the third Figure.
- V Its foremoſt ſuperiour Branch on the left ſide, going out at the ſecond hole of the Skull.
- w The ſixth pair of Nerves.

The Explanation of the Figure.

- X The Intercoſtal Nerve, in this ſubject proceeding from two Branches of the fifth Nerve, joyning with the body of the fixth Nerve.
- y Two Branches of the fifth pair of Nerves, in this ſubject running almoſt cloſe to the 6th pair, being partly the Roots of the Intercoſtal Nerve, which creeps out of the Skull under and between the Coats of the Carotid Artery.
- z z The Body of the Carotid Artery, after it has entred the Cranium.
- 1 1 The *Glandula Pituitaria*.
- 2 2 The Circular Sinus.
- 3 The *Infundibulum*.
- 4 4 The Frontal Arteries.
- 5 The place where the Lateral Sinus's begin to be declive and tortuous.
- 6 The *Dura Mater* raiſed and reclined to ſhew the ſubjacent Nerves.
- 7 7 The ſeventh or Auditory Nerves.
- 8 8 The eighth pair, or *Par Vagum*.
- 9 9 The ninth pair.

F I G. III.

Being the Fifth Nerve, with its Branches, whilſt within the Cranium.

- A Its Trunk.
- B Its Ganglion,
- C Its firſt or ſuperiour Branch, going out at the ſecond hole of the Cranium.
- D Its ſecond or midle Branch, going out at the ſecond hole.
- E Its third or hindermoſt Branch, going out at the fifth hole.

The Explanation of the Figure.

F I G. IV.

*Shews the superiour and lateral Sinus's of the Dura Mater,
opened after they had been injected with Wax.*

- A A The third or longitudinal Sinus.
- B B The first and second, or lateral Sinus's.
- C The fourth Sinus.
- d d d A Vein running on each side of the third Sinus.
- eeee Mouths of Veins opening into the longitudinal Sinus of the *Dura Mater*, after a contrary manner one to the other.
- f f The fifth Sinus at the bottom of the *Falx*.
- g The Torcular, where all the superiour and lateral Sinus's meet.
- h h The tortuous part of the lateral Sinus running under the *Cerebellum*.
- i i The Veins entering the fourth Sinus from the *Plexus Choroeides*.
- k The place where the fourth Sinus arises.
- * * The Specus or round hole at which the lateral Sinus's on each side go out into the internal Jugular Vein.
- l l Two large Veins, whereof one enters the fourth Sinus upon the second Process of the *Dura Mater*, so as to resist the course of the Blood in that Sinus, in its ascent to the Torcular; the other upon the same Process, so as to hinder its descent to the *Internal Jugular*, contrary to a conformation of Vessels which *Vieussenius* mentions in his third Table, H H.
- mmm Transverse Chordal Ligaments in the longitudinal and lateral Sinus's.
- n n Part of the *Dura Mater* on each side of the longitudinal Sinus.
- o o Portions of the *Pia Mater*.
- PP&C Divers small Veins on the *Dura Mater*, which enter those that run on the sides of the longitudinal Sinus, according to its length.

qq, &c.

The Explanation of the Figure.

- qq&c The Veins of the *Cerebrum* as they appear under the *Pia Mater*, before they enter the longitudinal *Sinus*.
 R R The falcated Process, with its Veins which enter the fifth *Sinus*.
 S S The second Process of the *Dura Mater*.
 † † The beginnings of the Jugular Veins.

F I G. V.

Representing the Brain in a middle section, the Blood-vessels being first injected with Wax.

- A A The *Fornix* cut off at its Roots and turned back.
 b b Its Roots at the beginning of the *Thalami Nervorum Opticorum*.
 cc&c. The *Thalami Nervorum Opticorum*.
 d d That part of the *Crura Fornicis* which growing somewhat thicker as it turns off towards the Lateral Ventricles, runs over the *Crura Medulla Oblongata*, which being very prominent in Sheep, and Calves, helps to thrust it up into such a Protuberance as the Ancients called *Bombyces* or *Hippocampi*.
 e e That part of the *Plexus Chorooides* which is made of the first Branch of the Cervical Artery, sometimes seeming as tho it came from the Communicant Branch, in the Lateral Ventricles.
 f The place where those two *Plexus's* on each side meet under the *Fornix*.
 g g That other part of the *Plexus* which is made of the second Branch of the Cervical Artery joyned with the first by a Communicant Branch not to be seen here, lying under the *Crura Fornicis*, which is expanded all over the *Isthmus*, becoming glandulous near to, and especially under the *Glandula Pinealis* covered here with the *Fornix*.
 h h Two

The Explanation of the Figure.

- h h Two large Veins coming from the top of the upper part of the *Plexus* down to the other Branch of the *Plexus*, all the length of the third Ventricle, and then terminates in the fourth Sinus.
- i i The Trunks of several Arteries, appearing as they were cut off in dividing the Medullary† and Cineritious * part of the Brain.
- k k A Venous Branch on each side entring the *Plexus Choroeides*, from whence there are many slips branched upon the *Corpora Striata*.
- △ △ The *Corpora Striata* whole.
- l The *Rima* of the third Ventricle.
- m m A long Medullary Tract between the *Thalami Nervorum Opticorum* and *Corpora Striata*.
- nn, &c. The *Centrum Ovale* of *Vieussenius*.
- O The fourth Sinus of the *Dur. Mater*.
- P The *Torcular*, where the four, and sometimes five, Sinus's meet.
- Q Q The Lateral Sinus's.
- R A large Vein entering the Lat. Sinus's on one side.
- SS, &c. The *Cerebellum* covered with the second Process of the *Dura Mater* on its uppermost part,
- T T The Vertebral Arteries.
- V V The Vertebral Sinus's.
- W The *Medulla Spinalis*, with its integuments.
- x x The Style supporting the large Veins of the *Plexus Choroeides* in the third Ventricle.
- q q The *Lymphæducts* of the *Plexus Choroeides*.
- Y Y Two of the Cervical Nerves springing from the *Medulla Oblongata*.
- †, &c. The Medullary part of the Brain.
- *, &c. The Cineritious part.

FIG.

The Explanation of the Figure.

F I G. VI.

Being a draught of the Annular Protuberance, Med. Spinalis, &c. cut through the middle lengthway.

- A A The *Crura Medulla Oblongata*.
- B B The Annular Process, or *Pons Varolii* divided.
- c c The Transverse *Striae*.
- cc The intervening Medullary Tract in which the *Striae* terminates on each side.
- f f The third or chordal Process of *Dr. Willis*.
- h The Spinal Marrow.
- i i Some part of the *Cerebellum*.
- k k The second Processes of the *Cerebellum*, which compose the Annular Protuberance.
- l l The cineritious part of the *Medulla Oblongata*.

F I G. VII.

Being the Cerebellum cut through on its hinder part, and reclined laterally.

- A A The *Cerebellum*.
- B B The arboreous ramification of the *Meditallium* of the *Cerebellum* appearing, being cut right downwards.
- CC The Pathetick Nerves.
- c c The *Nates*.
- d d The *Testes*.
- e The transverse Process whence [the Pathetick Pair have their original.
- f The *Glandula Pinealis*.
- g g The first Process of the *Cerebellum*, running from it to the *Nates* here extended laterally.
- h h The third or Chordal Processes.
- i i The transverse medullary Process in the 4th Vent. from whence the soft Branch of the 7th N. has its original.
- k k The Medullary Process descending from the Transverse Process behind the *Testes*, down to the aforementioned other Medullary Transverse Process.
- l l The Originals of that Process a little too low.
- m m The eighth pair of Nerves.
- n The *Calamus Script.* or Extremity of the 4th Ventricle
- o The Spinal Marrow.
- P P The Accessory Nerves.
- q q The tenth pair of Nerves,

THE TABLE.

A

A rtery Carotid, and the manner of its entrance into and distribution through the Brain.	Page 32, 33.
Where it parts with its borrowed Coat.	P. 33
Artery Vertebral, and its manner of entrance and distribution.	P. 35
Artery Cervical	ibid.
Why not Conical	P. 38
The Communicant Branches of Arteries.	P. 36
Their Use and Benefit	ibid. & 37
A small Branch of Arteries not before observed	P. 38
Why the Arteries of the Brain enter not the Cranium with the Veins	P. 27
Artery Spinal, how the Blood is forced into it,	P. 37
Animal Spirits, how more plentifully produced,	P. 54
Anatomy Comparative, its use	P. 54
Arteries, why their Ramifications are over-proportionable to the Trunks in the Brain,	P. 55
Q	The

The TABLE.

*The Use of the narrowness of the Communicant
branches,* p. 56

*How the Carotid Artery in Brutes comes to be
smaller above the Dura Mater than under it,*

Animal Fluid, what, p. 91, 108, & 155

How it passes out of the Carnous Fibres, p. 109

*Its effect in glandulous and other parts not ser-
viceable to Muscular Motion,* *ibid.*

Its production, p. 151

Anus, p. 124

Aquæ emissarium of Vieussenius, p. 132

B

Brain, its Vessels in general, p. 20

Their kinds, *ibid.*

*Blood-vessels, their different distribution in re-
lation to the Brain it self, and its Integu-
ments,* *ibid.* & 26

The reason of this different distribution, p. 27

Blood-vessels belonging to the Brain it self only,
p. 32

*What proportion the Blood-vessels of the Brain
bear to the rest of those of the whole Body,*

p. 32, & 38

The remarkable propagations of its Arteries,

p. 35

Blood-vessels belonging to the Nerves, p. 33, 34

Blood in the Sinus's hath two contrary torrents,

p. 53

The effects thereof, *ibid.*

Flow

The TABLE.

<i>How the circulation of the Blood comes to be retarded in the Brain,</i>	P. 53
<i>The Bony cell where the Sinus's go out into the internal Jugular,</i>	P. 53
<i>The effect of its structure,</i>	ibid. & 54
<i>The Brain, how distinguish'd,</i>	P. 87, 113
<i>Its two Substances,</i>	ibid.
<i>Their structure,</i>	p. 89, 90
<i>Why of a different colour,</i>	p. 90, & 92
<i>Blood, why red</i>	p. 91
<i>How the Brain is suspended,</i>	P. 7, 8.
<i>Its Lobes and particular description,</i>	p. 113, 114
<i>Its hinder Lobes stretched backwardly beyond the Cerebellum,</i>	ibid.
<i>Original of its medullary part,</i>	P. 115
<i>Bombyces, vide Hippocampi, Blood-vessels of the Nerves,</i>	P. 144
<i>Watery Bladders instead of Brain,</i>	p. 178, 179
<i>Brain petrified,</i>	p. 179
<i>Propriety of the Brain to Nerves often thought under the power of the Cerebellum,</i>	p. 198

C

<i>Consent of Parts.</i>	p. 19
<i>Carotid Artery, vid. Artery.</i>	
<i>The Circular Sinus,</i>	P. 43
<i>Communicant Branches between the Carotid and Cervical Arteries, their Use,</i>	p. 55, 56.
<i>The Cortical or cineritious part of the Brain,</i>	p. 88
<i>Its medullary part,</i>	ibid.
<i>Corpus Callosum,</i>	p. 115

Q 2

Its

The TABLE.

<i>Its Striæ,</i>	p. 116
<i>Centrum Ovale of Vieussenius,</i>	p. 117
<i>Crura Fornicis,</i>	p. 818
<i>Commissura Crassioris Nervi Æmula of Willis and Vieussenius,</i>	p. 126
<i>Corpus Callosum,</i>	p. 115
<i>Centrum Ovale,</i>	p. 117
<i>Crura Fornicis,</i>	p. 118
<i>Corpora Striata,</i>	p. 120
<i>The Cerebellum,</i>	p. 133
<i>Its difference from the Brain,</i>	p. 135
<i>Corpora duo alba pone Infundibulum,</i>	p. 140
<i>Corpora Pyramidalia,</i>	p. 141
<i>Olivaria,</i>	ibid.
<i>Power of the Cerebellum,</i>	p. 170, 173

D

<i>The Dura Mater,</i>	p. 1
<i>Its manner of adhesion to the Cranium,</i>	p. 2
<i>Is double,</i>	ibid.
<i>What sort of Fibres, and their distribution,</i>	p. 3
<i>Their Use,</i>	p. 4, 5, 6
<i>How affected in some Distempers, particularly in Vapours,</i>	p. 6
<i>Its Nerves,</i>	ibid.
<i>Its Processes,</i>	p. 7, 9
<i>Their Uses,</i>	p. 7, 8, 9
<i>Its Blood vessels apart from the Brain, their number and distribution,</i>	p. 20, 22
<i>Two sorts of Dropsies of the Brain observed by Tulpius and Wepler,</i>	p. 59
<i>Their Solution,</i>	ibid. & 60

E

The TABLE.

E

<i>Elasticity of the Blood,</i>	p. 53
<i>The Effects of that being weakened,</i>	ibid.
<i>Extravasation of the Nutritious Fluids, its effect,</i>	p. 97
<i>Elasticity not competent to the first principles of Bodies,</i>	p. 100
<i>The Occasion of it in other Bodies,</i>	ibid.
<i>Elasticity its æquilibrium in the whole compages of Muscles,</i>	p. 105
<i>The Effect thereof,</i>	ibid. & 106
<i>Experiments by Injection, of what use in Muscular Motion,</i>	p. 110

F

<i>The Falx and its particular uses,</i>	p. 7, 8, 9
<i>Is wanting in several Creatures, and why,</i>	p. 9
<i>Fibres of the Dura Mater do the office of Valves,</i>	p. 5
<i>Fleshy part of the Body, what,</i>	p. 94
<i>Fluids of the Body, their different motions,</i>	p. 96
<i>Fornix,</i>	p. 117
<i>Its Crura,</i>	p. 118
<i>The Fornix of Vieussenius,</i>	p. 115
<i>The Fornix commonly so called,</i>	p. 117
<i>Its Fimbria, according to Vieussenius,</i>	p. 118
<i>Its Crura,</i>	ibid.
<i>How natural and vital Functions relate to the Cerebellum, and with what difference,</i>	p. 170, 171

The TABLE.

- How they come to be not under the power of
the rational Soul,* p. 174
*How performed when the Brain is utterly inca-
pable of acting,* p. 177

G

- The Glandula Pituitaria enclosed in strong
Membranes* p. 46
No Serum can get through its Integument,
ibid. & 75
Glands of the Plexus Chorooides, p. 62, 63
*The Glandula Pituitaria not capable of carrying
an Excrementitious humour,* p. 69, 73
The Gland. Pit. its situation, p. 71
Is not suspended in Men as in Brutes, ibid. & 73
In substance it differs from all other Glands, ib.
Is of two sorts, and why, p. 81
In what manner the Lympha gets into it, ibid.
*The Glandula Pinealis, its situation and con-
nexion,* p. 83
Is of the Conglobate kind, p. 84
Errors of DesChartes, Lower and others about it,
p. 84, 85
*Geminum Centrum Semicirculare of Vieusse-
nius,* p. 122

H

- Headach, how happening in Feavers,* p. 29
From the closeness of the Pores in the Cranium,
p. 42
Two

The TABLE.

<i>Two sorts of Hydrocephalus,</i>	p. 59
<i>Hippocampi Arantii,</i>	p. 118
<i>Their Striae,</i>	ibid.

I

<i>Injection with Mercury makes Blood-vessels appear,</i>	p. 34
<i>The Infundibulum,</i>	p. 77
<i>The difference between it in Men and Brutes,</i>	ibid.
<i>Its two Ducts in Brutes,</i>	p. 78
<i>Its Office,</i>	p. 79, 80
<i>Infundibulum, the passage into it by three Foramina's,</i>	p. 124
<i>Isthmus,</i>	p. 125
<i>Instinct, what,</i>	p. 162, 163
<i>The differing effects of some Impressions upon the Soul,</i>	p. 181, 182, 183
<i>Transmission of Impressions, according to Doctor Willis, improbable,</i>	p. 184, 185
<i>Difference between involuntary and inadvertent acts,</i>	p. 187
<i>Internal Senses, their seats,</i>	p. 190

L

<i>Ligaments of the Sinus's,</i>	p. 51
<i>Their Uses</i>	p. 52, 56
<i>Lateral Sinus's,</i>	p. 40
<i>Longitudinal Sinus's,</i>	p. 41
<i>Lymphæducts of the Brain,</i>	p. 61, 62

Q 4

Lym-

The TABLE.

<i>Lympha, how generated within the Ventricles,</i>	p. 81, 82
<i>To what end,</i>	ibid.
<i>Laughter, how made,</i>	p. 181
<i>Why peculiar to Man,</i>	p. 182
<i>Libidinous Actions, how caused,</i>	p. 181, 182

M

<i>Membranes of the Brain,</i>	vid. Dura and Pia Mater.
<i>Muscular Motion,</i>	p. 99
<i>Divers Opinions about it,</i>	ibid.
<i>Muscle, its inflation or contraction,</i>	p. 102, 106
<i>Muscle, how contracted or swelled by force,</i>	p. 104
<i>Muscles, the effect of their being cut through,</i>	p. 105
<i>Muscles, their hardness and swelling in contraction, whence caused,</i>	p. 106, 107
<i>Muscular Motion, some particular Phenomena about it solved,</i>	p. 110, 111
<i>Muscular Motion made by the Nervous Fluid alone without concurrence of the blood,</i>	p. 177
<i>A Medullary Tract not before observed,</i>	p. 123
<i>Medulla Oblongata,</i>	p. 139
<i>Its Crura,</i>	ibid.
<i>Animal Motion,</i>	p. 158
<i>Motion voluntary and involuntary,</i>	p. 159, 160
<i>Two sorts of Motions in Brutes,</i>	p. 161
<i>Medullary Tracts of the Brain,</i>	p. 192

N

The TABLE.

N

<i>Noise in the Head, how occasion'd,</i>	p. 29
<i>Nervous Juice,</i>	p. 88, 93
<i>Nutrition</i>	p. 88, 89, 94
<i>Nervous Juice, how generated</i>	ibid.
<i>Nerve; its Structure</i>	p. 93
<i>The effect of its being taper,</i>	ibid. & 102
<i>Nates</i>	p. 125
<i>Nerves Olfactory,</i>	p. 143
<i>——— Optick</i>	p. 144
<i>Motorium or third Pair</i>	p. 145
<i>Patheticum or fourth pair</i>	p. 146
<i>The fifth pair</i>	p. 147
<i>The sixth pair</i>	p. 148
<i>The Intercostal</i>	ibid.
<i>The seventh or auditory pair</i>	p. 149
<i>The eighth or Par Vagum</i>	p. 150
<i>The Accessory Spinal Nerve</i>	p. 151
<i>The ninth pair</i>	p. 142
<i>The tenth pair</i>	p. 153
<i>The Structure of the Nerves</i>	p. 154
<i>Nerves their different functions</i>	p. 157
<i>The effects of Communications betwixt Nerves,</i>	p. 175, 181
<i>The Nerves within the Cranium, how supplied with Spirits from various medullary Tracts of the brain,</i>	p. 194, 195, &c.

The TABLE.

O	
<i>Optick Nerve its original</i>	p. 123
<i>External Objects, how they act</i>	p. 158
<i>Impropportionable actings of the Object</i>	p. 186
<i>Organization of the brain</i>	p. 189
<i>Overplus of the Animal Fluid of the Cerebrum with its use</i>	p. 199
P	
<i>The Pia Mater,</i>	p. 10
<i>Why called Choroeides</i>	ibid.
<i>Its particular distribution</i>	ibid.
<i>How to find it in the Ventricles</i>	p. 11
<i>Is double every where, but where most visibly,</i>	p. 12
<i>Its inward Lamina is of a Netlike Texture.</i>	p. 15
<i>Its Uses</i>	p. 16
<i>Its Blood-vessels, which are of two sorts,</i>	p. 18, 19
<i>How it invests the Nerves and their distinct Fibrils</i>	p. 19
<i>How the Arteries belonging to the Brain it self are ramified through it</i>	p. 33
<i>How some branches of the Carotid and Verte- bral Arteries are exempt from it,</i>	p. 34
<i>The Processes of the Dura Mater, with their distribution and use</i>	p. 7, 8, 9
<i>Pulsation of the Sinus's, whence</i>	p. 50
<i>The Plexus Choroeides of the Brain</i>	p. 57
<i>It is double</i>	ibid.
	Hath

The TABLE.

<i>Hath two different Originals</i>	ibid.
<i>What they are</i>	ibid.
<i>Where the first part begins to be glandulous,</i>	p. 58
<i>Where the first part of the Plexus terminate and meet</i>	p. 58
<i>Where the second part begins to be retiform,</i>	ibid.
<i>The double connexion of the two parts of the Plexus</i>	ibid.
<i>Two Veins joyning the first part of the Plexus in its extremity</i>	p. 61
<i>Its large reductory Veins entering the fourth Sinus</i>	ibid.
<i>Its Lymphæducts</i>	ibid.
<i>Its Glands</i>	p. 62
<i>Their Use</i>	ibid. & 63
<i>Its situation and use</i>	ibid.
<i>The Pituitary Gland hath Veins</i>	p. 66
<i>Processus Lentiformes, vid. Corpora Striata.</i>	
<i>Passage into the Infundibulum</i>	p. 123
<i>Processus Annularis, or second Process of the Cerebellum</i>	p. 129, 135, 140
<i>Its Striæ</i>	p. 136
<i>Processus Nativus antepositus</i>	p. 125
<i>Processus Nervi Æmulus</i>	p. 126
<i>Processus Nervuli Æmulus</i>	p. 128
<i>The Plexus Choroeides of the Cerebell.</i>	p. 134
<i>Processus Vermiculares</i>	p. 135
<i>The first Process of the Cerebellum</i>	ibid.
<i>The third or Choidal Process of the Cerebellum</i>	p. 136
	<i>The</i>

The TABLE.

<i>The medullary transverse Processes of the fourth Ventricle</i>	p. 136
<i>The medullary Processes descending to those transverse ones</i>	p. 137
<i>The Plexus Choroëides of the Cerebellum,</i>	p. 133
<i>Perception or Passion, what,</i>	p. 158

R

<i>The Receptacula Sellæ Equinæ, &c. of Vieussenius not existent in Men</i>	p. 45
<i>Their Use impossible</i>	p. 46
<i>The Rete Mirabile</i>	p. 64
<i>Always existent in Men</i>	ibid.
<i>Its situation</i>	ibid.
<i>Why smaller in them than Brutes</i>	ib. & 65
<i>The effect of its being so large in Brutes,</i>	p. 65
<i>Is differently situated in Men and Brutes,</i>	p. 72
<i>Hindermost Roots of the Medulla Spinalis, what formerly</i>	p. 126
<i>Respiration, how performed</i>	p. 165
<i>Why a Child unborn respire not,</i>	p. 168
<i>Why Respiration ceases upon cutting the Cerebellum,</i>	p. 174

S

<i>Sinus's of the Brain</i>	p. 39
<i>Their number</i>	ibid.
<i>The Lateral ones</i>	p. 40
<i>The third or longitudinal</i>	p. 41
<i>The</i>	

The T A B L E.

<i>The fourth or internal one</i>	ibid.
<i>Four other smaller Sinus's, and their first Author,</i>	P. 42, 43
<i>The Circular Sinus</i>	P. 43
<i>Its particular description</i>	ibid. & 44
<i>Its use</i>	P. 47, 48
<i>No Serum can be separated but by proper secretory Ducts</i>	P. 47
<i>The Sinus's have no pulsation of themselves,</i>	P. 50
<i>Their pulsation is from the Brain,</i>	ibid.
<i>The different Ligaments of the Sinus's</i>	P. 57
<i>The use thereof</i>	ibid.
<i>The blind Cavities or Diverticulums of the Sinus's</i>	P. 52
<i>Their Uses</i>	ibid.
<i>The Structure of the Sinus's</i>	P. 53
<i>Effects thereof</i>	ibid.
<i>Animal Spirits, how made more plentifully,</i>	P. 54
<i>Why the Sinus's grow so wide on a sudden,</i>	ibid.
<i>Their difference of Structure</i>	P. 56
<i>The longest Sinus commonly burst in strangled bodies</i>	ibid.
<i>How the blood passes the Lateral Sinus's in different positions of the Brain</i>	P. 54
<i>Structure of the Brain Vascular,</i>	P. 91
<i>Secretion, how made,</i>	P. 91, 92
<i>Sensation, how explained</i>	P. 88, 101
<i>How made,</i>	P. 158
<i>Corpora Striata</i>	P. 115, 120
<i>Septum Lucidum</i>	P. 119
<i>Its Striæ</i>	ibid.
<i>The</i>	

The TABLE

<i>The Spinalis Medulla in a Tortoise officiating instead of the Brain</i>	p. 176
<i>Sneezing, why peculiar to Man</i>	p. 182
<i>Commune Sensorium, what,</i>	p. 191
<i>Striæ of the Annular Process, why large,</i>	p. 193, 197
<i>Why terminating in a middle medullary Tract,</i>	p. 193
<i>Conformation of the Spinal Marrow differing from that of the Brain, and why</i>	p. 200

T

<i>Torcular Herophili</i>	p. 42
<i>Tractus Medullaris Th. Nerv. Opt. interjectus of Vieussenius</i>	p. 84
<i>Tract. Med. Natis antepositus of Vieussen.</i>	ibid.
<i>Transpiration, what,</i>	p. 95
<i>Conspiration of Hippocrates</i>	ibid.
<i>Tone of Parts</i>	p. 109
<i>Testes</i>	p. 125
<i>Thalami Nervorum Opticorum</i>	p. 121
<i>Tria Foramina relating to the Infundibulum, vide Infundibulum.</i>	

V

<i>Vapours, commonly so called, how sometimes affecting the Fibres of the Dura Mater,</i>	p. 6
---	------

Some

The TABLE.

<i>Some Veins of the D. Mater entering the third Sinus</i>	p. 41.
<i>Vertebral Artery,</i>	vide <i>Artery.</i>
<i>Veins of the Dura Mater enter the Brain with the Arteries contrary to those of the Brain it self.</i>	p. 26, 27, 28.
<i>Two Veins entering the Circular Sinus,</i>	p. 45, 46
<i>How the Veins enter the Sinus's</i>	p. 52, 53
<i>The effects of their different entrance,</i>	p. 54
<i>The Veins have a different disposition in the Sinus's of Brutes, from what they have in Men</i>	p. 54
<i>Veins of the Corpora Striata</i>	p. 61
<i>The large reductory Veins of the Plexus Chorooides,</i>	ibid
<i>Vapours condensed into Lympha</i>	p. 81
<i>Vascular constitution of Parts</i>	p. 91
<i>Veins, how continuous to Arteries</i>	ibid.
<i>Vessels containing the Animal Fluid are capillary productions of Arteries</i>	p. 93
<i>Veins only productions of Arteries</i>	p. 94
<i>Vessels their minuteness</i>	p. 95, 96
<i>Vessels of Vessels</i>	ibid.
<i>Ventricles of the Brain</i>	p. 117
<i>Valvula major</i>	p. 128, 129
<i>its situation and use</i>	p. 128, 129, 130, 132
<i>The three Ventricles of the Brain</i>	p. 117
<i>Vulva Cerēbri</i>	p. 124

F I N I S.

E R R A T A.

PAGE 9. l. 14. for *to read towards* ; p. 16. l. ult. for *from which* r. *which from* ; p. 32. in the title of the Chapter, for *Veins* r. *Vessels* ; p. 32. l. 13. after *Veins* insert *which last have already been treated of* ; p. 64. l. 5. dele only ; p. 89. l. 16. *Vitrious* r. *Vitrous* ; p. 92. l. 29. for *Septometry* r. *Leptometry* ; p. 102. l. 3. for *contracted* r. *contracts* ; *Ibid.* l. 29. for *reflexed* r. *relaxed* ; p. 109. l. 18. for *hastening* r. *happening* ; p. 117. l. 28. for *Semicirculari* r. *Semicirculare* ; p. 119. l. 12. for *becomes* r. *become* ; p. 138. from *And therefore* in the 7th line to the end of that Paragraph, leave it out : p. 137. l. 7. for *above* r. *below* ; p. 168. l. 8. after *passage* add *at least but very little.*

