A

TREATISE

OF THE

Organ of Hearing:

CONTAINING

The STRUCTURE, the USES,

AND

The DISEASES of all the Parts of the EAR.

Tranſlated from the *French* of the late

MONSIEUR *DU VERNEY*,

Of the Royal Academy of SCIENCES, Counſellor Phyſician in Ordinary to the late King of *France*,

And Profeſſor of *Anatomy* and *Surgery* in the ROYAL PHYSICK-GARDEN at *Paris*.

Adorn'd with Sixteen Curious Copper-Plates.

LONDON:

Printed for SAMUEL BAKER, at the *Angel* and *Crown* in *Ruſſel-Street*, *Covent-Garden*. MDCCXXXVII.

TO

Mr. FREKE
Mr. PHILLIPS
Mr. BIGG
} Surgeons to St. *Bartholomew's* Hoſpital.

GENTLEMEN,

WHATEVER tends to the Benefit of Mankind in general, has no need of an Apology to introduce it to the World; and the more exenſive the Benefit is, the more valuable the Work muſt be. Now as there is no Art or Science but what in ſome manner conduces to this End, ſo that parti-

cularly which frees us from Pain and Sickneſs, muſt certainly be of the moſt univerſal Advantage, and conſequently merit the greateſt Encouragement. Anatomy and Surgery are of this kind; the one may be ſaid to be the Theory, the other the Practice, which like two neighbour Stars mutually reflect Light upon each other. The Knowledge therefore of our own Bodies, and an inquiſitive Search into the Organs of our Senſes, is not (as ſome idly imagine) a Matter meerly of Curioſity and Speculation. 'Tis this Knowledge, Gentlemen, which has ſo particularly diſtinguiſh'd you, and plac'd you in the Rank of the moſt Eminent in the Profeſſion. I might here, like moſt Dedicators, though with infinitely more Truth and Juſtice, enlarge abundantly upon your great Abilities, and other ſhining Virtues, which ſerve to dignify your Characters; but that there is no need of a Pen to teſtify what is ſo loudly proclaim'd by the Tongues of Thouſands.

ſands of poor Wretches, who owe their Lives as well as their Eaſe to that Skilfulneſs, Care and Humanity, the happy Influence of which they daily experience, and which I my ſelf am frequently an Eye-Witneſs of. 'Tis upon this account, Gentlemen, and not upon any Preſumption of my own Merit, that I am embolden'd to prefix your Names to this Tranſlation; not only as a means of recommending it to the World, but as an acknowledgment of that Reſpect and Duty, which I ſhall always retain a grateful Senſe of, and particularly of the many Favours and Obligations which are continually conferr'd upon me, by my worthy Maſter Mr. *Phillips*.

Nothing need be ſaid in praiſe of the Author, this Treatiſe has gain'd him ſufficient Applauſe from the moſt accurate Anatomiſts: But as for this Tranſlation (which I have endeavour'd to render as literal as poſſible) I ſubmit it entirely

ly to your candid Judgments, hoping you'll excuſe thoſe Errors that may have eſcap'd me: And beg leave to ſubſcribe my ſelf,

Gentlemen,

Your Oblig'd

Humble Servant,

JOHN MARSHALL.

THE

THE

AUTHOR's *Advertiſement.*

OF all the Organs aſſign'd to the Uſe of Animals, we have the leaſt Knowledge of thoſe of the Senſes; but there is none more obſcure than that of Hearing: the Minuteneſs and Delicacy of the Parts which compoſe it, being inclos'd by other Parts, (which by reaſon of their Hardneſs, are ſcarcely penetrable) render the Enquiries into them more difficult, and their Structure ſomething ſo intricate, that there is as much Trouble in explaining, as there was in diſcovering them. It is eaſy to judge

judge how little known they were to the Ancients, by what they have wrote upon this Head: And amongst the Moderns, Mr. *Perrault*, who in his *Physical Essays* has treated it with more Exactness and Perspicuity than any one yet, nevertheless has omitted many things on this Subject, applying himself to those particular Parts which serve for the better Explanation of the Nature of Sound, by the Organs of that Sense of which it is the Object. And this is what has induced me to write upon this Matter.

Altho' I don't pretend that this Work is entirely perfect, yet I am in hopes there may something more be found in it, at least, than hath been describ'd before; for I have endeavour'd (by all the necessary Precautions I cou'd take, to avoid the Obscurity which is to be met with in most Authors, that I have read upon this Subject,) not only to give an exact and compleat Description of all the Parts belonging to the Ear,

Ear, but alſo to make that Deſcription as plain and intelligible, as much as poſſible: To attain which, I have ſpar'd no Pains, but have ſearch'd with all the Care and Patience imaginable, into the moſt minute Parts, examining their Subſtance, and their Figure, with a continual Apprehenſion of forgetting ſome Things, or miſtaking one for the other.

For to make this Treatiſe more intelligible, I have been very careful and exact in the Figures, which are particularly neceſſary to render theſe ſort of Deſcriptions neat: And becauſe it is not enough that theſe Figures ſhould be true and faithfully delineated, if they were not beſides order'd and diſpos'd in ſuch a manner, that they may leave no room for Ambiguity; I have repreſented the Parts of the right Ear always in their natural Situation, to preſerve the firſt Ideas that they imprint upon the Mind, that they may not be confus'd nor deſtroy'd

by one another. And becau[se] often happens, that in ſeeing t[he] ſame Parts in various Views, w[e] miſtake them for different Part[s], I have left certain remarkable Parts, which are eaſily known again, ſuch as the *Proceſſus Zygomaticus*, *Mammillaris*, and *Styloides*, and the bony Paſſage of the Ear, to ſerve as an Index to the Reader, and which will be his ſureſt Guide in his Enquiry into the Part which he examines. In ſhort, that I might not omit any thing which I thought belong'd to the Subject which I treated of, I have added the Deſcription of the Ear of a *Fœtus* to that of the Ear of an *Adult*, wherein I have taken notice of all the Difference I ever met with between the one and the other.

As for the uſe of ſome Parts of this Organ, I muſt confeſs that every thing that I have ſaid of them does not entirely ſatisfy me, no more than what others have wrote upon this Subject; I don't equally

affert

aſſert the Truth of thoſe particular Things which were diſcover'd before me: As for thoſe I have found out my ſelf, they are things which I maintain to be true, which I have many times experienc'd upon a great Number of Subjects, and which I promiſe to demonſtrate plainly to all thoſe who ſhall have the Curioſity to inform themſelves.

As I have reſolv'd to give a Deſcription of all the Organs of Senſe, and ſince it is abſolutely neceſſary to determine what is the Origin of their Nerves; I have been obliged to make a new Plate of the Baſis of the Brain, not being able to make uſe of any of the Figures that have hitherto appear'd, not even thoſe of Mr. *Willis*. I have ſaid nothing of the Senſes, nor of Senſation in general, becauſe I thought it neceſſary to know firſt the Structure of their Organs. I ſhall defer ſpeaking of them, till I have finiſh'd a particular Deſcription of all the Senſes, and

in

in the Interim I ſhall give you their anatomical Uſe.

I finiſh this Volume with a little Treatiſe of the Diſtempers of the Ear and their Cure, which muſt be look upon as an Eſſay, I ſhall endeavour to perfect it by the different Obſervation, which I may have an opportunity of making.

ERRATA.

Pag. 22. Line 6. for Plate IX. Fig. 11. read Plate IX. Fig. 1. Pag. id. Line 13. for *Feneſtræ* read *Feneſtra*. Pag. 26. Line 6. after *ſide*, read *next to the Aqueduct*. Pag. 27. Lin. 12. for *Incus* read *Stapes*. Pag. 32. Lin. 10. for *deſcrib'd* read *deſcrib'd*. Pag. 41. Lin. 12. for *there* read *theſe*. Pag. 54. Lin. 5. after *no* read *other*. Pag. 57. Lin. the laſt, for *upper* read *under*. Pag. 61. Lin. 6. after *fix'd* add *in Adults*. Pag. 67. Lin. 4. for *Inferior* read *Superior*. Pag. 106. Lin. 2. for *Yolk* read *Oil*. Pag. 109. Lin. 15. after *Ears* read *as alſo the Blood which comes out of 'em from Wounds in the Head*. Pag. idem. Lin. 27. after *Blood* read *which are at the* Baſis *of the* Cranium. Pag. 110. for *I do find*, read *I don't find*. Pag. 118. Lin. 7. after *conſiſts in* read *Extracting*. Pag. 139. Lin. 17. after *Particles* read *mov'd*.

OF THE ORGAN OF HEARING.

PART I.

Containing the Structure of the Organ *of* Hearing.

THE Ear itself without being dissected is divided into two Parts, that which appears externally from the Head, and is properly called the Ear; and that which is sunk into the Head, and is call'd the Hole of the Ear, or the Auditory Passige. *The External Part of the Organ of Hearing, called only the Ear.*

Is compos'd

The Ear is form'd of a pretty thick Cartilage, which is cover'd with a thin tender Skin, ſtor'd, eſpecially in young Subjects, with a little Fat; under which is found another Nervous Covering, which ſtrictly adheres to all the Cartilage.

Of a Cartilage,

This Cartilage commonly conſiſts of many Foldings, which are continued and terminate in a Cavity call'd the *Concha*, from its Reſemblance to the Entrance of a Snail-ſhell. The Windings or Folds of this Cartilage are more diſtinct in Adults, and their Figure is often varied. Beſides the Skin, the Cartilage, the Nervous Membrane, and the Fat, the Ear is furniſhed with ſome Muſcles, and adorn'd with Arteries, Veins, and Nerves.

Of Skin, of Fat, of a nervous Membrane,

Of two Muſcles.

It has two Muſcles, the firſt conſiſts of fleſhy Fibres, which are fix'd to that part of the Skull which the *Muſculus Temporalis* covers; they deſcend in a ſtrait Line, and are inſerted into the ſuperior Part of the ſecond Fold of the Ear: The ſecond is alſo compoſed of five or ſix fleſhy Fibres, which take their Origin from the ſuperior and anterior Part of the *Proceſſus Mammillaris*, they deſcend obliquely about the Length of an Inch, and are inſerted into the Middle of the *Concha*. See *Plate* I. *Fig.* I. and II.

Expla-

Explanation of Plate I.

Fig. I. *represents the Ear in its natural Situation.* A B C D, *the Ear.* A B C, *its three Folds.* D, *the End of the Ear.* E, *the* Concha, *near* E *the Orifice of the Auditory Paſſage is ſeen.* F, *the Scituation of the* Tympanum. *The two dotted Lines ſhew the Length of the Paſſage.* G G, *the ſcaly Part of the Temporal Bone ſhewn bare.* H, *the firſt Muſcle, which is here repreſented as lying upon the ſcaly Part of the* Os Temporale, *becauſe it is diveſted of the Temporal Muſcle, upon which the Muſcle belonging to the Ear is naturally ſcituated.* I, *the* Proceſſus Zygomaticus. K, *the* Proceſſus Styloides.

Fig. II. *retreſents the Ear revers'd, to ſhew its ſecond Muſcle and its Integuments.* A, *the Ear revers'd.* B, *the ſecond Muſcle of the Ear, whoſe Fibres have been diveſted of their Membranes, to render their Origins and Inſertions the more diſtinct.* C, *the Place where the ſecond Muſcle is inſerted, ſtript of the Skin.* D, *the Skin of the Ear, ſtor'd in the lower Part with a little Fat.* E, *the Nervous Membrane.* F, *the Scaly Part.* G, *the* Proceſſus Mammillaris.

Of Arteries. The Arteries are Branches of the exin ternal Carotid, which after part of them being distributed to the *Larynx*, and to many Parts of the Face, are divided near the Articulation of the *Maxilla* into two other Branches; one of which passes over the fore-part of the Ear, and the other over the back-part. That Branch which passes behind the Ear, sends off many little Ramifications, and is dispers'd all over the back Part of the Ear: One of the most considerable of these Ramifications enters the Ear near the Auditory Passage, and is afterwards distributed into a great Number of small Branches, which are expanded over the Skin, which lines the Inside of the *Concha*.

That Branch which passes over the fore-part of the Ear, is that which is perceiv'd to beat at the Temples, and which is commonly open'd for great Pains in the Head. In passing it is divided into many lesser Branches, which sprinkle the Cartilaginous Passage; and continuing its Course, it is again ramified, and sends forth in this place Branches, which are spread over the fore-part and back-part of the Ear.

The

Of Veins.

The Veins are Ramifications of the External Jugular, which follow the Distribution of the Arteries. *See* Plate II. Fig. I, II.

Explanation of Plate II.

Fig. I. *represents the Arteries, which are distributed upon the fore-part of the Ear.* A, *the external Carotid, cut off above the Angle of the Jaw.* B, *the Branch which passes behind the Ear.* C, *the Branch which passes to the fore-part.* D, *the Ramification of this Branch, which is distributed to the Lobe of the Ear.* E, *a Branch of an Artery, which passes through the Cartilage from the back-part to the fore-part, and is distributed to the Inside of the* Concha.

Fig II. *represents the back-part of the Ear, to shew the Arteries which are behind the Ear.* A, *the same Trunk of the Carotid.* B D, *the Branch which passes behind the Ear, and which as it passes furnishes it with many Ramifications.* C, *a Branch which is distributed to the* Cavernulæ *of the* Processus Mammillaris. E, *the Branch which passes through the Cartilage, to be distributed to the Inside of the* Concha.

Of Nerves. As for the Nerves, we ſhall treat of them when we come to deſcribe all thoſe which belong to the Organ of Hearing.

The Hole of the Ear is divided into two Parts. That which is called the Hole of the Ear, is a Paſſage, of which the *Concha* is as the *Veſtibulum* or Entry, and which leads to a Membrane, called the Drum. This Paſſage is partly Cartilaginous, and partly Bony.

1. The Cartilaginous Part. The Cartilaginous Part is formed by the Contraction of the *Concha*; this Part is about four or five Lines in length; the Cartilage which forms it is continued in itſelf, but it is broke off and ſeparated in many Places, as by ſo many Cuts which are not join'd together again, but by the Skin which covers the Inſide of the Paſſage. This Cartilaginous Part covers but half the Auditory Paſſage, almoſt all the upper Part being only enclos'd by the Skin, which lines its Inſide. See *Plate* III. *Fig.* I. and II.

Which is broke off in many Places.

Explanation of Plate III.

Fig. I. *repreſents the Cartilage of the Ear, and the cartilaginous Paſſage diveſted of all their Integuments.* A, *the Cartilage of the Ear, with its Folds.* B, *the cartilaginous Paſſage growing ſomething flat.*

to Face page 7

Plate. III.

Fig. I.



Fig. III.

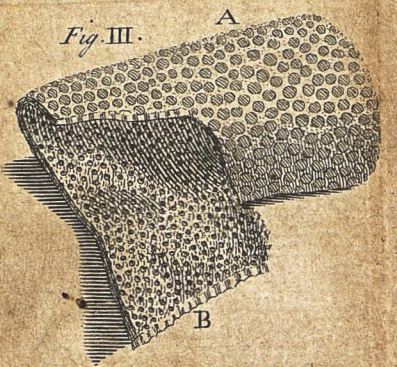
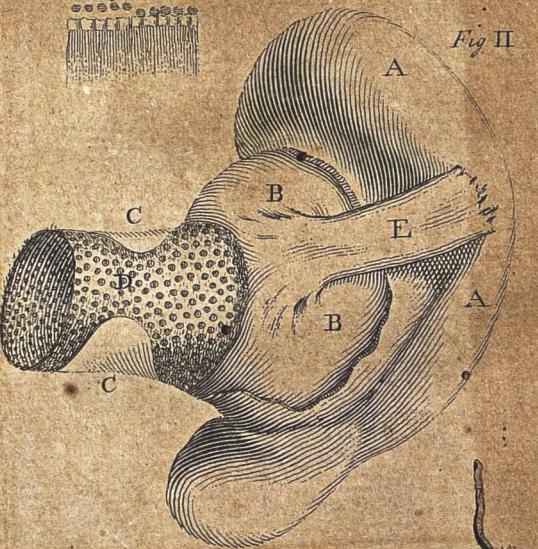


Fig. IV.

Fig II



B Cole. Sculp.

C, *the Part of the Cartilage which forms the Entrance of the Paſſage, and which makes a little Tongue at the forepart of the* Concha. 1, 2, 3, *The three Interruptions of the cartilaginous Paſſage.*

Fig. II. *repreſents the back Part of the Ear, and the upper Part of the cartilaginous Paſſage, with the Ligament, which ties the* Concha *to the temporal Bone.* A, A, *the back part of the Ear,* B, B, *the back part of the* Concha, *diveſted of the Skin.* C, C, *the Appendixes which terminate the Cartilage in the upper Part.* D, *the ſuperior Part of the Paſſage, which is form'd of nothing but of a glandular Membrane.* E, *the Ligament of the Ear revers'd.*

Fig. III. *repreſents the glandular Membrane, which inveſts the cartilaginous Paſſage; it appears in this place three times larger than Nature, for the better diſtinguiſhing all the Parts.* A, *the exterior Part of the glandular Membrane.* B, *the Paſſage open'd, in which the ſmall Hairs and the Orifices of the excretory Ducts of the Glands are viſible.*

Fig. IV. *repreſents the Diameter of the Part of the Paſſage, to ſhew how the Glands are half buried in the Thickneſs of the Membrane: Some of them are drawn out, to ſhew more plainly how deep they are buried.*

And cover'd with a Skin.

Adorn'd with many little Glands.

This Skin, which is a Continuation of that which is in the fore-part of the *Concha*, is ſtrew'd with an infinite Number of ſmall Glands of a yelloviſh Colour, and a little inclining to an oval Figure, which lie under this Skin, and are ſomewhat depreſs'd in its Thickneſs. Each Gland has a ſmall Duct, which opens into the Cavity of the Paſſage among the little Hairs with which it is ſtor'd: And theſe are the ſmall Ducts which emit that thick glutinous and yellow Matter, which is commonly found in the auditory Paſſage. This cartilaginous Paſſage ends by adhering to many Inequalities, which are at the entrance of the bony Canal; which is only a Continuation of that which is Cartilaginous. Theſe Inequalities are pretty conſiderable on that ſide of the Entrance next the Face, to which the Cartilage ſtrictly adheres. And as there are but few of theſe Inequalities at the oppoſite Side, next to the back part of the Head,

And is connected to the Os Temporum by a Ligament.

the Cartilage is connected in this place to the Bone by a ſtrong Ligament; which coming from the Extremities of the *Concha*, paſſes along the membranous Part of the cartilaginous Paſſage, and is inſerted into a ſmall Cavity in the *Os Temporale*,

Temporale, at the Entrance of this bony Canal. See *Plate* III. *Fig.* II, III, IV. and *Plate* IV. *Fig.* I.

Explanation of Plate IV.

Fig. I. *repreſents the* Os Temporale *bare.* A, *the ſcaly Part of this Bone.* BB, *the* Proceſſus Zygomaticus. C, *the little Cavity, in which the Ligament of the Ear is inſerted.* D, *the Entrance of the bony Paſſage of the Ear.* E, *the Inequalities which are on that Side of this Entrance next the Head.* F, *the* Membrana Tympani, *in its Situation.* G, *the* Proceſſus Mammillaris. H, *the* Proceſſus Styloides. I, *the Tube, which incloſes the internal Carotid.* K, *a ſmall* Sinus, *which is between the bony Paſſage and the ſcaly Part of the* Os Temporale, *through which the external Muſcle of the* Malleus *penetrates into the* Tympanum. L, *the Extremity of the bony Paſſage, which forms part of the Paſſage which goes from the Ear to the Palate.* M, *the Cavity, into which the Condyloide Proceſs of the lower Jaw is inſerted.*

Fig. II. *repreſents the bony Paſſage, taken off from the temporal Bone.*

adly. The y Part.

This bony Part of the Auditory Paſſage, appears as if it was join'd to the *Os Temporale*. This Paſſage is, as it was ſaid before, the Continuation, or rather the Foundation of the cartilaginous Paſſage: Its Bore is a little Oval at the Beginning, but the more it advances towards the Extremity, it grows flat.

The cartilaginous and bo- Parts form e auditory aſſage.

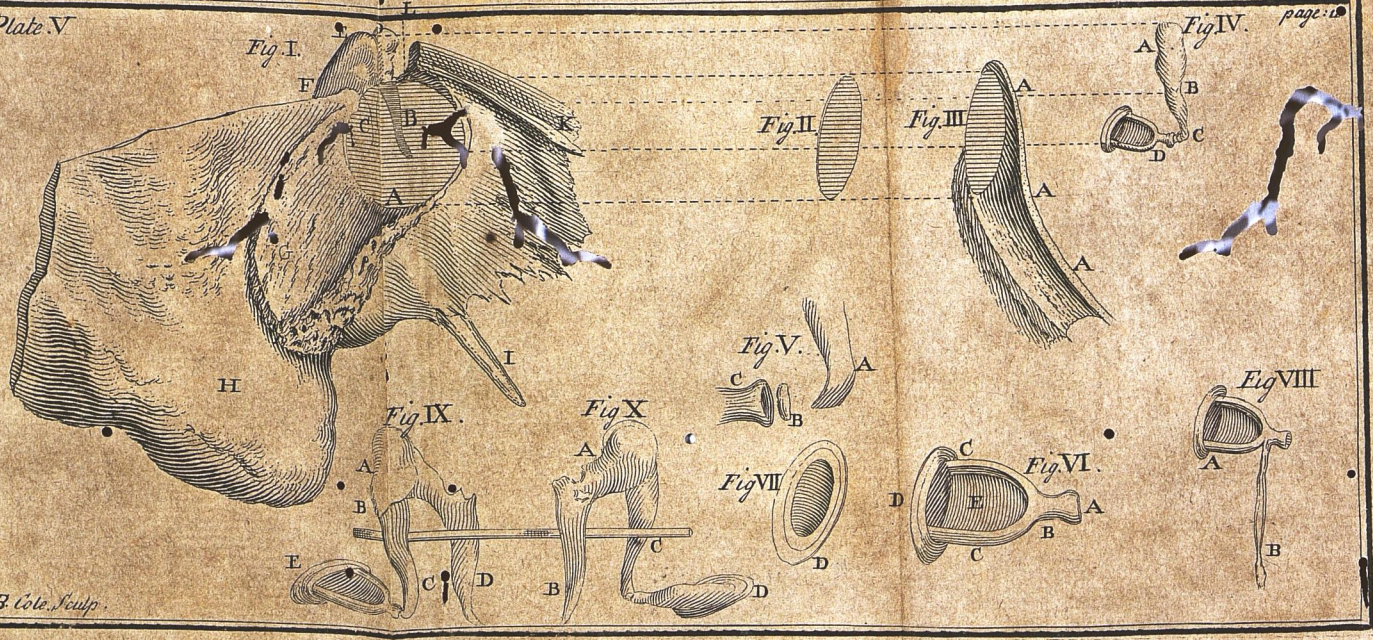
That which is called the Auditory Paſſage, is form'd of a cartilaginous and bony Canal, placed one at the End of the other; this Canal runs obliquely and grows curv'd. For its Courſe, which at firſt aſcends and proceeds from the hind part to the fore-part, as far as its Middle, turns aſide afterwards, and deſcends again, always proceeding forwards as far as the *Membrana Tympani*. *See* Plate IV. Fig. I, II.

The external art of the Or- n of Hear- g, is ſepara- from the ternal, by the embrana ympani.

At the End of this Paſſage we find the *Membrana Tympani*, which ſeparates the above deſcrib'd external Ear from the Internal, and exactly cloſes up the Extremity of the Paſſage, as before taken notice of. This Partition is compos'd of a thin, dry, firm, tranſparent Membrane, almoſt round, and connected into a hollow Groove in the Circumference, at the end of the bony Paſſage. This Groove lies nearer the Inſide of the Head at its bot-

tom

Plate V



B. Cole. Sculp.

tom than at its Top; it does not make a compleat Circle, but ends at the upper parts of its Circumference. Although this Membrane be extended, yet it does not make a plain Superficies; but it is indented inwards, by being fixed to the Handle of the Malleus. *See* Plate V. Fig. I, II, III. and Plate VII. Fig. I, II.

Explanation of Plate V.

Fig. I. *represents the temporal Bone twice as large as Nature, in which all the scaly Part is cut off, and but as much of the bony Passage taken away, as was necessary to shew the* Membrana Tympani *bare.* A, *the* Membrana Tympani *in its Situation, and seen in the Front.* B, *the Handle of the* Malleus, *which is join'd to the back part of this Membrane.* C, *the long Branch of the* Incus, *which appears cross this Membrane, though it is a little way remov'd from it.* D, *the Head of the* Malleus. E, *the massy Part of the* Incus, *with its short Branch.* F, *which in this Section appears plainly.* G, *the bony Passage, half of which is cut off.* H, *the* Processus Mammillaris. I, *the* Styloides. K, *the external Muscle of the* Malleus *in its Situation.* L, *a punctur'd Line, which shews*

the thin Proceſs of the Malleus, *into which this Muſcle is inſerted.*

Fig. II. *repreſents the* Membrana Tympani *ſeen ſideways, to ſhew the better how it inclines.*

Fig. III. *repreſents the* Membrana Tympani *in the ſame View, and fix'd in the Extremity of the bony Paſſage; it alſo ſhews in what manner the Side of this Paſſage next the Face recedes, at the lower part from the* Membrana Tympani, *and how it approaches inſenſibly nearer to it as it aſcends.* AAA, *the Side of the bony Paſſage next the Face.*

Fig. IV. *repreſents the* Incus, *and the* Stapes *in their Scituation ſideways.* A, *the maſſy Part of the* Incus. B, *the ſhort Branch of the* Incus, *which in this Scituation appears exactly in the Front.* C, *its long Branch.* D, *the Head of the* Stapes, *which is joined with the long Branch of the* Incus, *by the Intervention of a fourth little Bone.*

Fig. V. *repreſents the Beak of the long Branch of the* Incus, *the fourth little Bone and the Head of the* Stapes *with its Cavity; all of them being four times larger than Nature.* A, *the Beak of the long Branch of the* Incus. B, *the fourth little Bone.* C, *the Head of the* Stapes *with its Cavity.*

Fig.

Fig. VI. *repreſents the* Stapes *five times larger than Nature.* A, *the Head of the* Stapes. B, *its* Collum *or Neck.* C C, *its Branches, which are hollow like a Gutter.* D, *its Baſis.* E, *the Membrane of the* Stapes.

Fig. VII. *repreſents the Baſis of the* Stapes *ſeen in the ſame Senſe, to ſhew that it is hollow like a Gutter.* D, *the Baſis of the* Stapes.

Fig. VIII. *repreſents the* Stapes *with its Muſcle in its natural Scituation.* A, *the* Stapes. B, *its Muſcle, the whole being repreſented twice as large as Nature.*

Fig. IX. *repreſents the* Officulæ *ſeen in the Scituation they would be in, if the Eye was placed in that Paſſage which penetrates into the* Proceſſus Mammillaris. A, *the maſſy Part of the* Incus. B, *its ſhort Branch ſeen in the Front.* C, *its long Branch.* D, *the back part of the Handle of the* Malleus. E, *the upper part of the* Stapes.

Fig. X. *repreſents the* Officulæ *in their Scituation, view'd from the oppoſite Side, the Eye being placed in the Paſſage which paſſes from the Ear to the Palate.* A, *the Head of the* Malleus, *which covers the maſſy Part of the* Incus, *and its ſhort Branch.* B, *the Handle of the* Malleus. C, *the long*

long Branch of the Incus. D, *the* Stapes *ſeen ſideways: The Stick which croſſes the* Officulæ *is placed here, to diſtinguiſh which are placed before and which behind, in theſe different Views.*

Explanation of Plate VII.

Fig I. *repreſents the back part of the temporal Bone, with as much of it cut off as was neceſſary to ſhow the* Membrana Tympani, *upon which the back part of the* Malleus *and* Incus *is ſhewn, with the ſmall Branch of a Nerve, called the* Chorda Tympani, *and the Tendon of the external Muſcle of the* Malleus, *beſides the Cavity, upon which the Head of the* Malleus *and the maſſy Part of the* Incus *reſts, all in their natural Situation.* A, *the back part of the ſcaly part of the temporal Bone.* B, *The* Proceſſus Mammillaris, *in the ſame View.* C C, *the* Os Petroſum *cut off.* D, *the* Membrana Tympani. E, *the* Malleus. F, *the* Incus *with its ſhort Branch, reſting upon the Entrance of the Paſſage, which penetrates into the* Cavernulæ *of the* Proceſſus Mammillaris. G, *the* Foramen *of the auditory Nerve.* 1. *The Tendon of the external Muſcle of the* Malleus. 2, 3. *The* Chorda Tympani.

Fig.

to Face page 14

Plate VII.

Fig. I.



Fig. II.



B. Cole. Sculp.

Fig. II. *likewiſe repreſents the back part of the* Os Temporale *twice as large as Nature, all the ſcaly Part of which is taken away, and is ſaw'd from the Top to the Bottom, according to the Plan of the Groove, in ſuch a manner, that it is divided through the Middle of the* Proceſſus Mammillaris: *By this is ſhewn the Groove which receives the* Membrana Tympani *into it, and the Place where this Groove is wanting; it alſo ſhews how the Side of the bony Paſſage, next the Face grows flat near its Bottom, and covers a Part of the* Membrana Tympani; *and laſtly, it diſcovers all the* Cavernulæ *of the* Proceſſus Mammillaris. AA, *the Groove.* a a, *the Place where it is wanting.* B, *the Side of the bony Paſſage next the Face, which grows flat in this Place.* C, *the* Malleus. D, *the* Chorda Tympani *which is drawn inwards, to ſhow how it paſſes over the external Muſcle.* 2, 3. *The ſmall Sinus which is excavated out of the Bone above the Groove, and which ſerves as a Pulley to the Muſcle.* E, *the external Muſcle, which is alſo drawn inwards.* F F, *the bony Part of the Paſſage, which goes to the Palate.* G, *the Paſſage which leads into the* Proceſſus Mammillaris. H, H, *the* Cavernulæ *of the ſame Proceſs.*

Behind

e first Ca-
) in the in-
nal Ear,
led the
mpanum,
Drum.

Behind this Membrane is a Cavity called the *Tympanum*, from a ſort of Reſemblance it bears to the Box of a Drum; being on every Side ſurrounded with Bone, enclos'd before by the above-mention'd Membrane, and behind by the Surface of the *Os Petroſum*. This *Tympanum* is two or three Lines deep, and ſix broad; there are two Paſſages in its Sides, one of which is ſcituated in the fore-part, and is called the Aqueduct, and opens into the Palate. The other is ſcituated on the oppoſite Part, and in the Top of the Cavity opens into the *Cavernulæ* or Sinuoſitys of the *Proceſſus Mammillaris*: At the Top of this *Tympanum* there is a ſmall Cavity, in which the Heads of the *Officula*, (which we ſhall deſcribe in the ſequel) are placed. The Cavity of the *Tympanum* is rugged, unequal, and furniſh'd with a Membrane, which is ſtrew'd with a great Number of Veſſels, ſome of which are Ramifications of the carotid Artery, which are diſtributed to the *Dura Mater*: The *Foramina* through which they paſs are placed in the ſuperior Part of the *Tympanum*, and very high the *Foramen*, through which this Artery belonging to the *Dura Mater* enters the *Cranium*.

to Face page 17

Plate IX.

Fig. I.



B. Cole Sculp.

Fig. II.



nium. The others are Ramifications of those that furniſh the Membranes, which cover the *Cavernulæ* of the *Proceſſus Mammillaris.* *See* Plate IX. Fig. I.

Explanation of Plate IX.

Fig. I. *repreſents the temporal Bone twice as large as Nature, all the ſcaly Part being taken off, and being ſaw'd perpendicular down a little diſtance before the Groove, to ſhew the Depth of the* Tympanum *and the* Cavernulæ *of the* Proceſſus Mammillaris, *to diſcover their Veſſels, and thoſe which are ſpread upon the Membrane, which lines the* Tympanum. A, *a conſiderable Artery, which is a Ramification from that of the* Dura Mater. B, *a Vein which is ſent off at the Entrance of the internal Jugular, which is at the bottom of the* Tympanum. C, *the Veſſels which are ſent off from the* Cavernulæ *of the* Proceſſus Mammillaris, *to be diſtributed to the* Tympanum.

Fig. II. *repreſents half a Head one third leſs than Nature, all the upper Part of the* Cranium *of which is taken off, and the reſt cut perpendicular through the Middle of the Noſe, to ſhew the Orifice of the Paſſage which goes from the Ear to the Palate.* A A, *the Cavity of the Noſe, with its*

Laminæ.

Laminæ. B, *the* Fundus *of the Palate.* C, *the Orifice of the Paſſage which leads from the Ear to the Palate.* 1. *its cartilaginous Side, which forms a Border in the ſhape of a Creſcent.* D, *the* Uvula *cut through the middle.*

Has five remarkable things in it.

There are five remarkable Things to be taken notice of in the whole *Tympanum*, *viz.* Two Paſſages, two *Feneſtræ*, four ſmall Bones, three Muſcles, and a Branch of a Nerve.

1. Two Paſſages, one of which paſſes into the Palate.

The Paſſage which paſſes from the Ear into the Palate, is called Aqueduct, not only becauſe it is like a Canal, but alſo becauſe it can make room for the Filth and other extraneous Humours, which are often gathered in the Inſide of the *Tympanum*, not being provided with any ſmall Valve to hinder their Egreſs. This Paſſage is bony as it comes from the *Tympanum*, and its Inſide is lin'd with the ſame Membrane which covers the *Tympanum*. It is ſcituated in the fore-part of the bony Canal, which encloſes the internal carotid Artery, and afterwards proceeding about three Lines in length, it terminates by many Unevenneſſes, which form Gaps, to which another Tube partly membranous and partly cartilaginous

is

is fix'd, which compoſes the reſt of the Paſſage. The membranous Side of this Paſſage faces the Hole of the Ear, and the cartilaginous Part the back-part of the Head. This Tube runs obliquely backwards as far as the Root of the Noſe, at the Extremity of the Palate, a little above the *Uvula*, and proceeding about the length of an Inch, it ends near the Middle of the interior Part of the internal Side of the Proceſſes, which are called *Pterigoidei*. This Paſſage is much larger than that which is bony; it is cover'd on the Outſide by one of the Muſcles, which ſerve to dilate the *Pharynx*, and on the Inſide by a glandulous Skin, which is a Continuation of that which lines the Inſide of the Noſe. The cartilaginous Part of this Paſſage grows thick towards its End, and forms a Border in the ſhape of a Creſcent. The Inſertion of the Aqueduct is ſo diſpos'd, that the Air which is receiv'd into the Mouth through the Noſtrils, is neceſſarily drawn into it. For the Horns of the Creſcent, particularly the lower one, extend in ſuch a manner into the Inſide of the Noſtrils, that it is impoſſible but that the Air muſt ſtrike againſt theſe Horns as it paſſes along; and that a great Part of this Air being ſtop'd, and as it were

were intercepted in the Paſſage, muſt enter into the Aqueduct; otherwiſe all the Air would paſs through the great Apertions of the Noſtrils, directly into the Cavity of the Thorax. Mr. *Louver* has obſerv'd a like Piece of Mechaniſm in the Inſertion, or Opening of the axillary and carotid Arteries into the *Aorta*. For this Veſſel which paſſes out of the left Ventricle of the Heart, growing curv'd as it deſcends, would carry almoſt all the Blood which is ſent out of the Heart into its deſcending Trunk, if the axillary and carotid Arteries, which ariſe from the Middle of the Curve of the *Aorta*, were not diſpos'd, in ſuch a manner, that that Side of every Orifice which is the fartheſt from the Heart, being more elongated than the other, they ſtop a great part of the Blood as it paſſes before their Orifices. *See* Plate VIII. Fig. I, II. and Plate IX. Fig. II.

Explanation of Plate VIII.

Fig. I. *repreſents the temporal Bone twice as large as Nature, the ſcaly Part being taken off, and part of the bony Paſſage taken away, and in general all the Parts of the* Tympanum, *which might hinder the View of the Surface of the* Os Petroſum, *which*

Plate VIII.

Fig. I.

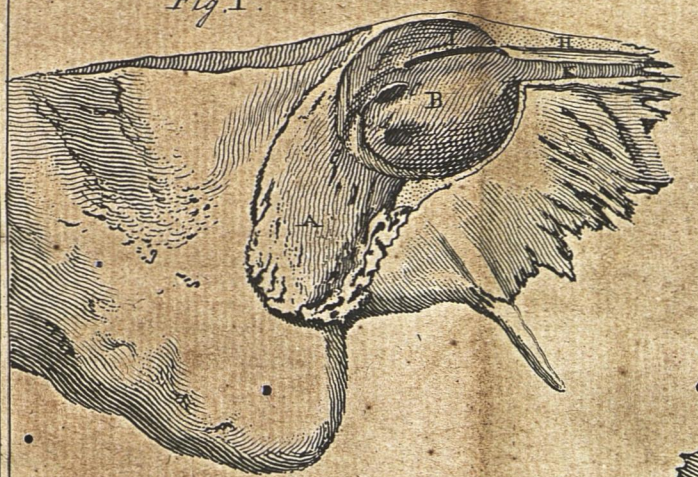


Fig. II.



which makes one of the Parietes *of the* Tympanum. A, *Part of the bony Paſſage.* B, *the Protuberance which is in the Surface of the* Os Petroſum, *and which covers the* Lamina Spiralis. C, *the* Feneſtra Ovalis. D, *the* Feneſtra Rotunda. E, *the bony Canal which encloſes the Muſcle of the* Stapes, *from which the Tendon is ſhown extruded, to be inſerted into the Head of the* Stapes. F, *the Canal which encloſes the* Portio Dura *of the auditory Nerve.* G, *a punctur'd Line to ſhew the Circumference which the* Membrana Tympani *takes up, and how large the* Tympanum *is.* H I, *the Semi-Canal, which encloſes the internal Muſcle of the* Malleus. H, *that Part of this Semi-Canal, which is extruded from the* Tympanum. I, *the Part which is in the* Tympanum. K, *half of the bony Paſſage, which leads from the Ear to the Palate.*

Fig. II. *repreſents the temporal Bone, pretty nigh in the ſame View as the preceeding Figure, but only as large as Nature, to ſhew the* Stapes *in its Situation, and the Canal which leads from the Ear to the Palate in its natural Direction.* A, *the* Stapes *in its Scituation.* B C, *the bony Part of the Canal.* D, *its cartilaginous Part, which grows thicker and larger at its Extremity.* E, *its membranous Part turn'd back.*

The

The other into the Cavernulæ of the Proceſſus Mammillaris

The other Paſſage, which is ſituated on the Top of the *Tympanum* is broader, but much ſhorter than the Aqueduct, and penetrates, as before mentioned, into the *Cavernulæ* of the *Proceſſus Mammiformis*. *See* Plate VII. Fig. II. Plate IX. Fig. II.

2dly, *Two Apertures, or* Feneſtræ.

The two Apertures, or *Feneſtræ* of the Tympanum, are placed in the Surface of the *Os Petroſum*, which lies directly oppoſite to the *Membrana Tympani*. The *Os Petroſum* being about the thickneſs of a Line where they pierce, is the Reaſon why each of theſe *Feneſtra* forms a ſort of a ſmall Paſſage, the Thickneſs of a Line. The firſt *Feneſtræ* is called Oval from its Figure, and is ſcituated a little higher than the other. At the end of its Paſſage it has a ſmall Border in the form of Foliage, upon which the Baſis of one of the ſmall Bones, term'd *Stapes*, is placed. The other *Feneſtra*, which is call'd *Rotunda* or Round, though it is like the other of an Oval Figure, has a Groove in the middle of its Paſſage, for the Inſertion of a dry, thin, and almoſt tranſparent Membrane, very like that of the *Tympanum*. *See* Plate VI. Fig. I. Plate VIII. Fig. I, II. and Pate IX. Fig. I.

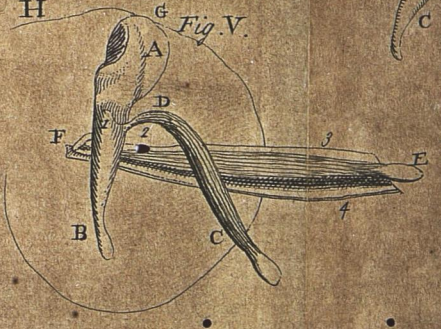
Expla-

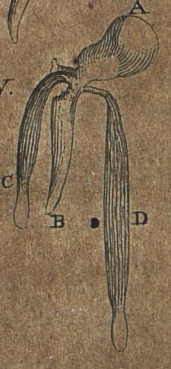
Plate VI.











B Cole Sculp

Explanation of Plate VI.

Fig. I. *represents the same Bone, cut in the same manner as* Fig. I. *of* Plate V. *The whole being also twice as large as Nature, only the* Membrana Tympani *is taken off, to shew the* Officulæ *in their Scituation, and the Inside of the* Tympanum *with its contain'd Parts.* A, *the* Malleus. B, *the* Incus. C, *the* Stapes *seen in the Front, its Head being cover'd by the Beak of the long Branch of the* Incus; *its Basis stopping up the* Feneſtra Ovalis. D, *the* Fundus *of the* Tympanum, *which is the Surface of the* Os Petroſum. E, *The* Feneſtra Ovalis. F, G, *the Semi-Canal, which incloſes the internal Muſcle of the* Malleus. F, *that Part of the Semi-Canal which is ſituated out of the* Tympanum. G, *the part which is in the Inſide of the* Tympanum. H I, *the bony Part of the Paſſage, which goes from the Ear to the Palate, half of it being cut off to ſhew its Cavity.* i, *the End of the Tube, which encloſes the Muſcle of the* Stapes.

Fig. II. *represents the* Incus, *on that Side where it is articulated with the* Malleus. A, *the maſſy Part of the* Incus. B, *the ſhort Branch, placed almoſt in the Front.* C, *the long Branch.* 1, *The firſt Cavity.* 2, *the Second.* 3, *The Eminence betwixt the other two Cavities, mark'd by a punctu'd Line.*

Fig.

Fig. III. *repreſents the* Malleus *on that Side where it is articulated, to ſhew its Eminences and Cavity, which ſerve for its Articulation.* A, *its Head.* B, *its Handle.* C, *the large Proceſs.* 1. *The firſt Eminence;* 2. *The ſecond Eminence;* 3. *The Cavity which is between them, mark'd by a punctur'd Line.*

Fig. IV. *repreſents the* Malleus *with its two Muſcles, the Eye being plac'd in the Aqueduct, to ſhew the Compaſs of the two Muſcles, particularly that of the Internal which croſſes the* Tympanum *in its Progreſs to be join'd to the* Malleus. A, B, *the* Malleus. C, *the external Muſcle.* D, *the internal Muſcle.*

Fig. V. *repreſents the Circumference of the* Tympanum, *and the fore-part of the* Malleus, *with its Muſcles in their Scituation.* A, *the Head of the* Malleus. B, *the Handle.* C, *the external Muſcle of the* Malleus. D, *its Inſertion.* E, *the internal Muſcle.* F, *the Place where it bends, to be inſerted in the Handle of the* Malleus, *below the external Muſcle.* G H, *the Circumference of the* Tympanum; 1. *The large Proceſs of the* Malleus *ſeen in Front;* 2. *The thin Proceſs, into which the external Muſcle is inſerted;* 3, 4. *The nervous Coat of the internal Muſcle, open'd to ſhow the Muſcle.*

This

This Figure serves to explain the Manner in which the two Muscles of the Malleus *act, in the Contraction and Relaxation of the* Membrana Tympani: *For their Insertions make it easily be conceiv'd, that when the external Muscle* C D, *acts alone, the Extremity of the Handle mark'd* B *is drawn outwards, because the Head of the* Malleus *rests against the* Tympanum *at the Place* G; *but when the two Muscles act together, the Extremity of the* Malleus *being drawn inwards by the internal Muscle* E F, *causes a Tension in the* Membrana Tympani; *because the external Muscle* C D, *draws, or at least supports the Head of the* Malleus, *which does not rest against the* Tympanum *at* H, *as it does at* G.

The first among the little Bones contained in the *Tympanum*, which presents itself to View, is called the *Malleus*, because it is thicker at one of its Extremities, call'd the Head, and slenderer at the other, which is called the Handle. The Head of this Bone is fix'd in the above-describ'd Cavity, which is in the Top of the *Tympanum*: At the Side and a little towards the back-part of the Head of this Bone are two Protuberances, and a Cavity for its Articulation with the *Incus*. The other Part of the

3dly, Four little Bones. *The* Malleus.

Bone, which is thinner, ſlenderer, and more elongated, call'd the Handle, is encreas'd in Bulk by two *Proceſſes*, the largeſt of which is outermoſt, and is fix'd to the *Membrana Tympani*: The other, which is on one Side, is ſlenderer and ſmaller, and receives the Tendon of a Muſcle. This Handle leans upon, and is fix'd a little obliquely to the *Membrana Tympani*, and growing flat at its Extremity, is more firmly connected to it in this Place: This little Bone is commonly about the Length of four Lines, and the Diameter of its Head is the Third of its whole Length.

The Incus. The ſecond little Bone is called *Incus*, or *Anvil*, becauſe of its Figure. There are three Parts to be taken notice of in this Bone, *viz.* Its maſſy Part, which makes up the Body of the Bone, and its two Branches which are *Proceſſes*, and ſeem like Legs to it: The maſſy Part has two Cavities and one Protuberance, to anſwer the two Protuberances, and one Cavity of the Head of the *Malleus*, to be join'd to it by that ſort of Articulation which is call'd *Ginglymus*, and which Mechanicks term Hinges. Almoſt all this maſſy Part lies conceal'd in the aforeſaid Cavity, in the Top of the *Tympanum*.

The

The ſhorteſt of theſe Branches is placed at the Entrance of the Paſſage, which goes into the *Proceſſus Mammillaris*, and its Extremity is conceal'd and fix'd by a Ligament in a ſmall Cavity, which is at the Entrance of this Paſſage. The other Branch, which is the longeſt, deſcends perpendicular into the *Tympanum*, and growing curved within, on that Side oppoſite the *Membrana Tympani*, it forms a little Beak which is articulated, by the Help of a fourth Bone, to the *Incus* which is the third Bone.

The *Stapes*, or Stirrop, is ſo call'd from its exact Reſemblance to a Stirrop, having two Branches plac'd upon a flat and oval Baſis, pretty like that part of the Stirrop upon which we lean our Foot; and at the Top it has a ſmall Head, which is like that Part through which the Stirrop is tied. It is in this Part that there is found a little Cavity, to receive the fourth little Bone. The *Stapes* is ſituated in ſuch a manner, that its Head being ſeen in the Front, almoſt hides its Baſis; all the interior Part of the Branches and Baſis of the *Stapes*, is form'd hollow like a Gutter. This ſmall Bone is plac'd almoſt horizontal in this Cavity; its two Branches and its Baſis make a *The* Stapes.

kind of a Frame, to the Bottom of which is fix'd and join'd a Membrane, in the ſame manner as oil'd Paper is fix'd to a Window-Frame. This Membrane is of a fine Texture, and ſtrewed with a great Number of Veſſels. The Baſis of the *Stapes* is ſunk into the *Feneſtra Ovalis*, which it exactly cloſes up: It is fix'd to that Border which is made in the Form of Foliage, and which has been deſcrib'd before, by the Help of a Membrane, which connects it to it ſo exactly, that it can't poſſibly by any Means be ſunk down into the Cavity, which is at the Bottom, nor lifted up to the Top of the *Feneſtra*, without breaking the Membrane.

The fourth little Bone.

The fourth little Bone is of a very inconſiderable Thickneſs, it is a little convex on the Side next to the Head of the *Stapes*, and as much, though but a little concave on the Side, which is articulated with the Beak of the *Incus*.

Theſe ſmall Bones are cover'd with a *Perioſteum*, and there is no Cartilage found at the Places of their Articulation; but they are firmly connected together only by Ligaments which ariſe from their Extremities.

The *Malleus* and *Incus* are of a very compact and ſolid Subſtance; they only

are

are pierced by ſome *Foraminula*, which afford an Entrance for the Veſſels which nouriſh them. The *Stapes* on the contrary is of a very light and porous Subſtance. *See* Plate V. Fig. I, IV, V. VI. VII, IX, *and* X. Plate VI. Fig. I, III, *and* IV; *and* Plate VII. Fig. I, *and* II.

Two of the three Muſcles which are in the *Tympanum* belong to the *Malleus*, the third belongs to the *Stapes*: The Firſt of thoſe which belong to the *Malleus*, may be called External, becauſe it is ſituated upon the exterior Side of the bony Canal, which paſſes from the Ear to the Palate, and continuing its Courſe upwards and ſomewhat backwards, it enters the *Tympanum*, lying concealed in a very oblique *Sulcus*, which is excavated directly above the Bone which has that Groove in it, into which the *Membrana Tympani* is inſerted. This *Sulcus* is that which is ſeen in the upper part of the bony Circle of the *Fœtus*, which we ſhall treat of in the Sequel. This Muſcle after it enters into the *Tympanum* is immediately inſerted into the thin Proceſs of the *Malleus*, which has already been deſcribed. *See* Plate V. Fig. I. Plate VI. Fig. IV, *and* V; *and* Plate VII. Fig. I, *and* II.

4thly, *Three Muſcles, two of which belong to the* Malleus, *viz. The External.*

And the Internal Muſcle.

The ſecond Muſcle may be called Internal, becauſe it is hid in a bony Semi-Canal, ſituated in the *Os Petroſum*, which Bone makes one of the *Parietes Tympani*. One Part of this Semi-Canal is without the *Tympanum*, and is contained in the Top of the Paſſage, which goes from the Ear to the Palate: The other Part, which is within the *Tympanum*, advances as far as the *Feneſtra Ovalis*, and forms in this Place a little Ridge, upon which the Tendon of the Muſcle runs, as upon a Pulley, paſſing from one Side of the *Tympanum* to the other, and is inſerted into the poſterior Part of the Handle of the *Malleus*, a little below the Inſertion of the external Muſcle, to draw it towards the *Os Petroſum*. The Origin of this Muſcle is exactly at the Place where the bony Part of the Aqueduct ends; it is cover'd with a nervous Coat, which forms a Sheath, which accompanies it in all its Courſe, and firmly connects it to the Semi-Canal. *See* Plate VI. Fig. I, IV, *and* V.

And one to the Stapes.

The Muſcle of the *Stapes* is hid in a bony Tube, which is formed out of the *Os Petroſum*, almoſt at the Bottom of the *Tympanum*, from whence this Muſcle takes its Origin: It has a large fleſhy Belly, which ends ſuddenly in a very ſmall Tendon,

don, which is inſerted into the Head of the *Stapes*. The Tube which encloſes the Belly of this Muſcle is about two Lines long, and is much larger at its End, where the Tendon of the Muſcle paſſes through it. *See* Plate V. Fig. VIII. *and* Plate VIII. Fig. I.

A Branch of a Nerve.

The laſt Part to be taken notice of in the *Tympanum*, is the ſmall Branch of a Nerve which paſſes behind the *Membrana Tympani*, which ſome have miſtook for the Tendon of one of the Muſcles which belong to the *Malleus*; but which is a Branch of the fifth Pair of Nerves, which ſhall afterwards be deſcribed.

The ſecond Cavity of the internal Bar called the Labyrinth, is divided into three Parts.

The above-mention'd two *Feneſtræ*, have each of them an opening into a Cavity, which is excavated out of the *Os Petroſum*, which is call'd *Labyrinthus*, from its being very intricate, becauſe of its many Windings: This Cavity is divided into three Parts; The Firſt is that which may be called the *Veſtibulum*, or Entry of the Labyrinth, becauſe it leads to the two others; The Second Part contains three round Canals, which being curv'd in the Half Circle, I ſhall in the Sequel call them the three *Canales Semi-Circulares*; they are placed on that Side the *Veſtibulum*, towards the back-part of the Head: the

Third Part is the *Cochlea*, which is situated on the contrary Side.

1ſt. The Veſtibulum.

The *Veſtibulum* is a Cavity almoſt round, formed out of the *Os Petroſum*, and about a Line and a half in Diameter: It is ſituated behind the *Feneſtra Ovalis*, and covered on the Inſide by a Membrane, furniſh'd with a great many Veſſels. There are nine *Foramina* in it, of which one has been already deſcribed, *viz.* the *Feneſtra Ovalis*, which forms an Entrance from the *Tympanum* into the *Veſtibulum*; the other eight are in the Cavity of the *Veſtibulum*: The firſt leading into the upper Range or *Scala* of the *Cochlea*; the five more which afford an Entrance into the three Semi-circular Canals, and the two laſt through which two Branches of the *Portio Mollis* of the auditory Nerve paſs.

Which has nine Foramina.

2dly, The three Canales Semi-circulares, *viz.*

I ſhall give Names to the three *Canales Semi-circulares* to diſtinguiſh them, and ſhall take thoſe Names from their Situation: The firſt I call *Superior*, becauſe it takes up the upper Part of the Arch of the *Veſtibulum*; the ſecond *Inferior*, becauſe it ſurrounds its lower Part; and the third, which is placed more towards the Outſide, and is ſituated betwixt the other two, *Medius*.

The

The *Canalis Semi-circularis Superior* passing out of the *Veſtibulum*, runs from the fore-part to the back-part, afterwards growing curv'd turns a little from the back to the fore-part, proceeding as far as the Middle of the poſterior Part of the *Os Petroſum*, making a little more than a Half-Circle, and there it unites with the *Canalis Inferior*. Canalis Semi-circularis *Superior*.

The other which I call *Canalis Inferior*, comes from the inferior Part of the *Veſtibulum*, and forms alſo a little more than a Semi-Circle, and joins itſelf to the ſuperior Canal, as has been before deſcribed. Theſe two Canals being joined together form but one, which advancing forwards a little obliquely, opens into the Middle of the *Veſtibulum*. *Inferior*.

The third, which I call *Medius*, has its two ſeparate Orifices, and forms no more than its Semi-Circle. The Bore of theſe Canals is ſometimes round and ſometimes oval, and is enlarg'd towards their Extremities, like the broad End of a Trumpet. Medius.

The ſix Extremities of theſe three *Canales Semi-circulares*, form only five Orifices into the *Veſtibulum*, ſince there is one of theſe Orifices common to both the Extremities of the ſuperior and inferior

Canals, as aforesaid. These Orifices are disposed in such a Manner, that there are two at the Top, two at the Bottom, and one in the Middle of the *Vestibulum*.

The first, to begin from the Top to the Bottom, is the Orifice of the *Canalis Semicircularis Superior*, the other is one of the Orifices of the *Canalis Medius*: These two Orifices are separated near their Entrance into the *Vestibulum*, only by a small bony Ridge, which ends insensibly as it enters into the *Vestibulum*.

As for the two Orifices which are at the lower Part of the *Vestibulum*; the first, reckoning from the Top to the Bottom, is that of the *Canalis Inferior*, and that which is situated above it is the other Orifice of the *Canalis Medius*.

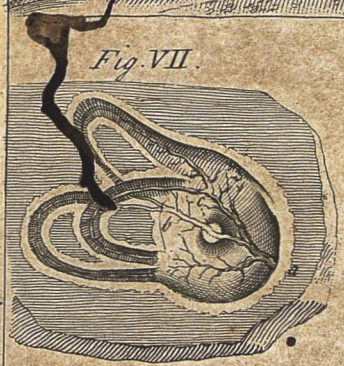
The Orifice which is in the Middle of the *Vestibulum*, and which is the largest of them all, is that which is common to the superior and inferior Canals. *See* Plate X. Fig. I, IX.

Explanation of Plate X.

Fig. I. *represents the temporal Bone twice as large as Nature; it is prepar'd in such a manner that it shews the* Cochlea, *and the Semi-circular Canals in their natural Situation.*

Plate X.



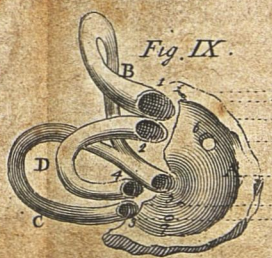


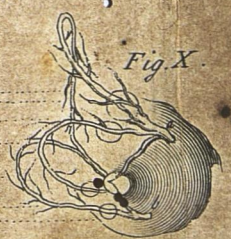














B Cole Sculp

ation. A, *the Vault of the* Veſtibulum. B, *the* Feneſtra Ovalis, *mark'd by a punctur'd Line.* C, *the* Feneſtra Rotunda *open.* D, *the* Lamina Spiralis *mark'd by a punctur'd Line, diveſted of the ſpiral Canal which covers it, and of the Membrane which connects it to the Surface of this Canal.* 1, 2, 3, *the three Semi-circular Canals in their natural Situation.* 1. *the Superior.* 2. *the Middle.* 3. *the Inferior. The Middle and the Inferior are open, to ſhew that they are hollow.*

Fig. II. *repreſents the Inſide of the Covering of the* Cochlea *taken off, to ſhew the Semi-oval Spiral Canal.*

Fig. III. *repreſents the Height of the* Cochlea *much larger than Nature, to ſhow it thus, The fore-part of its Covering only is taken off by a perpendicular Section: This ſhews how the* Lamina *makes two Turns and a Half round the Axis, how it is fix'd to the Surface of the Canal which ſerves as an Arch to it, and how the Sides of this Canal, which are connected to the Axis, become as thin as the* Lamina. A, *the inferior Portion of the* Veſtibulum, *which is put into this Figure, and only left to ſhew how the* Lamina Spiralis *proceeds out of its Cavity, and paſſes before the* Feneſtra Rotunda. B, *the* Feneſtra Rotunda *clos'd up*

by a thin Membrane, like the Membrana Tympani. 1, 2, 3. *The two Circumvolutions and a half of the* Lamina Spiralis *round the Axis.* 4, 5, 6, *The two Turns and a half of the Spiral Canal.*

Fig. IV. *represents the* Lamina Spiralis *in the Air much larger than Nature, with the Membrane which connects it to the Surface of the Canal.* 1, 2, 3, *The* Lamina Spiralis. 4, 5, 6, *The Membrane which is fix'd to it, and which is distinguish'd from it by a Line, which is drawn between both.*

Fig. V. *represents the Axis much larger than Nature, upon which the Traces of the Circumvolutions of the* Lamina Spiralis, *and of the Spiral Canal are remarkable.* 1, 2, 3. *The Traces of the Windings of the* Lamina Spiralis, *which are perforated by a great many* Foraminula, *which afford a Passage to the Filaments of the auditory Nerve.* 4, 5, 6. *The Traces of the Side of the Spiral Canal.*

Fig. VI. *represents the* Cochlea *standing, and half of it cut perpendicularly off, much like* Fig. III. *except that all the Bone is here taken away: This Figure is made for the better comprehending that third Figure, and for its Explanation it is sufficient to remark, that the* Lamina *appears here disengag'd from the Surface of the Canal, that it may shew the Inside of this same Canal, and how*

its

its Sides are elongated to be connected to the Axis.

Fig. VII. *represents the* Veſtibulum *and the three Semi-circular Canals open, to ſhew the Diſtribution of their Veſſels.* a, *the Branch of an Artery which enters into the* Veſtibulum. b, *a Ramification of this Artery, which paſſes through the common Orifice of the* Veſtibulum, *and which is diſtributed into the ſuperior and inferior Canals.* c, *the Ramification which furniſhes the middle Canal.*

Fig. VIII. *repreſents the Arteries of the* Cochlea, Veſtibulum, *and three Semi-circular Canals.* A, *the* Feneſtra Rotunda. B, *the Orifice of the Paſſage which gives Entrance to the Veſſels, which is at the Entrance of the* Scala Inferior *of the* Cochlea; *it ſhews that one Part of theſe Veſſels is diſtributed into the* Cochlea, *and the other into the* Veſtibulum, *and the three Semi-circular Canals; theſe laſt are repreſented as in the Air.*

Fig. IX. *repreſents a Portion of the* Veſtibulum *and the three Semi-circular Canals in the Air, to ſhew their natural Situation and their Orifices.* A, *the Inferior Portion of the* Veſtibulum. B, *the Superior Canal.* C, *the Inferior.* D, *the Middle.* 1, *the Orifice of the ſuperior Semi-*

Semi-circular Canal. 2, *the first Orifice of the middle Canal.* 3, *the Orifice of the inferior Canal.* 4. *the other Orifice of the middle Canal.* 5, *the common Orifice to the superior and inferior Canal.* 6, *the first* Foramen, *which affords an Entrance to one of the Branches of the* Portio Mollis. 7, *the second* Foramen, *which affords an Entrance to another Branch of the same Nerve.*

Fig. X. *represents the* Vestibulum, *in the same Disposition as in the preceeding Figure, with the Nerves of the three Semi-circular Canals in the Air.* a, *a Branch of a Nerve, which enters into the* Vestibulum *by a* Foramen *mark'd* 6, *in* Fig. IX. *It is divided into three Branches, the first of which enters into the Orifice of the superior Semi-circular Canal, the second into the superior Orifice of the middle Canal, and the third which is the least descends to cast itself into the common Orifice.* b, *the Branch which enters by the* Foramen, *mark'd* 7 *in* Fig. IX. *and is divided into two Ramifications, the Inferior of which enters into the Orifice of the inferior Canal, and the other advances into the common Orifice, and unites with the third Ramification of the Branch mark'd* a. *These Nerves are represented somewhat larger than Nature.*

On

On that Side of the *Vestibulum* near the Face, opposite to the three Semi-circular Canals, we meet with the third Part of the Labyrinth, call'd the *Cochlea*, which is compos'd of two Parts, *viz.* Of a Semi-oval spiral Canal, and a *Lamina*, which runs spirally upwards. This *Lamina* follows the Course of the Canal, and separates it into two.

3*dly*, *The* Cochlea, *in which two Things are to be taken notice of*, viz.

This Semi-oval Canal is excavated out of the interior Part of the *Os Petrosum*, it covers the *Lamina Spiralis* in the Form of a Vault, and which makes a Dint in the Surface of this Bone, which advances forwards into the Inside of the *Tympanum*, opposite to the *Membrana Tympani*: This Dint is elongated and terminates in a small Ridge, which makes the Separation between the two *Fenestræ*, as above-described. The Canal makes two Turns and a half round the Axis, diminishing and growing narrower as it proceeds upwards: Its Sides, which are fix'd to the Axis, diminish so much of their Thickness, the nearer they approach it, that they appear as thin as the *Lamina*.

1. *The Semi-oval Canal.*

The *Lamina Spiralis* separates this Canal into two Parts, in which it is contain'd, being fix'd to the Axis by its *Basis*, and by its other Extremity to the Surface of

2. *The* Lamina Spiralis.

of the Canal oppoſite to the Axis, by means of a very fine Membrane, much thinner than the *Lamina*, and of a darker Colour; which does not proceed in a plain *Superficies* like the *Lamina*, but turns a little downwards. This Membrane, as it unfolds itſelf, lines the interior Part of this Canal: It is eaſy to imagine, that in taking out the Axis from this Vault in the *Cochlea* which ſurrounds it, there muſt of Neceſſity appear four entire Rounds, and two half Rounds, *viz.* Two Rounds and a half of the Semi-oval Canal, and two Rounds and a half of the *Lamina Spiralis*. This *Lamina* is hard and brittle; its Baſis near the Axis is perforated with many oblique *Foraminula* in the ſame manner as the Axis is; the other Extremity of the *Lamina* is very thin, firm, and tenſe.

Which is fix'd to the Canal by a very fine Membrane,

The Canal of the *Cochlea* being thus divided into two *Scalæ* or Ranges of Stairs in the *Cochlea*, built upon the ſame Axis, one above another, which have no Communication one with another, they have only two ſeparate Orifices, one of which forms an Entrance from the *Veſtibulum* into the *Scala Superior* of the double Range; the other, which is the *Feneſtra Rotunda*, affords a Paſſage from the *Tympanum* into the *Scala Inferior*.

And which divides this Canal into two.

See

See Plate X. Fig. I, II, III, IV, V, *and* VI.

There is an Orifice in the inferior Part of the *Os Petrosum*, below that through which the auditory Nerve enters, which forms a Paſſage for an Artery and a Vein, which are Branches of the internal Carotids and Jugulars: This is the Entrance of a Canal, which proceeding about the Length of a Line and a half, opens into the *Scala Inferior* of the *Cochlea*, near the *Feneſtra Rotunda*. There Veſſels entring in this Place divide themſelves into a great many Branches, which are diſtributed to the *Lamina Spiralis*, and to the Membrane that lines the Inſide of the Spiral Canal. This Artery alſo in its Entrance furniſhes a conſiderable Branch to the *Veſtibulum*, which as it enters is divided into two Ramifications, one of which is extended on the right Side, and the other on the left. Theſe two Ramifications are commonly ſubdivided again into two more, one of which enters by the Orifice of the *Veſtibulum*, which is common to the ſuperior and inferior Semi-circular Canals, and divides itſelf into two ſmall Filaments, which are diſtributed on the Inſide of theſe Canals: the other Branch entring at the ſuperior Orifice of the middle Canal,

And 3dly, The Arteries and Veins of the Cochlea.

And of the Veſtibulum.

nal, re-enters into the *Veſtibulum* by its other Orifice. Theſe Ramifications form *Anaſtomoſes* in many Places in the Inſide of the *Veſtibulum*: The Veins follow the ſame Courſe as the Arteries.

4thly, The implanted Air. Since the two *Feneſtræ*, which enter into the Cavities of the Labyrinth, are exactly ſtopt up, one by the Baſis of the *Stapes*, the other by its Membrane, it is eaſy from hence to conclude, that the Air which is confin'd in this Place can have no Communication neither with that in the *Tympanum*, nor conſequently with the external Air; and this Air is that without doubt which Anatomiſts have term'd Implanted Air. *See* Plate X. Fig. VII. *and* VIII.

The other Parts of the Organ *of* Hearing, *are the Canal of the auditory Nerve.* The Canal through which the auditory Nerve paſſes is very large. It is form'd out of the middle of the hinder Part of the *Os Petroſum* next the Brain, and proceeeding obliquely backwards about the Length of two Lines, it forms an impervious Paſſage, whoſe Bottom is partly terminated by the Baſis of the *Cochlea*, and partly by a Portion of the Arch of the *Veſtibulum*: At the Extremity of this impervious Paſſage there is a ſmall bony *Septum*, which ſeparates the Baſis of the *Axis* from the *Foramen*, through which the

the *Portio Dura* of the auditory Nerve passes.

The *Nervus Auditorius* arises from the posterior Side of that Protuberance, which Modern Anatomists have call'd *Annular*, about the Distance of a Line from a small Lobule of the *Cerebellum*, which is fix'd to the Origin of this *Processus Annularis*: This Nerve is compos'd of two Branches, the uppermost of which is the largest, and term'd *Portio Mollis*, because it is not only in Reality more tender and soft than that which accompanies it, but also than all the other Nerves of the *Medulla oblongata*, except the Olfactory Nerves. The inferior Branch is called *Portio Dura*, not only because it is more fibrous and compact; but also because it passes out of the *Cranium*, whereas the *Portio Mollis* loses itself in the *Organs* of *Hearing*. These two Branches run strait and parallel as far as the *Foramen* of the *Os Petrosum*, proceeding about the Length of three Lines; and as soon as they enter into it, the *Portio Dura* passes above the other. It is at the Bottom of this impervious Passage which we have already describ'd, that the *Portio Mollis* is divided into three Branches; the most considerable of which being come to the Basis of the *Axis*, seems to terminate and

Nervus Auditorius.

Is divided into two Branches, viz. *The* Portio Mollis.

The Portio Mollis *divided into three Branches*; *the largest of which is distributed into the* Axis *of the* Cochlea.

and be loſt in this Place: Whereas in reality it enters into thoſe above-mention'd oblique *Foraminula*, and is divided into many ſmall Filaments which are diſtributed to each Winding of the *Lamina Spiralis*. The Diviſion and Diſtribution of this Nerve may well be compared with that of the Olfactory Nerve, which being come to the Root of the Noſe ſeems to be terminated in this Place, and many Anatomiſts have believed that it really terminates here; but if they examine it ſtrictly, they would find the Nerve divided into ſmall Fibres, which are cover'd with the *Dura Mater*, paſſing thro' the ſmall *Foramina* of the *Os Cribroſum*, and entring into the Cavity of the Noſtrils, are diſtributed to the Membrane, which lines the *Laminæ* of the Noſe. *See* Plate XI. Fig. I, II, *and* III.

Explanation of Plate XI.

Fig. I. *repreſents the Baſis of the* Cerebrum *diveſted of all its Veſſels, to ſhew the Origin of the ten Pair of Nerves, which proceed from the* Medulla Oblongata; *all that Part of the Subſtance of the* Cerebrum, *which Mr.* Willis *call'd its Poſterior Lobes, is cut off*; i. e. *the Inciſion paſſes through that*

that Place, where a great lateral Branch of the carotid Artery is ſent off upon the Subſtance of the Cerebrum, *into the Interſtice of its Lobes: This Inciſion ſerves to diſcover the true Origin of the firſt Nerves, and to place the* Cerebellum, *which in a revers'd Brain is always found ſupported by the poſterior Lobes, in the ſame* Superficies *as the* Cerebrum; *which is abſolutely neceſſary to ſhew the true Figure of the* Medulla Oblongata, *and the Origin of all the Nerves which proceed from it.* A A, *the fore-part of the* Cerebrum *revers'd.* B B, *the* Cerebellum. C C, *the Place where a Part of the* Cerebrum *has been cut off; this Cut is mark'd but on one Side, but we may ſuppoſe the ſame on the other.* D D, *the* Corpora Striata, *which are the Origins of the* Medulla Oblongata, *their poſterior Part is here ſhewn, and a Portion of them is cut off with the* Cerebrum. E E, *the* Nervorum Opticorum Thalami. F, *the* Medulla Oblongata, *whoſe two Branches are united in this Place, although Mr.* Willis *fancied they were divided.* G, *the* Proceſſus Annularis. H H, *the firſt Pair of Nerves, nam'd the Olfactory, which take their Origin from the Baſis of the* Corpora Striata, *by a medullary Fibre mark'd* h h, *and which increaſes in Bulk in the Place*

where

where they wind about, near the optic Nerves. I I, *the optic Nerves, or the second Pair of Nerves, which from their Origin from the* Thalami *are shewn as far as to their Exit out of the* Cranium. K K, *the third Pair of the Nerves, call'd* Oculorum Motorii. L L, *the fourth Pair of Nerves, call'd* Pathetici. M M, *the fifth Pair of Nerves.* N N, *the sixth Pair of Nerves.* O O, *the auditory Nerves, which form the seventh Pair; they are divided from their Origin into two Branches, the largest of which, which is the uppermost, is the* Portio Mollis. P P, *the eighth Pair of Nerves, which proceed out of the* Medulla, *below the two Eminencies mark'd* y y. Q Q, *the ninth Pair of Nerves, which is mark'd but on one Side of the* Medulla, *and is even placed out of its Direction, for fear of rending the Figure puzzling, on the other Side we have contented ourselves with shewing the Origin.* R R, *the tenth Pair of Nerves which proceed out of the* Medulla Oblongata, *which Mr.* Willis *has confounded with the first vertebral Pair.* S, *the* Medulla *cut off at its Entrance into the* Vertebræ. T T, *the two Nerves which proceed out of the* Medulla Spinalis, *in the Inside of the Cavity of the* Vertebræ *of the Neck, and ascend up into the* Cranium, *to*

be

e united to the eighth Pair of Nerves. u, *he* Infundibulum. x x, *two small medul-ary Processes, which Mr.* Willis *has taken for Glands.* y y, *two Eminences of the* Medulla *form'd in the Shape of Olives, which Mr.* Willis *has call'd* Corpora Py-midalia. z z, *two small Filaments of erves which proceed out of the* Medulla, *to be united to those Nerves which come from he Spi[illegible]d are join'd to the eighth Pair; ometimes two or three of these Filaments of Nerves are found on each Side.*

Fig. II. *represents the back-part of the* Os Petrosum *much larger than Nature, and as much of it taken off as was necessary to discover the three Semi-circular Canals, and the impervious Passage, which terminates the Canal of the auditory Nerve, and to shew all the* Foramina *which we find there.* A, *the Canal of the auditory Nerve taken off.* B, *the Semi-circular Canals.* C, *the Basis of the* Axis *of the* Cochlea, *pierc'd by a great Number of small* Fora-raminula, *which give Entrance to the ner-vous Filaments, which are distributed to all the Turnings of the* Lamina Spiralis. D, *the Entrance of the Canal which incloses the* Portio Dura. e, *the* Foramen *which gives Entrance to the Branch mark'd* e *in* Fig. III. f. *another* Foramen *which gives Entrance*

to

to the third Ramification of the Portio Mollis, *mark'd* f, in Fig. III.

Fig. III. *represents the auditory Nerve much larger than Nature, which appears as if it were torn off from the* Os Petrosum, *to shew how it is divided at the Bottom of the Passage.* A, *the auditory Nerve divided into two Branches.* B B, *the* Portio Mollis. C C, *the* Portio Dura, *part of which is plac'd at the Top of the Figure, to shew the Filaments of one of the Branches of the* Portio Mollis. *The Trunk of the* Portio Dura *enters into the* Foramen *marked* D, *in* Fig. II. D, *a large Branch of the* Portio Mollis, *which is divided in a great many small Filaments which enter into the* Foraminula, *which are situated at the Basis of the* Axis *of the* Cochlea, *and are distributed to all the Circumvolutions of the* Lamina Spiralis. e, *another Branch of the* Portio Mollis, *which enters into the* Foramen, *mark'd* e, *in* Fig. II. f, *the third Branch of the* Portio Mollis, *which enters through the* Foramen, *mark'd* f, *in* Fig. II. *See the Distribution of these two last Branches in* Plate X. Fig. X. *the Branch* e, *is there mark'd by the Letter* a, *and the Branch* f, *by the Letter* b.

The

The two other Ramifications of the *Portio Mollis*, are for the use of the *Vestibulum*. The most considerable of these two Branches run in at the Entrance of the Canal of the *Portio Dura*, and afterwards enters obliquely into a particular *Foramen*, which opens into the Arch of the *Vestibulum* at the side of the Orifice of the superior Canal of the *Cochlea*: This Ramification, as it enters, forms a sort of a Tuft, one Part of which proceeds into the Orifice of the superior semi-circular Canal, and into that of the anterior or middle Canal, joining them together, and partly shutting them up; afterwards it furnishes a small nervous Filament to each of these Canals, joining it self to an Artery which is distributed to these Parts, and proceeding every where with it in the same Course; the other Part of the Tuft is elongated at the bottom of the *Vestibulum*, and produces a small Twig, which enters into the common Orifice.

The two other Branches into the Vestibulum.

And into the Semi-circular Canals.

The second Branch of the *Portio Mollis*, which is destin'd for the use of the *Vestibulum*, enters into a very oblique *Foramen*, which opens a little below the above-describ'd Branch: This Nerve at its entrance into the *Vestibulum*, is di-

vided into two ſmall Twigs; one of which enters into the Orifice of the inferior Canal, which is ſituated at the bottom of the *Veſtibulum*, and the other aſcends towards the common Orifice. All theſe ſmall Ramifications of Nerves, have a Communication with one another. *See* Plate X. Fig. X.

The Portio Dura,

The *Portio Dura* enters into a *Foramen*, ſituated near the upper Part of the *Fundus* of that impervious Paſſage, which we have already deſcrib'd. This *Foramen* is the entrance of the bony Canal, which is form'd out of the *Os Petroſum*, running obliquely towards the *Tympanum*, into which it does not penetrate, but only inſinuates it ſelf into the Surface of the *Os Petroſum*, which makes one of the *Parietes* of the *Tympanum*. This Canal proceeding down to the Top, and by the Side of the *Feneſtra Ovalis*, and to the upper Part of the little Canal, which incloſes the *Muſculus Stapedis*, deſcends yet lower; and having proceeded about two lines and an half, being all along cover'd by the *Os Petroſum*, it paſſes out thro' a *Foramen*, which is between the *Maſtoid* and *Styloid Proceſſes*. This Nerve before it protrudes out of its *Foramen*, receives a Ramification from a

Nerve

Nerve of the fifth Pair, which passes behind the *Membrana Tympani*, which we shall describe in the Sequel. This same *Portio Dura* at its Exit out of the *Foramen*, furnishes a Ramification, which ascending towards the back part of the Ear, is expanded over all the Parts of the exterior Ear, and near the *Processus Mammillaris*. It furnishes many other Branches which are distributed to other Parts, of which we shall treat at the End of this Description. *See* Plate XI. Fig. II. Plate XII. Fig. I, II, and III.

Which produces as it passes out of the Cranium, *a Ramification which is expanded over the back part of the Ear.*

Explanation of Plate XII.

Fig. I. *represents the Surface of the* Os Petrosum, *twice as large as Nature, to shew the bony Canal, thro' which the* Portio Dura *passes, and that thro' which the* Chorda Tympani *descends to be join'd to the* Portio Dura. A, *the* Processus Mammillaris. B, C, *the bony Canal which is in the* Tympanum. C, D, *part of the same Canal which is situated without the* Tympanum, *and which is excavated out of the* Os Petrosum. *Its Extremity lies between the* Processus Mammillaris *and* Styloides. E, *the little Canal of the* Os Petrosum, *thro' which the small Nerve of*

the Tympanum *passes to be join'd to the* Portio Dura.

Fig. II. *represents the* Portio Dura *bare, extracted from its Canal, with the little* Chorda *which crosses the* Tympanum. A, B, *part of the* Portio Dura, *which is inclos'd in the* Tympanum. B, C, *part of the* Portio Dura, *which is conceal'd in the* Os Petrosum. D, E, *that part of the* Chorda *which crosses the* Tympanum. E, F, *part of the same* Chorda, *which passing out of the* Tympanum, *hides it self in the little Canal, mark'd* E, *in the first Figure of this Plate, and which is join'd to the* Portio Dura. F, *the place where this little Nerve joins with the* Portio Dura.

Fig. III. *represents the Ear revers'd, to show the Ramification of the* Portio Dura, *which is distributed upon it.* A, *the Ear revers'd.* B, *the* Processus Mammillaris. C, *the Trunk of the* Portio Dura, *passing out of the* Os Petrosum. D, D, *the first Ramification of this Nerve which ascends up the back Part of the Ear, and distributes a great many Filaments to it, and to the* Processus Mammillaris. E, *the Division of the* Portio Dura *into two Branches.* F, *the superior Branch.* G, *the inferior Branch.*

The

The little Nerve which croſſes the *Tympanum*, takes its Origin immediately from a Branch of the fifth Pair, which proceeding downwards, is diſtributed on the Side of the Tongue; afterwards this Nerve reaſcends up to the exterior Side of the bony Canal of the Aqueduct, and following the Courſe of the external Muſcle of the *Malleus*, upon which it is plac'd, it enters into the *Tympanum* through the ſame *Foramen*; afterwards it repaſſes under the Tendon of the internal Muſcle, and deſcending obliquely backwards, it leans upon the *Membrana Tympani*, and paſſing before the long Branch of the *Incus*, it comes out of the *Tympanum*, running into a ſmall Canal, which is form'd out of the *Os Petroſum*, and joins to the Trunk of the *Portio Dura*, a little before the *Portio Dura* is protruded out of its Canal. It is this ſmall Thread of a Nerve, which Anatomiſts have conſider'd as the *Chorda Membranæ Tympani*, and which they fancied might cauſe ſome Sound in communicating its Agitations to this *Membrane*, in the ſame manner as a Cord does, which they put upon a Skin of a Drum. But although it is true, that this *Chorda* touches the *Membrana Tympani*,

The Chorda Tympani, *is a Nerve which is a Branch of the fifth Pair.*

Which is join'd to the Trunk of the Portio Dura.

pani, if we but examine its Structure, we ſhall ſoon diſcover its Uſe. For beſides its Origin, which plainly makes it appear that it is a Nerve, its diſtribution leaves no room to doubt of it; there being no Nerve, which is diſtributed either to the Muſcles or the *Officula*, or to the other Parts which are contain'd in the *Tympanum*. *See* Plate VII. Fig. I, *and* II. Plate XIII. Fig. I. *and* Plate XII. Fig. I, *and* II.

Explanation of Plate XIII.

This repreſents the whole temporal Bone as large as Nature, ſomewhat revers'd, and the under Part ſhewn, with the Branch of the fifth Pair of Nerves, which is diſtributed to the lower Jaw, to ſhew the Origin and Courſe of that ſmall Twig of a Nerve, which is call'd the Chorda Tympani, *and the diſtribution of another Ramification of this ſame Nerve, which goes to the external Ear.*

A, *the ſcaly Part of the temporal Bone.* B, *the* Proceſſus Mammillaris. C, *the* Proceſſus Styloides. D, *the* Zygomaticus. E, *the Paſſage which goes from the Ear to the Palate.* F, *the Branch of the fifth Pair call'd the inferior maxillary Nerve, becauſe it is particularly diſtributed to the lower Jaw, and to the Part which* ſur-

to Face page 54

Plate XIII



B Cole Sculp

ſurrounds it. 1, 2, 3, 4. *Four Ramifications that this Branch furniſhes immediately after its Exit from the* Cranium, *the* 1. *of which goes to the temporal Muſcle.* 2. *to the external Maſſeter.* 3, *to the* Buccinator, *and to the Glands of the Cheek.* 4. *to the* Pterygoideus internus. G, *another Ramification which it alſo ſends off at its exit.* H, *a Branch of this Ramification, which goes to join the Ramification of the* Portio Dura, *mark'd* 6, *in the* XVIth *Plate.* I, *the Diſtribution of the Ramification* G, *to the external Ear, the Branches of which are cut off.* K, *the Branch which enters into the lower Jaw cut off.* L, L, *the Branch which goes to be diſtributed to the Sides of the Tongue.* M, M, *a Ramification of this Branch which aſcends over the bony Part of the Paſſage of the Aqueduct, and enters into the* Tympanum; *and this is what is call'd the* Chorda Tympani. N, *the external Muſcle of the* Malleus *in its Situation.*

The ſecond vertebral Pair, furniſhes a Branch to the Ear.

Laſtly, The ſecond vertebral Pair ſends forth a conſiderable Branch, which goes up to the Ear: It creeps under the Skin, the Length of the *Muſculus Maſtoideus*, and of the parotid Gland, and parts into three Branches near the Ear, one of

which is expanded upon the back Part, and upon the End of the Ear, and the third diſtributes its Fibres into the cartilaginous Paſſage.

It is here proper to take notice, that Mr. *Willis* makes this Branch of a Nerve proceed from the firſt vertebral Pair: The Reaſon of this is, that he ſuppoſes, that the tenth Pair of the Nerves of the *Medulla Oblongata* paſſes out no where elſe but between the firſt and ſecond *Vertebræ*, and ſo he reckons for the firſt Pair of the *Medulla Spinalis* that which iſſues out into the *Interſtitiæ* of the ſecond and third *Vertebræ*: But the Reaſon of this Error proceeds from his not knowing the Egreſs of the tenth Pair, which he has confounded with the firſt vertebral Pair; tho', theſe two Nerves have different Origins, Exits, and Diſtributions. *See* Plate XIV. Fig. I.

Explanation of Plate XIV.

A, *the* Proceſſus Mammillaris. B, *the back Part of the Ear.* C, *the Trunk of the ſecond vertebral Pair.* 1, 2, 3, 4, 5, 6, 7. *Many Branches cut off, that this Nerve ſends to the neighbouring Muſcles, and to the vertebral Nerves.* D, D, *the*



B. Cole Sculp.

the Branch of this Nerve, which ascends up to the external Ear. E, *the Branch which is lost in the Lobe of the Ear, and in the cartilaginous Passage.*

There are many particular Things in the Ear of a Fœtus.

After having explain'd the Structure of the Ear, in Subjects of eighteen or twenty Years old, we thought it necessary to take notice, in what it differs from the Ear of a *Fœtus.*

1. That Part of the auditory Passage, which is bony in Adults, is nothing but a Membrane in the Fœtus.

1. The bony Canal of the auditory Passage is, in the *Fœtus*, nothing but a pretty hard Membrane, join'd by one of its Extremities to the cartilaginous Passage, and by the other it adheres to the *Membrana Tympani*, by the help of a Groove in the bony Circle, which we are going to describe: This Passage, which in Adults is about five or six Lines long, is not above a Line and a half in length; and what appears to us of it, is really nothing else but what serves to form that part of the Canal, which grows flat towards the *Fundus*. *See* Plate XV. Fig. I.

Explanation of Plate XV. which represents many Parts of the Ear of a *Fœtus.*

Fig. I. *represents the Ear of a Child one Year old.* A, *the upper Part of the*

Ear. B, *its cartilaginous Paſſage.* C, *the Membrane which connects the cartilaginous Paſſage to the bony Ring, and which indurates afterwards to form the beginning of the bony Paſſage of the Ear.* D, *the bony Ring.* E, *the* Proceſſus Zygomaticus.

Fig. II. *repreſents the forepart of the temporal Bone of a* Fœtus. A, *the ſcaly Part, whoſe ſmall bony Fibres are eaſily diſtinguiſh'd, as they are alſo in all the other Bones which compoſe the* Cranium *of a* Fœtus. 2, 3, *the Sides of its Circumference, which are yet Cartilaginous.* B, *the* Proceſſus Zygomaticus. C, *the* Membrana Tympani. D, *the bony Ring which receives the* Membrana Tympani. E, *the* Proceſſus Styloides, *which is as yet cartilaginous.* F, *the* Proceſſus Mammillaris, *which is yet very ſmall.* 4, *the* Foramen, *thro' which the* Portio Dura *paſſes out.* G, *this Letter marks an obſcure Line, which is the Place where the ſcaly Part is ſeparated from the* Proceſſus Mammillaris; *theſe two bony Pieces are exactly united in Adults.* H, *the Canal, which incloſes the internal* Carotid. I, *the* Foramen *where the Tube which goes from the Ear to the Palate is connected.*

Fig.

Fig. 2.



Fig. 3.

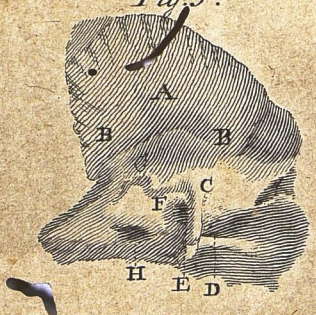


Fig. 5.



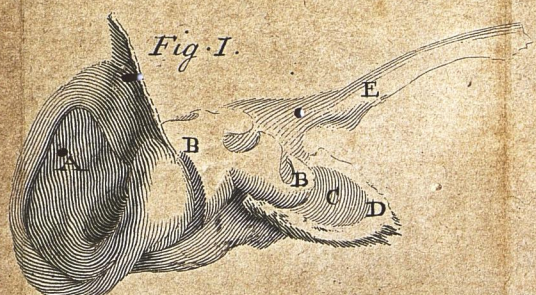
Fig. 4.



Fig. 6.



Fig. 1.



B Cole Sculp

Fig. III. *repreſents the back part of the temporal Bone.* A, *the ſcaly Part.* B, B, *the Place where it ſeparates from the reſt of the* Os Petroſum. C, *the ſuperior Semicircular Canal, which is ſeen without any Preparation.* D, *the Inferior.* E, *the Place of their Communication.* F, *A conſiderable* Foſſa, *which is ſituated under the ſuperior Canal, and which is fill'd up and effaced as the* Fœtus *grows older.* G, *a* Foramen, *which is in the Paſſage of the* Portio Dura. H, *the* Foramen *of the auditory Nerve.*

Fig. IV. *repreſents the bony Ring, leaning a little to ſhew the Groove.* A, *the bony Ring leaning on one Side.*

Fig. V. *repreſents the ſame Ring, leaning in another manner, to ſhew the reſt of its Groove.*

Fig. VI. *repreſents the* Membrana Tympani, *twice as large as Nature, half of it diſcover'd from a Membrane, which covers it.* A, *the* Membrana Tympani. B, *a mucilaginous Matter indurated into a Membrane which covers it in the* Fœtus.

In the *Fœtus*, we find a Circle which is plac'd exactly above the Entrance of the *Tympanum*: this Circle is eaſily ſeparated from the *Os Temporum*; and may plainly be ſeen with the *Membrana Tympani*,

2. *There is a Circle.*

pani, when the Ear and auditory Paſſage is remov'd.

Which is not entire. This Circle is broke off about half a Line in its upper Part, near the Place where the Head of the *Malleus*, and the maſſy Part of the *Incus*, are conceal'd in the *Tympanum*; this interruption is found in Adults, as we have ſaid before, and in this Place the *Membrana Tympani* is directly fix'd to the Edge of the Extremities of the bony Canal, belonging to the external Ear.

It is hollow on the Inſide like a Gutter. In the Inſide of this Circle, there is a ſmall Cavity, which runs hollow through its whole Circumference, which forms the above-mention'd Groove, in which the *Membrana Tympani* is inchas'd. We muſt alſo take notice of a ſmall Sinuoſity in its ſuperior Part, upon which the external Muſcle of the *Malleus* runs: This Sinuoſity is alſo found in Adults.

This Circle is united to the bony Canal in Adults. Although this ſmall Circle is eaſily diſtinguiſh'd, and ſeparated in new-born Infants, yet it diſappears in Adults, and forming but one Body with the bony Canal, it is impoſſible to ſeparate it. One may diſtinguiſh it in Children of three or four Years old, but it is ſo ſtrongly fix'd to the temporal Bone, that it is not to be ſeparated from it. We muſt take notice

that

that it begins to join by its two Extremities, and insensibly through the rest of its circumference.

There is no room to doubt, but that the Groove into which the *Membrana Tympani* is fix'd, is the same as the Cavity in the bony Circle, since the *Membrana Tympani* has constantly the same Situation, and the same Plan in the *Fœtus*, which it has in the Adult. *See* Plate XV. Fig. IV.

It has the same Plan, both in the Fœtus *as in the* Adult.

3. The Passage which goes from the Ear to the Palate, which in Adults is partly bony, and partly cartilaginous, is almost entirely membranous in the *Fœtus*, and its bony Part becomes insensibly ossified, as the *Fœtus* advances in Age, in much the same manner as the bony Canal of the auditory Passage does.

3. *The* Aqueduct *almost entirely* Membranous.

4. During the Time, the *Fœtus* remains in the *Uterus*, the *Membrana Tympani* is cover'd with a mucilaginous Matter, which indurates into a *Membrane*, but afterwards it disappears. *See* Plate XV. Fig. VI.

4. *The* Membrana Tympani *is cover'd with mucilaginous Matter.*

Besides these, in the posterior Part of the *Os Petrosum*, there are some pretty remarkable Differences to be seen.

The *Canalis semi-circularis Superior* of the *Labyrinth*, may be distinguished

5thly, *The superior Semi-circular Ca-*

and

nal, and a Portion of the Inferior are visible, without any Diſ-ſection.

5thly, There is a Foſſa *and a* Fora-men, *in the* Os Petroſum.

7thly, The ſcaly Part of the Temporal Bone is ſeparable from the Pro-ceſſus Mam-millaris, *which is ve-ry minute.*

8thly, The Officula, *and the* Laby-rinth *are of pretty nigh the ſame Size, in the* Adult, *and in the* Fœtus.

The Trunk of the Portio Dura, *has two principal*

and ſeen almoſt without any Preparation, as may alſo a Portion of the *Canalis Semicircularis Inferior*, at the Place where it communicates with the inferior.

2. Under the ſuperior Canal, there is a conſiderable *Foſſa* to be ſeen, which diſappears as the Child grows older: And there is beſides, a *Foramen* in the upper Part of the *Os Petroſum*, and in the Paſſage of the *Portio Dura*, which is very remarkable in the *Fœtus*, and which is alſo found in People of a very advanc'd Age, but is much more minute in them.

3. The ſcaly Part of the *Os Temporum* is ſeparated from the *Os Petroſum*, the *Proceſſus Mammiformis* is very ſmall. As for the other Parts of the Ear, there is no remarkable Difference between them. *See* Plate XV. Fig. I, II *and* III.

We ſhall here take notice, that the ſmall Bones of the Ear, the Semi-circular Canals, and the *Cochlea* are of the ſame Form, and very near of the ſame Size, in new-born Children, as they are in *Adults*: So that Age ſerves only to ſtrengthen and render them firmer.

To finiſh this Deſcription, there remains nothing to be taken notice of, but ſome other Ramifications which the *Portio Dura* ſends forth. After it hath furniſh'd a

Branch

Branch which goes to the Ear, it proceeds about the Length of four or five Lines, without any Diviſion; after this, it is divided into two conſiderable Branches, the Superior of which is many times divided and reunited, as it aſcends over the Maſſeter Muſcle, and croſſing the Parotid Gland, at laſt forming a Figure like a Gooſe's Foot, it is commonly ſubdivided into ſeven other Ramifications; the firſt five of which aſcend obliquely, and are diſtributed to the Muſcles of the Forehead, the Temples and Eye-lids. Some of theſe Ramifications being ſpread over the *Os Malæ*, paſs through particular *Foramina*, into the *Orbit*: The ſixth Branch paſſing over the middle of the Maſſeter Muſcle, receives a conſiderable Branch from the fifth Pair, which we ſhall afterwards deſcribe; it furniſhes ſome Branches which accompany the ſalivary Duct, and which embrace it in many places, and it is ſubdivided upon the Middle of the Cheek, into a great Number of ſmall Filaments, which are diſtributed to the Muſcles of the Noſe, and upper Lip. The Seventh is deſtin'd for the Uſe of the Muſcles of the lower Lip. Laſtly, many Ramifications

Branches, which are divided into many Ramifications.

The Ramifications of the firſt Branch, are diſtributed to the Muſcles of the Forehead, Temples, and Eyelids.

And paſs into the Orbit.

They alſo go to the Muſcles of the Noſe and Lips.

And to all Integuments of the Face.

cations of all these Branches, are lost in the outward Integuments of the Face.

The Ramifications of the second Branch are distributed to the Muscles which are under the Jaw.

The inferior Branch proceeds downwards under the Angle of the Jaw, and is divided into many little Twigs, which are distributed to the Muscles that are cover'd by the Jaw. *See* Plate XVI. Fig. I.

Explanation of Plate XVI.

It represents the Portio Dura, *in the different Parts of the Face.* A, *the Trunk of the* Portio Dura, *which proceeds out of the* Cranium *thro' the* Foramen, *which is between the* Processus Mammillaris *and* Styloides. B, B, *a large Ramification, which it furnishes to the external Ear, some Branches of which are cut off, which appear whole in* Fig. III. Plate XII. C, C, *the inferior Branch which is distributed to the Chin, to the Muscles, which are situated under the Jaw, and to the Integuments.* D, *the superior Branch, which immediately divides into the Shape of a Goose's Foot.* 1, 2, 3, 4, 5, *five Ramifications of this Division, which are distributed to the Muscles of the Temples, Forehead, and Eyelids.* 6, *the Ramification of this Division, which expands it self over the Middle of the Cheeks,*

and

to Face page 64

Plate XVI



B. Cole Sculp.

and which is enlarg'd by the Branch of the fifth Pair, mark'd 7, 8, *the laſt Ramification of this Diviſion, which furniſhes Twigs to the* Muſculus Buccinator, *and to thoſe of the Lips.* 9, 9, *two ſmall Filaments, which appear as if they were cut off, becauſe they ſink into the* Orbit *thro' particular* Foramina, *which are in the* Os Malæ. *All theſe Ramifications furniſh a very great Number of Filaments to all the Integuments of the Face, we muſt ſuppoſe them cut off in taking off the Integuments.* E, *the Branch of the fifth Pair, mark'd* G *in the* Plate XIII, *from whence a ſmall Branch.* 7, *paſſes out, which is united to the Ramification,* 6, *of the* Portio Dura. *The other Branches being cut off, which are diſtributed to the external Ear, and to its Paſſage, may be ſeen in the ſame Plate,* i. e. *the* XIII.

The fifth Pair furniſhes a Branch to the Portio Dura.

One of the Ramifications from the Trunk of the fifth Pair call'd the *Maxillary,* immediately at its Egreſs out of the *Cranium,* ſends off many Branches, one of which paſſing under the *Proceſſus Condyloides* of the Jaw, advances forwards, and aſcending above the Jaw, very nigh the Place of its Articulation, ſends forth a Filament, which paſſes over the Maſſeter Muſcle, and is united to that Branch of the

the *Portio Dura*, which ſpreads it ſelf over the middle of the Cheek. All the reſt of this Branch is divided into many Ramifications, which are diſtributed to the cartilaginous Paſſage, to the Ear, and to the parotid Gland. Sometimes this Communication is made by a double Branch. Mr. *Willis* and all the modern Anatomiſts after him, have advanc'd that the eighth Pair furniſhes a Branch, which is join'd to the Trunk of the *Portio Dura*, at its Egreſs out of its *Foramen*: I have examin'd many Subjects in hopes of finding this Branch, but never could meet with it; and I can ſcarce believe Mr. *Willis* has ever ſeen it but in Brutes, where this Communication is always to be found, and is form'd before the *Portio Dura* proceeds out of its Canal.

End of the Firſt Part.

OF.

OF THE ORGAN OF HEARING.

PART II.

Containing the Use of the Parts of the Ear.

AFTER having given a pretty exact Description of all the Parts of the Ear, to render this Treatise more useful, I thought my self obliged to accompany it with some Reflections, and to draw from the Mechanism

The Mechanical Structure of the Organs of Hearing, serve to discover the Use of them.

niſm of theſe Parts, ſome Conſequences by which we may be able to explain their Uſe, and the Manner by which we are made ſenſible of different Sounds and Noiſes. As it is a very important Subject, and appear'd to me to be very nice and difficult, I wou'd not truſt entirely to my own Judgment, and I confeſs that I am oblig'd to Mr. *Mariote* for a great Part of what will here be found curious; nevertheleſs, I muſt not expect that what I am going to treat of, will be well receiv'd by every body. My Conjectures appear probable to me, but other People may be of a different Opinion. However it happens, I ſhall think I have ſucceeded very well; if by this Eſſay I may induce them to give us ſomething better.

The external Ear performs the Office of the Trumpet, which deaf People make uſe of.

I ſhall follow the ſame Order that I did in my Deſcription, and therefore I conſider the external Ear as a natural Trumpet, whoſe neat and ſmooth Cavity ſerves to amaſs the Sound, and conſequently renders its Impreſſion ſtronger upon the other Organs of Hearing. Experience favours this Opinion, in that, thoſe People who have their Ears cut off, can't hear ſo well, and are oblig'd to make Uſe of the Palm of their Hand, or of a ſpeaking Trumpet to ſupply this Defect;

and

and also for this Reason, Brutes, as Deer and Hares, always turn their Ears that way from which the Noise comes, that they may hear the better. Some say that the directions of Sound, insinuating themselves into the Folds of the Ear, there form many Refractions before they come to the *Concha*, and that these repeated Refractions serve to increase the Impression upon the other Organs; as it happens in a Semi-circular Vault, that the Rays of the Sound being refracted to equal Angles, the Length of the Circumference of the Vault, at last pass from one end to the other, by many great and small Refractions.

Its Folds serve to augment the Force of the Air, which acts upon the Organs by the Refractions which they cause.

The Motion of the Muscles of the external Ear, is very obscure; but they seem to be designed for the Contraction and Dilatation of the *Concha*, according to the Force or Weakness of the Undulations of the Air.

The Muscles of the external Ear, serve to contract and to dilate it.

The Obliqueness of the auditory Passage serves not only to defend the *Membrana Tympani* from the Injuries of the Air, but also this Obliquity affords a larger Surface to the Passage, and is the Cause that there are more Refractions made there, and this may contribute to render the Impression stronger.

The Obliquity of the Passage, is proper to preserve the Membrana Tympani *from the Injuries of the Weather. And to render the Vibrations stronger, by doubling its Refractions.*

The

The Wax ſtops extraneous Bodies, which might impair the Membrana Tympani.

The Wax, or ſort of Glue, which is found in the anterior and cartilaginous Part of the auditory Paſſage, ſtops any Filth and Inſects which elſe might enter into the Ear, and which wou'd be a ſure Cauſe of impairing the *Membrana Tympani*. But if this Wax has its Uſes, it has alſo its Inconveniencies, ſo that if we don't take care to clean our Ears, this glutinous Matter will be amaſs'd in it in too great a Quantity, and growing thick by its Detention, will at laſt be a means of obſtructing the Undulations of the Air from coming to the *Membrana Tympani*. It is not long ſince, that ſearching out the Cauſe of Deafneſs in a Perſon, who had been afflicted with it many Years before his Death, I found in the auditory Paſſage, about two Lines from the *Membrana Tympani*, a ſmall Pellet, which was ſoft and pretty thick with a conſiderable Quantity of Filth indurated, collected before it, and I don't doubt but that this ſort of Deafneſs is very common.

It may alſo be prejudicial to the Ear, when it is too thick, and in too great a Quantity.

We have taken Notice, that the cartilaginous Paſſage which is broke off in many Places, forms a ſort of a little Tongue, which is at the Extremity of the Cheek before the *Concha*, and directly

ly at the Entrance into the auditory Paſſage. This little Tongue hinders the Refractions which are made in the Inſide of the *Concha*, from eſcaping out of this Cavity, making them paſs more exactly into the Inſide of the auditory Paſſage: It ſeems alſo to be of Uſe in ſtopping up the Ear upon which it is plac'd, and conſequently hindering the Impreſſion of the Air upon theſe Parts, as the Eyelid being ſhut, hinders it from coming to the Eye.

We have already ſaid, there are three Ramifications of three different Pair of Nerves, which are diſtributed upon the cartilaginous Part of the auditory Paſſage, which occaſion that extreme Senſibility, which is found in this Part, by which the Animal is advertis'd of the leaſt extraneous Body, which might inſinuate it ſelf into the auditory Paſſage.

This will ſuffice for what concerns the external Ear; the *Membrana Tympani* is the firſt Part which preſents it ſelf to view in the internal Ear, and although it may be ſaid not to be abſolutely neceſſary to Hearing, ſince ſome that are deaf taking hold of the Handle of an Inſtrument by their Teeth, can hear the Sound of it; it is nevertheleſs of ſo great a Conſe-

The Membrana Tympani is neceſſary for the Preſervation of the other Organs.

quence, that if we lacerate or pierce it through in any Animal, they may hear tolerably well for some time; but their Hearing will grow insensibly weaker, and they will entirely lose it at last.

It is extended and relax'd by the Muscles of the Malleus.

This Membrane is extended and relax'd by the little Muscles belonging to the *Malleus*, which is join'd to the back Part of this Membrane: the external Muscle relaxes it, and forms it into a plain Superficies; the internal Muscle which is situated upon the Surface of the *Os Petrosum*, draws it inwards, and consequently extends it more than it is in its natural State. Now the Tension of the *Membrana Tympani* is form'd in such a manner, that both the Muscles act together; whereas in its relax'd State, the Action is perform'd by the external Muscle alone. The Reason of this is, because the Insertion of the external Muscle, being opposite to it, is fix'd near the Head of the *Malleus*; whereas the other Muscle is inserted on the other Side, a little lower towards the Handle. The Force of the Contraction of the internal Muscle, is increas'd by that of the External, so that these two Muscles draw the Extremity of the Handle of the *Malleus* inwards, to which the Tension of the *Membrana Tympani*

pani is chiefly attributed. The Figure explains this more clearly. *See* Plate VI. Fig. V.

It is certain then that these little Muscles act, and it is also evident at least of the two first, that one extends and the other relaxes the *Membrana Tympani*; but the Difficulty is to know on what Occasions they act, and what it is that causes them to place this Membrane in those different Positions in which it must necessarily be, to receive the different Impressions of Noise, and of different Sounds.

Is it the Will that makes them act? There is not the least Reason to suspect it: For in short, a Noise most commonly surprises us without our being appriz'd of it. And it is my Opinion that the Objects themselves are the sole Motives, which cause these Muscles to extend or relax the *Membrana Tympani* on different Occasions, according to their different Impressions.

The Will is not the Cause of these Muscles acting;

Therefore it is my Sentiment, that the Membrane of the *Tympanum* must be variously dispos'd for the receiving the various Undulations of the Air, and that in Reality it wou'd be impossible for it to transmit them such as they are, if it was not in some measure fitted to their Character; and if on different Occasions, it did

But the different Dispositions of the Objects.

not form it ſelf, if I may uſe the Expreſſion, into proper Tenſions to repreſent the various Tones of the ſonorous Bodies. We know that upon placing two Lutes upon one Table; if upon playing upon one String, we would make a String of the other Lute move, we muſt of Neceſſity place it in Uniſon with that which we play upon; either in the Octave, or ſome other Accords; as the double Octave, or the Fifth or the Fourth; otherwiſe it will indeed vibrate, but the Vibrations will be very weak, and never audible.

And according to the different Occaſions which concur, The Membrana Tympani *is more or leſs relax'd.*

This being allowed, we may with a great deal of Probability advance, that ſince the Diverſity of Noiſes and Sounds depend upon the different Nature and various Pulſations of the ſonorous Bodies, that for example, the acute Tone proceeds from a Pulſation on a Body, whoſe Particles are diſpos'd in ſuch a manner, that they are incapable of any but very quick Vibrations, which they immediately communicate to the Air; that on the contrary the Grave Tone is produc'd by a Pulſation on a Body ſo order'd, that it is capable of none but very ſlow Vibrations: We may, I ſay, aſſert that the Membrane of the *Tympanum* conforms in ſome manner to the different Diſpo-

According to the Diverſity of Sounds.

ſitions

sitions of the sonorous Bodies in its different States of Tension and Relaxation; and, if we may be allow'd the Expression, puts on their Character; as for example, it is extended for acute Tones, because in this State of Tension it is more capable of quick Vibrations, but on the contrary, it is relax'd for Grave Tones, because it being thus relax'd, it is better dispos'd for slower Undulations; and lastly, it rises and falls in a thousand different Ways, as the different Ideas of the different Noises and Sounds. I confess it is hard to conceive how this is perform'd; they are mechanical Motions which are imperceptible, the Nature and Causes of which are difficult to explain.

Which it does in putting on their Characters.

By mechanical Motions, which are difficult to explain.

The *Membrana Tympani* therefore receives the various Undulations of the Air, and communicates them afterwards to the other Parts of the internal Ear. It is a dry, thin and transparent Membrane, this Structure renders it fit for that Use, and if these Qualities happen to be impair'd, we need not be amaz'd if a Thickness of Hearing thereupon ensues.

The Agitation of the Membrana Tympani *is communicated to the other Organs of Hearing.*

There is room to believe that the Air, which is found in the *Tympanum*, being agitated by the Pulsations on the *Membrana Tympani*, contributes partly at least to communicate them to the immediate

Not so much by the help of the Air which is inclos'd in the Cavities of the Ear.

Organ. But nevertheleſs there is no apparent Reaſon to imagine that this ſmall Quantity of agitated Air, is capable of ſhaking the *Os Petroſum*, or rather the Labyrinth which is contain'd in the *Os Petroſum* ſtrong enough: So that we may aſſert with great probability, that the Pulſations on the *Membrana Tympani* are alſo communicated to the *Malleus*; which the *Malleus* communicates to the *Incus*, the *Incus* to the *Stapes*, whoſe Vibration ſhakes the *Os Petroſum* and the *Labyrinthus*, in the ſame manner as the Air which is between two Lutes that are placed upon one Table, is incapable of communicating entirely the Undulation of a String of one of them to that of the other: but the String that is ſtruck, muſt firſt ſhake the Wood of the Lute to which it is fix'd; afterwards the Wood of the Lute muſt ſhake the Table, the Table the Wood of the ſecond Lute; and laſtly, the Wood of this Lute the String which is fix'd to it, and which is in Uniſon with that of the other. And this is ſo true, that if we take one of the Lutes off of the Table, and hold it up in the Air, the Experiment won't ſucceed.

As by the Aſſiſtance of the little Bones.

Which ſhake the Labyrinth, and the Air which is incloſ'd in it.

The Nature, Mechaniſm, and Articulation of theſe three little Bones ſeem to favour this Opinion; they are dry, thin and

and hard, and consequently very capable of being agitated. The *Malleus* through the whole length of its Handle is fix'd to the *Membrana Tympani*, so that it is easy to imagine that this Membrane can't be agitated without communicating its Agitations to the *Malleus*, and so successively to the other little Bones, since they are articulated together, and their Articulation being without Cartilages, may easily facilitate this Communication of the Vibrations from one to the other.

It is very difficult to determine the Use of the Muscle of the *Stapes*; we may suppose that in drawing the *Basis* of the *Stapes* a little outwards, which is immediately situated upon the *Fenestra Ovalis*, it extends the little Membrane with which the upper part of its *Basis* is cover'd; and therefore as it extends it more or less, it renders it also more or less dispos'd to receive the Vibrations of the *Membrana Tympani*, and to communicate them to the *Vestibulum*, and to the Labyrinth. We may also add, that in drawing out the *Stapes*, which is also pretty flexible, it extends it in some measure, and keeps it in a firmer State, and consequently disposes it in a better way, to receive the Vibrations of the *Malleus* and *Incus*.

The Muscle of the Stapes *serves to extend the Membrane which is fix'd to its* Basis.

And to extend the Stapes *itself.*

The Passage of the Processus Mammillaris *affords a Passage to the Air, when it is over-press'd in the* Tympanum.

I have already said, that at the Sides of the *Tympanum* there are two Passages, one of which terminates at the Palate, and the other proceeds into the *Cavernulæ* of the *Processus Mammillaris*. It seems to be very likely, that when the *Membrana Tympani* is drawn inwards, the Air which is inclos'd in the *Tympanum* retires into these two Passages, and that it returns into the *Tympanum*, when the *Membrana Tympani* is relax'd, otherwise the Motion of this Membrane wou'd be very much retarded by the Elasticity and Resistance of the Air, if it had no way to pass out of it. And there is the same Reason to believe, that the return of this Air into the *Tympanum*, favours the Reduction of the *Membrana Tympani* into its natural Disposition.

The Aqueduct *serves to bring the Air from without to it.*

And to renew that which is in the Tympanum.

The Passage which goes from the Palate to the Ear, furnishes the Air which is necessary for the continual Renewing of that of the *Tympanum*: And as the too great Coldness of the external Air might be prejudicial to the internal Parts of the Ear, therefore this same Air as it ascends up the Length of the Cavity of the Nostrils, and during its whole Course as far as the *Tympanum*, receives such Modulations as are necessary and suited to the Structure of the Parts thro' which it is to pass, yet with-

without losing the strength of Elasticity which makes it capable of performing the Uses for which it was design'd; and therefore the Air which returns from the Lungs, and which is mix'd with impure Vapours, does not so easily enter into this Canal, the Orifice of which is so plac'd at the *Fundus* of the Mouth, that it oftener receives the Air from the Nostrils, than that which returns from the Lungs.

Almost every body believes that by the assistance of this Canal, some deaf People can hear the sound of string'd Instruments, and that their Deafness proceeding from the *Membrana Tympani* its not being able to discharge its Offices, no body shou'd be surpriz'd, if the Vibrations of the external Air being communicated to the *Tympanum*, that these sort of People are capable of hearing the Sound of an Instrument. Nevertheless, to make it appear that the Vibrations of the Air which come into the *Tympanum* by the help of this Canal, are not sufficient to make these deaf People hear the Sound of an Instrument, we must here take notice that they are oblig'd to hold the Handle with their Teeth, otherwise they could not hear it at all, or at least not so perfect; now it is easy to imagine

And not to supply the Office of the Membrana Tympani.

that the Teeth being agitated, this Agitation is communicated to the maxillary Bone, from thence to the *Os Temporale*, then to the little Bones of the Ear; and what yet more ſtrengthens my Opinion, is, what I have ſaid concerning the Uſe which I have aſcrib'd to theſe laſt mention'd Bones: for even thoſe who are not Deaf, hear better and more ſtrongly the Sound of an Inſtrument, when they hold its Handle with their Teeth, and ſtop their Ears. Beſides this, there are ſome deaf People, who hear much better when we talk with them over their Heads: and in theſe we have Reaſon to believe that the whole *Cranium* being ſhook, the *Os Petroſum* and all the other Bones are alſo ſhaken ſucceſſively.

The Feneſtra Ovalis *communicates the Vibrations of the Air to the Labyrinth.*

I have already remark'd that the *Feneſtra Ovalis* is exactly ſhut up by the Baſis of the *Stapes*: This little dry and fine Bone, whoſe Baſis is very ſlender, and one of whoſe Sides is cover'd with a Membrane, having receiv'd the Vibrations from the two other Bones, and from the Air contain'd in the *Tympanum*, may very eaſily communicate them to the *Veſtibulum* and to the Air contain'd there in, and afterwards to the *Cochlea*, and to the three Semi-circular Canals.

Beſides

Beſides this *Feneſtra Ovalis*, there is another which is call'd *Rotunda*, which is ſhut up by a Membrane pretty much like the *Membrana Tympani*; and we imagine that it receives the Vibrations from the Air contain'd in the *Tympanum*, and that it communicates them to that which is inclos'd in the *Scala Inferior* of the *Cochlea*; which being very much confin'd and pent up in this Place, where there is no Paſſage for its paſſing out, it is very capable of cauſing a ſtrong Vibration in the *Lamina Spiralis*; and after this Manner, the Vibrations of the Air at laſt reach the immediate Organ of Hearing, which remains to be treated on.

The Feneſtra Rotunda *communicates them to the* Scala Inferior *of the* Cochlea.

This Organ is comprehended under the Name of the Labyrinth, which being inclos'd in the *Os Petroſum*, conſiſts of two principal Parts, *viz.* the *Cochlea*, and the *Veſtibulum*, with its three Semicircular Canals.

The immediate Organ conſiſts of two Parts which compoſe the Labyrinth.

As for the *Cochlea*, no body need doubt of its forming Part of the immediate Organ. Its Compoſition is a convincing Proof; for firſt the *Lamina Spiralis*, which is the principal Part of it, is hard, dry, ſlender and brittle, which are the Conditions requiſite to render Bodies capable of being vibrated. Secondly, This

The firſt of which is the Cochlea. *The* Lamina Spiralis *is eaſily vibrated* 1. *Becauſe of its Subſtance.*

2. Because it is very much extended.

Lamina does not lie upon the Inside of the Semi-oval Spiral Canal, but is extended, joining on one Side to the Axis; on the other, to a very fine Membrane which is connected to the Surface of this Canal: so that this Situation of the *Lamina Spiralis*, is very favourable to the Disposition it must have to be easily vibrated.

3dly. Because in dividing the Semi-Oval Canal into two Scalæ, it receives Pulsations from the upper and the under one.

Thirdly, The *Lamina Spiralis* by the means of the little Membrane divides the whole Passage of the Spiral Canal as it were into Ranges of Stairs or *Scalæ* in the *Cochlea*, built upon the same *Axis*, the upper one of which has no Communication with the lower. The *Fenestra Rotunda* opens into the lower one, which has no Communication with the *Scala Superior* of this Canal, which I have before taken notice of, nor with the *Vestibulum*: So that the Air which is inclos'd in the *Scala Inferior*, is agitated as much by the Vibrations of the *Fenestra Rotunda*, as by those of the Air in the *Scala Superior* of the Semi-oval Canal, which is also as much shaken by the Impulses of the Air contain'd in the *Vestibulum* with which it has a Communication, as by those of the Air inclos'd in the *Scala Inferior* of this Canal; the *Lamina Spiralis* being agitated on both sides, its Vibrations

brations must be more lively and strong. Fourthly, The Spiral Figure of this *Lamina* is moreover a very powerful Argument to sustain what I assert; for as it makes two Turns and a half round the *Axis*, it receives the different Vibrations of the Air in many Places, and this Mechanism is also observ'd in the Tongue and in the Nose, *&c.* Fifthly, A considerable Branch of the *Portio Mollis* of the auditory Nerve, after it is come to the Basis of the *Cochlea*, divides it self into many small Ramifications, which passing through all the little Perforations in the *Axis*, are distributed and lost in the different Windings of this spiral *Lamina*. In short, this *Lamina* is not only capable of receiving the Vibrations of the Air, but its Structure makes it appear credible, that it is sufficient to answer to all their different Characters: For it being larger at the beginning of its first Convolution than it is at the Extremity of the last, where it finishes as in a point, and its other Parts diminishing in proportion in Bulk, we may suppose that the larger Parts may be vibrated without the others participating in that Vibration; and therefore they are capable of receiving none but the slower Undulations, which consequently answer

4thly. Because its spiral Figure is the cause of its being vibrated in many Places.

5thly. This Lamina *receives all the different Vibrations of the Air, because of its unequal Figure.*

to grave Tones: And that, on the contrary, its narrower Parts being agitated, their Undulations are quicker, and conſequently anſwer to acute Tones. In the ſame manner that the larger Parts of a ſteel Spring form the ſloweſt Undulations, and anſwer to grave Tones: And ſo its narrower Parts form quicker and more frequent Vibrations, and conſequently anſwer to acute Tones. So that in ſhort the Spirits of the Nerve, which expanded over its Subſtance, receive different Impreſſions which repreſent in the Brain the different Appearances of Tones according to the different Vibrations of the *Lamina Spiralis*.

The ſecond Part of the immediate Organs comprehends the Veſtibulum *and the three Semi-circular Canals.*

As for the *Veſtibulum* and the three Semi-circular Canals, although ſome ſay that they are only ſubſervient in increaſing the Impreſſions of the Vibrations of the Air, others affirm that they deaden them; it is my Opinion that they form Part of the immediate Organ, for the following Reaſons.

In the firſt place, all Birds have but three Paſſages which are curv'd in a Semi-circle, and a fourth which is ſtrait and clos'd up at one End, but which opens with the others in a Cavity common to them all, and which ſupplies the Place of a *Veſtibulum*. Theſe three Canals

are

are alſo found in Fiſhes; there is no *Cochlea* in neither of them, nevertheleſs they hear: it is therefore certain, that theſe Semi-circular Canals are the immediate Organ of Hearing in Birds and in Fiſhes. Why then ſhould they not have the ſame Uſe in Man, ſince their Structure is the ſame in Man as in theſe Animals? From hence at leaſt it neceſſarily follows, that theſe Semi-circular Canals form part of the immediate Organ in Man, and that therefore this Organ is compos'd of two eſſential Parts.

The Cochlea is not to be found either in Birds or in Fiſhes.

The Semi-circular Canals alone perform the Office of the immediate Organ in theſe Animals.

Secondly, No body diſputes the Communication of the Impreſſion of Sounds to the Brain being perform'd by the *Portio Mollis*: now this *Portio Mollis* has two Ramifications which enter the Cavity of the *Veſtibulum*, and which unfold themſelves and are extended into Filaments and Membranes, which line theſe Semi-circular Canals internally; from hence I conclude, that this Part of the Labyrinth forms alſo part of the immediate Organ.

There are Nerves and Membranes which are the cauſe of theſe Semi-circular Canals, forming part of the immediate Organ.

Thirdly, The Structure of the *Veſtibulum*, and of theſe Semi-circular Canals is ſuch, that we may very reaſonably imagine that the Impreſſion of Sounds is increas'd and ſtrengthen'd in theſe convoluted Paths, and that it muſt conſequently

Their Windings ſerve to augment the Force of the Air, by the Refractions which they cauſe.

ly become more capable of causing a Vibration on the Nerves which are distributed there.

These Canals receive the different Characters of Tones as well as the Lamina Spiralis.

But as I have already said, that the *Lamina Spiralis* does not barely receive the Vibrations of the Air, and that all its Parts are not indifferently capable of answering to the same Tones; I also assert as much of these three Semi-circular Canals. Every one of these Canals is in the form of two Trumpets, which have their narrower Ends plac'd one within the other; that is to say, that the two Orifices of these Canals are larger in the Cavity of the *Vestibule*, like the broad Ends of two Trumpets; and that the Middle of these Canals, which I look upon as the Place where the two Trumpets meet is narrower in Proportion: There are two of these Canals which have an Orifice into the *Vestibulum* common to them both, which together form a very large End in comparison to the others. Now it is demonstrated by Experience, that the greater Circles of the broad Ends of Trumpets may be agitated without the lesser being sensibly affected: That the Vibrations of the great Circles are slower and more distinct, and that on these Occasions the Sound of the Trumpet is grave;

grave; whereas when the ſmall Circles of the ſame Ends of the Trumpets are agitated without the great being ſenſible of it, the Sound of the Trumpet is then acute, becauſe the Vibrations of theſe ſmall Circles are quicker and more frequent. We may aſſert the ſame of the Semi-circular Canals; their larger Parts may be agitated without the others being ſo, then the Vibrations of theſe ſame Parts will be ſlow; from whence will neceſſarily follow the Appearance of a grave Tone: *& vice verſâ*, when the narrower Parts are agitated without the others being ſo, the Appearance of an acute Tone will of neceſſity follow, becauſe the Vibrations of theſe ſmall Parts are quicker. From all that I have ſaid, we may conclude that the *Cochlea* and Semi-circular Canals, are the common and immediate Organs, which not only receive the Undulations of the Air in general, but alſo which receive the true Idea, and the different Characters of Tones, according to the different Places of thoſe Parts which are agitated.

Becauſe they are made like Trumpets.

It may be objected, that theſe Semi-circular Canals are too much continu'd, and too much fix'd to part of the *Os Petroſum*, to be eaſily agitated in their different

And their Subſtance is very eaſily vibrated.

different Parts, and in ſo many different ways. But beſides that no body can make any conſiderable Noiſe without the *Os Petroſum* being agitated, it is certain that when we prepare theſe Circles to ſhew 'em plainly by themſelves, we take notice that they are ſurrounded with nothing but a ſpongy Subſtance. It is true, that in old Heads the bony *Laminæ* which cover theſe Circles before and behind, are pretty hard; but that which fills up the Space which is round theſe Circles, is of a more porous Nature: therefore they are always diſengag'd enough, and very capable of being agitated, and of Reverberating.

It is by the Communication of the auditory Nerves with thoſe of the Voice, That the Sympathy between the Voice and the Hearing is caus'd.

By the Communication of the *Portio Dura* of the auditory Nerve, with the Ramifications of the fifth Pair which are diſtributed to the Parts, which ſerve to form and to modulate the Voice, the Communication which there is between the Hearing and Speech is commonly explain'd. Some ſay that the Vibration of the Nerves of the Ear, being communicated to the Nerves of the fifth Pair, cauſes the Spirits which flow from the Brain into theſe Nerves, which proceed to the Parts which form the Voice, to diſpoſe the Muſcles in ſuch a manner, that

that answering the Impression which the Voice hath made in the Brain, they are put in a Method of forming a Voice quite like it. And this Reason is alledg'd for Men and Birds exciting one another to sing, and for those Men who are born deaf, being also consequently dumb.

And by the Communication of the second vertebral Pair.

It is also said, that it is by the Communication of the second vertebral Pair with the external Ear, that at the least Noise it is customary to turn one's Head: And all the Body is dispos'd to make different Motions, according as the Causes of the Noise are beneficial or hurtful. And as these Nerves communicate with those of the Heart and the Lungs, it is from hence that we feel the same Alterations in the Pulse and in Respiration, according to the Difference of the Noises. But every one does not agree in the Effects of all these Communications.

That the Affinity that there is between the Tones of Hearing, and the Motions of the Body is produc'd.

And that of the Pulse.

End of the Second Part.

OF

OF THE ORGAN OF HEARING.

PART III.

Containing the Diſorders of the Organ of Hearing.

The Knowledge of the Diſtempers of the Ear, depends upon that of its Parts which are affected.

AFTER having explain'd the Structure and Uſes of the Organ of Hearing, to finiſh this Subject, there remains nothing elſe for me to deſcribe, but the Diſtempers of the Ear.

Ear. My Deſign is not to trace them from their Origin, but only as they relate to the Structure of this Organ; to make it appear how advantageous the Knowledge of the Parts is to the Explication of the Diſeaſes. I ſhall not confine my ſelf to the Diviſions which Authors commonly make; but ſhall here follow, as I have done in my Explanation of the Uſe of the Parts, the Order of my Deſcription: that is to ſay, I ſhall firſt examine what Diſtempers happen to the external Parts, afterwards thoſe which attack the *Membrana Tympani*, the *Tympanum* and *Labyrinthus*; and laſtly, thoſe which belong to the auditory Nerve. After which I ſhall explain the Noiſe or Tinckling, which is a Symptom common to the Diſorders of all theſe Parts; and I ſhall not ground my Reaſons but upon Obſervations taken from very creditable Authors, and upon thoſe which I have had an Opportunity of making my ſelf, when I was working upon the Ear.

The Diſorders of the auditory Paſſage, which cauſe extreme Pain and remain in this Part, proceed from

The moſt common Symptom of the external Parts of the Ear, is Pain; it commonly infeſts the *Concha*, and the whole auditory Paſſage as far as the *Membrana Tympani*. Experience teaches us that it is accompany'd with Pricking, Eroſion,

Eroſion, Tenſion, Weight and Pulſation.

I ſhall not in this place explain the Nature of Pain in general, but ſhall treat of it more largely when I come to the Organ of Feeling. Now here it will be ſufficient to know that Pain is caus'd by a Solution of Continuity of Particles, which when they are united, form the firſt Conſtitution of the Parts of Animal Bodies: This Solution of Continuity cauſes an irregular Motion in the Spirits, and in theſe two Things the former Reaſon of Pain conſiſts.

The Solution of Continuity.

This being allow'd, we may eaſily know that whatſoever can cauſe a Solution of Continuity in the Particles of the Membrane, which lines the auditory Paſſage, and excite this irregular Motion of the Spirits, is capable of producing Pain. Thus an Inflammation, extraneous Bodies in the paſſage, Worms, and in a word, all that can cauſe Pain in other Parts, may be applicable to this here. But beſides this, the Ancients have maintain'd that the Pains in the Ear may happen without an Inflammation, and without any conjunct Cauſe; from whence they have explain'd theſe Pains by Intemperies alone without Matter, which

which they commonly believ'd to proceed from Exceſs of Cold or Heat: but as theſe Intemperies without Matter are imaginary, and as we may find in the Part, Things capable of producing this violent Pain, I will lay down my Sentiments of it in few Words.

Caus'd by the Wax, which is in the Inſide of the auditory Paſſage.

I take notice, that the Wax which is amaſs'd in the Ear is bitter and viſcous, and that conſequenlty it abounds with acrid and lixivious Salts, which are mix'd with thick and oleaginous Particles; theſe Principles give it very nigh the Qualities which are attributed to the Bile, which it very much reſembles. If it happens by any Means whatſoever, that theſe ſaline Juices diſengage and expand themſelves, and that being more exalted than uſual, their Points act with more Violence; it is evident that they muſt cauſe great Diſorders in the auditory Paſſage, becauſe of its extreme Senſibility. Cold and Heat are moſt commonly the Cauſes of it. For Cold thickening this Wax, and rendering it more viſcous, cauſes it to obſtruct and ſtop up the excretory Ducts of the Glands, as it may be obſerv'd in the other neighbouring glandular Parts, in which this Action of the Air cauſes the like Obſtructions: from whence

The external Cold increaſes the Acrimony of it; By the Obſtruction of the excretory Ducts of the Glands.

whence it follows, that the ſaline Juices which were in motion, and in a Diſpoſition to paſs out, being obſtructed in the Glands, puff up and ſwell them; and becoming more acrimonious by their being detain'd, prick upon the Extremities of the Nerves, with which the auditory Paſſage is ſtor'd; and are the Cauſe of a very great Diſorder in the Spirits, and conſequently of that great Pain of the Ear. On the other hand, the external Heat looſens and diſſolves the ſaline Juices of this Wax, and produces by this Means the ſame Effect. The ſame Thing is obſervable in the Pains, which are caus'd by the Bile in the alimentary Parts, by the exceſſive Degrees of Heat or Cold.

Which renders the ſaline Juices more purgent.

By Heat, which looſens and diſſolves theſe ſaline Juices.

But the Ear-Wax is not the only Cauſe of theſe acute and violent Pains; it very often happens that thoſe ſharp, ſaline, ſerous Humours, which are evacuated by the Glands of the Ear, cauſe Pain in the auditory Paſſage, which is apparent in the Suppurations of this Part: For as theſe ſerous Humours which are emitted, are ſometimes Acrimonious or Saline, they ſtimulate the Membrane of the Paſſage, and excite an uneaſy Senſation, which is what we call Pain.

Or by the ſharp ſaline and ſerous Humours, which ſometimes come out of the Glands of the Ear.

As

As for the different Senſations of Pain, I believe they may be accounted for in this Manner: When the ſaline Particles of Wax, or even the other Humours contain'd in the Subſtance of the Glands, are become pointed and hard, and by being more ſtrongly agitated than uſual, they ſtrike violently upon the nervous Filaments of this Paſſage, and produce a pungent Pain, which happens in all Inflammations, and eſpecially in Perſons of a dry and bilious Habit of Body, whoſe Humours are fill'd with thoſe acrid and ſaline Juices: and in People of a melancholic Habit, in whom the ſerous Part of the Blood is always ſharp or ſalt; when theſe Salts become very acrimonious or very corroſive, they cauſe Pain accompany'd with Eroſion, which is chiefly to be taken notice of in Ulcers of this Part. When the Subſtance of the Wax which is ſtill contain'd in the Glands, is fermented alone or with other Fluids, it extends or dilates the Particles of the Membrane, and cauſes a Senſation of Tenſion. When the Glands are ſwell'd with the abundance of the Fluid with which they are fill'd, they leave a Senſation of Weight: As for that ſort of Pain which is accompanied with Pulſation, I believe

The different Solutions of Continuity, cauſe the different Senſations.

Of pungent Pain.

Of Eroſion.

Of Tenſion.

Of Weight.

Of Pulſation.

believe it never happens to the auditory Paſſage, but when it is inflam'd.

This Pain is very violent, becauſe

There is nothing ſo ſurprizing as the Violence of this Pain; it is hardly ever without an acute Fever, which is attended with Wakings, Deliriouſneſs, Convulſions, and Swoonings; Symptoms which are often the Cauſe of Death, as may be ſeen in Obſervations made by many Authors: For the better underſtanding the Violence of this Pain, we muſt obſerve, Firſt, That the Membrane, which lines the auditory Paſſage, is fine and nervous, and compos'd of the ſame Texture as the nervous Membrane of the Stomach and Inteſtines, excepting its not being indu'd with thoſe *Villi*, to preſerve it from the Acrimony of the Humours.

The Membrane of the Paſſage is compos'd of a fine and nervous Texture.

And receives a great Number of Nerves.

2. It is cover'd with an infinite Number of Nerves, which it receives from the fifth Pair, from the *Portio Dura* of the auditory Nerve, and from the ſecond vertebral Pair, as it has been deſcrib'd in the firſt Part of this Treatiſe; and we may aſſert, that there is no Membrane in the whole Body, which has more Nerves in proportion than this has. It is certain that thoſe Membranes which are fix'd cloſe upon the Bones, have a more exquiſite Senſation than the others, which

This fix'd cloſe upon the Bone.

may

may possibly proceed from their being more firm and more extended, and that being connected to the Bones by all their small Vessels which they send off to them; it is impossible that these Vessels can be stimulated, without all their small Ramifications being agitated at the same time, and for this Reason the *Periosteum* and *Pericranium* have so exquisite a Sensation: and in the same manner we may imagine that the acutest Pains of the Head proceed from the Adherence of the *Dura Mater* to the Top of the *Cranium*, as it has been observ'd. This is easily applicable to the Membrane of the auditory Passage, for this Passage is partly bony and partly cartilaginous, and the Membrane is extended upon the Cartilage, though not quite so much as it is upon the Bone. Now it is remarkable that those Pains which infest the Bottom of the Ear, which is the bony Canal, are always the most violent. 4. The Connexion of this Membrane with the neighbouring Parts, may greatly contribute to the Acuteness of the Pain; for this Membrane is extended as far as the *Membrana Tympani*, which communicates with the Membranes which line the *Tympanum*, and with those of the Labyrinth; and

And connected with other very sensible Membranes.

by their means with the *Dura Mater*: After, need we be aſtoniſh'd if the Pains in the Paſſage are ſo ſharp and violent?

Although the greateſt Part of the Symptoms which accompany the Pain of the Paſſage, may be met with in the Pains of other Parts, nevertheleſs as theſe Symptoms are more frequent and more violent in this Part, I judg'd it neceſſary to explain them.

When this Pain is caus'd by an Inflammation, there is no Difficulty in giving a Reaſon for the Fever, and the other Symptoms which commonly attend it. But as I am convinc'd the Acuteneſs of the Pain alone may cauſe all theſe Symptoms without either Inflammation or Tumour, I ſhall apply myſelf chiefly to this laſt Caſe.

And this often cauſes an acute Fever,

I begin with the violent Fever, which almoſt always accompanies the Pain of the Ear; and I take this to proceed from

By the Agitation of the Spirits.

the Spirits being agitated by the Violence of the Pain, which encreaſe the Motion of the Heart and of the Arteries, which is the Cauſe of the Quickneſs of the Pulſe and of the Increaſe of Heat, as is viſible in ſome Paſſions, and particularly in that of Anger. But this Augmentation of the Motion of the Heart

and

and Blood, does not produce a real Fever without it disorders the Principles of the Blood. Now it is easy to conceive, that by these strong Contractions of the Heart, the Parts of the Blood being more exactly broken and divided, an Exaltation of its most active Particles is caus'd, and its oily Part is more perfectly dissolv'd, whose swift and rapid Motion is the Cause of Heat in the Fever. Moreover, the acrimonious and corrosive Juices of the Wax, and of the serous Humours which are amass'd in the Ear, may re-enter and mix with the Mass of the Blood, and there cause an extraordinary Fermentation, in which the Essence of a Fever consists. We shall easily comprehend this sort of Fever, if we consider that in Colds the Fever springs from the Mixture of the sharp Juices, which separating from the Mass which is the Cause of the Continuance of the Cold, mix with the Blood.

And by the Fermentation of the Blood.

The Watchfulness, or Inability of Sleep, depends upon the extraordinary Agitation of the Spirits; which finding themselves continually irritated by the Violence of the Pain, flow continuallly into the Parts, and maintain them in their Functions.

Watchfulness.

The Delirium. The Deliriouſneſs differs in nothing from the Watchfulneſs, but that in this the Spirits moving irregularly in the Brain, they touch at the ſame time many Traces of the Memory and Imagination, which cauſe a Confuſion in the *Ideas*, that theſe ſame Spirits repreſent to the Soul.

Convulſions, The Convulſions are eaſily explain'd in this *Hypotheſis*; for the involuntary Contractions of the Muſcles being caus'd by the irregular Motion of the Spirits, it is ſufficient that the ſaline Juices ſtimulate the Nerves, which are interſperſed in the Membrane of this Paſſage, to cauſe that Irritation to be communicated to all the Spirits, by the Communication of the Nerves and Membranes, and afterwards to cauſe Convulſions in the Muſcles. Beſides, it may happen that theſe ſharp Juices re-enter the Blood, and being carried to the Brain, cauſe Irritations in that Origin of the Nerves.

And Swooning. To give a Reaſon for the Swooning, we muſt conſider, that the Spirits flowing ſwiftly, and in great abundance into the Muſcular Fibres, which contract and ſhut up the Orifices of the Heart, they ſtop the Motion of the Blood; and when this Contraction ceaſes, and the Blood

Blood enters afresh into the Heart, the Pulse and the Heat are renew'd: The Oppression of the Heart and Weight in the Breast, which are felt in this State, are pretty sure Indications of the Swooning proceeding from the Cause which we have just describ'd; and this Oppression of the Heart may continue so long, as sometimes to be the Occasion of Death.

History upon this Subject.

For an Example of a great Pain in the Ear, accompanied with violent Symptoms, I shall content myself with only giving you the fourth Observation of the first Century from *Fabricius Hildanus*, because it includes all the principal Symptoms. A young Girl twelve Years old, having by chance let a Glass-Ball enter into the Hole of her left Ear, which could by no means be extracted, was seized with acute Pains, which were communicated to the same Side of the Head: These Pains, after a long space of Time, did produce a Numbness in the Arm and Hand, afterwards in the Thigh and Leg, and at last in all the left Side. This Numbness was accompanied with very great Pains, which encreas'd in the Night, and in cold and wet Weather with an Irregularity in her *Menses*, with Epileptic

Fits, and with an Emaciation of her left Arm. *Fabricius Hildanus* eight Years after extracted the Glass-Ball, and then all the Symptoms ceased, to which all the other Remedies which were us'd for so long a time, could not give the least Ease.

Remarks upon this History. Many Remarks might be made upon this Observation; but as I have explain'd the greatest part of its Symptoms, I shall apply myself only to some which are particular in this Case. The Pains and Convulsions seiz'd on all her left Side to the end of her Foot. *Hildanus* has explain'd this *Phænomenon*, by saying that the *Portio Dura* is distributed along the Arm, and to the Thigh: But as this Distribution is imaginary, I shall endeavour to give a Reason more suitable to the Parts. I therefore think that the Irritations and irregular Motion of the Spirits, had past into all the Nerves of the *Medulla* on this side, by the Communication of the second Vertebral Pair: This is what would not have happen'd, if the Irritation had been communicated to the Brain; for then there is Reason to imagine that this Girl would have suffer'd Pains and Convulsions in all Parts of her Body: From whence I suppose the left Side of the

the *Medulla* to be only affected: it is eaſy to conceive how this Indiſpoſition ſhould paſs into the Arm and into the Leg, ſince we know that all the vertebral Nerves of the ſame Side communicate with one another by tranſverſe Ramifications, after they have paſſed out of the *Foramina* of the *Vertebræ*.

All the Symptoms increas'd in the Night and in wet weather, becauſe the Humidity of the Air puffing up the Glands and the Membranes of the Paſſage, made it more cloſely embrace the Glaſs-Ball, which increas'd the Irritations.

The Numbneſs in all likelihood proceeded from the irritated Spirits opening and dilating the Orifices of the Nerves, in ſuch a manner that they not only afforded a Paſſage to the Spirits, but alſo to much groſſer Subſtances; which being forc'd into their Tubes, caus'd a ſort of an Obſtruction in them, capable of hindering the Motion of the Spirits, which is ſufficient to cauſe a Numbneſs. Theſe Subſtances becoming more acrimonious by their Detention, increas'd the Pains and Convulſions; which being found more violent in the Arm, its Nerves imbibed ſuch a Quantity of theſe extraneous Sub-

ſtances, that the Motion of the Spirits was thereby interrupted, which was the Reaſon of the Arms becoming emaciated and wither'd, as it happens in Palſies.

After the Glaſs-Ball was extracted, the Irritations which it caus'd ceas'd, and conſequently the Pains and Convulſions: The Spirits recovering their common Courſe, inſenſibly diſſipated all the extraneous Bodies, which caus'd the Arm to regain its Motion and priſtine Vigour.

Remedies to be us'd for the Pain caus'd

I now come to the Means which are to be us'd in the Cure of this Diſtemper. They muſt be different, becauſe of the Diverſity of the Cauſes which produce it. As for the Pain, that which is produc'd by Cold, is ſometimes cur'd by taking away the external Cauſe; that is to ſay, by keeping it from the Cold and the Wind, and by applying upon the Ear, every thing that way warm it, as thick Wool, or hot Bread, which may alſo be ſteep'd in Spirits of Wine; but the Pain ſeldom yields to theſe firſt Remedies, and then we muſt be oblig'd to proceed to the general Remedies: Bleeding is neceſſary to hinder a Collection of thoſe Bodies, which the Cold has detain'd; and as for Purging, it is not to be order'd till the violence of the Pain is diminiſh'd. During

ring their Use, Fomentations are very successfully employ'd, or Injections compos'd of the Juices or of the Decoctions of *Baum*, *Hyssop*, *Calamint*, *Origany*, *Marjoram*, in which we may mix some Drops of Bullocks Gall, or rather some Drops of Oil of bitter *Almonds*, or *Camomile*, *Cloves*, *Aniseeds*, &c. Authors very much recommend the stopping the Ear with Cotton perfum'd with Musk; there is no Difficulty in explaining the Effect of these Remedies, they are all endued with a very penetrating volatile Salt, which warming these Parts, open the Pores, and the Ducts of the Glands, and cause the Substance to flow, which was before retain'd by the Cold.

For the Pain proceeding from Heat.

The Pain which proceeds from Heat, is most commonly cur'd by general Remedies, especially by Bleeding, which is absolutely necessary to hinder a Fluxion and an Inflammation, which might happen to the Part. During the Use of these Remedies, we may with great success make use of Injections compos'd of Milk, that of a Woman is better than any other, when it is mix'd and beat up with the White of an Egg; besides this, they make their Injections of some cooling and emollient Decoction, in which they

drop ſome Oil of ſweet Almonds; the Yolk of an Egg is very much commended by *Devigo*. We may alſo apply ſome emollient and anodyne *Cataplaſm* upon the Ear; and when the Pains are extremely violent, we muſt have recourſe to *Narcotics*, which may be mix'd with the topical Remedies, and likewiſe be given internally. All theſe Remedies are ſo well known, and ſo much us'd, that I ſhall not ſtop here to give you an Account of their Operations.

For the Pain caus'd by ſerous Humours.

When the Pain is caus'd by ſharp and ſalt ſerous Humours, the Water of *Carduus Benedictus*, or bleſſed Thiſtle, is us'd, in which, Woodlice, Earthworms, and Ants Eggs, *&c.* are boil'd: We may add, a few Drops of Oil of Box. As the Medicines abound with an *Alkalious* volatile Salt, they deſtroy the Acidity of the ſerous Humours, which were the Cauſe of the Pain.

The Cauſes which produce the Inflammation in the auditory Paſſage are,

The ſecond Diſtemper that I ſhall take notice of incident to the auditory Paſſage is Inflammation with Abſceſs, and Ulcer, which commonly ſucceed it. An Inflammation proceeds from Wounds and Contuſions of this Part, and may alſo be the Sequel of certain Fevers, as of the *Pleuriſy*, *Quincy*, and of many others

of

of the ſame nature. It very often happens that an Inflammation may be produc'd in the auditory Paſſage, in two different Ways. The firſt is from an Obſtruction of the Glands, which preſſing upon the Veſſels, ſtop the Blood, and by that means are lacerated by it. The ſecond is from the Acrimony of the Wax, which may lacerate theſe ſame Veſſels, and by that means cauſe an Extravaſation of the Blood. However it be, the Inflammation and Abſceſs which ſucceed it, have nothing particular in them, but the violent Pain which I have already deſcrib'd.

The Obſtruction of the Glands.

The Acrimony of the Wax.

Which cauſe Abſceſſes.

The Ulcers of this Part are form'd in the ſame manner as Ulcers of other Parts, either from a Rupture of an Abſceſs, or by the Acrimony of ſome Fluid: I take notice that they commonly ſend forth a very large Quantity of Matter, and that they are very difficult to cure, eſpecially thoſe which are in the bony Part of the Paſſage. The Quantity of Matter proceeds not only from the Blood which is ſuppurated, but alſo from the Glands, which being always irritated by the *Pus*, ſpue forth a very large Quantity of Fluids through their excretory Ducts; and the Difficulty which is found in curing theſe

And Ulcers.

Which are very difficult to cure.

Ulcers, proceeds from their being conſtantly moiſten'd by the Fluid, which comes from theſe Glands, ſo that they cannot be dry'd up: beſides, the Matter which proceeds from theſe Glands, being ſharp and ſaline, hinders the *Reunion* and the *Cicatrix*; the ſame thing happens in Ulcers of the Noſe, of the ſalivary Ducts, *&c.* Ulcers in the bony Paſſage are more difficult to cure than thoſe of the cartilaginous Paſſage, becauſe the bony Paſſage runs down towards the *Membrana Tympani*, and makes a conſiderable Deſcent in the Place where it grows flat, which is the Cauſe that the *Pus* cannot paſs out of it but with difficulty; whereas the Deſcent of the cartilaginous Paſſage being towards the *Concha*, the *Pus* and other Humours are immediately evacuated, and don't remain here as they do in the other Paſſage.

We ſometimes meet with Worms in the Paſſage.

It ſometimes happens in old Ulcers of the Ear, that Worms of different Figure and Size come out with the *Pus*, as may be ſeen in the Obſervations made by *Foreſtus Schenkius*, and in the *German* Journals. I ſhall not ſtay here to examine whether theſe Worms are produced by the Corruption of Humours, or whether the Heat only of theſe Ulcers hatch the

the Eggs, which thousands of Insects that fly in the Air may possibly leave in this place; I shall have an Opportunity of treating of it upon some other Occasion.

The Cause of the Suppuration, and the Flux of Blood.

Besides the *Pus* which passes out of the Ears in Ulcers, it is remark'd that in almost all Children the Ears emit a great Quantity of Humidity, and that this Evacuation is of very great use to 'em; wherefore we take care not to stop it, or else the Children wou'd fall into convulsive and epileptic Fits, which has made it been believ'd that this Fluid came from the Brain as well as those clear and fetid Humours which some People emit at their Ears: Nevertheless, it is certain that there is no visible Ways by which any thing can come from the Brain into this Part: for there is but one *Foramen* in the *Os Petrosum*, which forms an impervious Passage at its Extremity on the Side of the Ear, and which is exactly stop'd up by the auditory Nerves; therefore it is scarcely credible, that any thing can come by that Way. But if even these watry Humours and Blood cou'd erode the Bottom of this *Foramen*, and so procure a Passage through this Place, these cou'd enter no where but into the *Vestibulum* and *Cochlea*, and must necessarily

Which apparently does not come from the Brain.

neceſſarily erode the Membrane which cloſes up the *Feneſtra Rotunda*, the Baſis of the *Stapes*, and the Membrane that covers it, to paſs into the *Tympanum*; at laſt, when they are come into the *Tympanum*, they certainly muſt rather fall into the Mouth through the Aqueduct, than lacerate the *Membrana Tympani*, to paſs through the auditory Paſſage. I do find this Difficulty in explaining theſe *Phænomena*; if Children emit a great Quantity of watry Humours through their Ears, it muſt be attributed to the Diſpoſition of their Blood, which is aqueous; and to the Relaxation of the Glands of the Ear, which is alſo found in the Glands of the neighbouring Parts. And if the Suppreſſion of this Evacuation cauſes them to fall into Convulſions and Epilepſies, it is eaſy to underſtand how this happens, becauſe theſe Juices being ſtopt, may become more acrimonious by their being retian'd, and cauſe Irritations on the Membrane of the Paſſage, and may even return into the Maſs of Blood, and afterwards be diſcharg'd on the Brain. As for thoſe Perſons who emit clear fetid Water from this Paſſage, we muſt take notice, that although the Glands of the Ear are chiefly deſign'd in their natural State

State for the Secretion of the Wax, for the Uſes I have before ſpoke of; there is no Obſtacle to hinder them from ſerving as an Outlet, for the Evacuation of pernicious Humours, which is plainly ſeen in all the conglomerate Glands: and as for the Blood which in Wounds of the Head comes out of the Ears, we know that this proceeds from a Rupture of the Veſſels, which are interſpers'd upon the Paſſage. It is eaſy to judge, by the violent Emotion, that all the *Cranium* ſuffers on this Occaſion, how a Rupture may be produc'd in this Part as well as in the Brain. Laſtly, I ſhall give ſome Obſervations to prove that the Suppurations which are made in the Ear, have no manner of Communication with the Brain. A Man about ſixty five years old, of a full and ſanguine Habit of Body, had a very conſiderable Suppuration in his Ears, and eſpecially in his Right, for five and twenty Years together, although in all other reſpects he enjoy'd a perfect Health. The Matter which he diſcharg'd was fetid and very thick; he died of an Apoplexy in four and twenty Hours after this Suppuration was ſtopt. I open'd the *Cranium*, and having carefully examin'd all the Parts of the Brain near

the

the *Os Petrosum*, I found them perfectly sound, and the Bone in its natural State, and I actually met with serous Humours in the Ventricles and Cavities of the Brain, which were extremely different from the Matter which came from the Ears: I have open'd the Ears of many Children, whose *Tympanum* was full of Filth, yet I never found any bad Disposition either in the Brain, or in the *Os Petrosum*.

Cure of the Inflammation.

To cure the Inflammation of the auditory Passage, we must take the same Methods that are used in all Inflammations of the external Parts; that is to say, first to stop the Fluxion by Bleedings, and by those Remedies which are called *Anodyne*, which we have already mentioned in the Cure of the Pain; to which may be added, Oil of Roses, Oil of Water-Lillies, the Juice of Lettices, of Garden-Nightshade, *&c.* But if the Inflammation continues and tends to Suppuration, we must make use of Suppuratives; such as the Cataplasms of Crumb of Bread, and those which are made of Onions, Lilly-Root, fresh Butter, and Oil of Chamomile or Melilot.

Abscess.

Ulcer.

When the Abscess is open'd, we must make use of detersive Injections, made with

with Barley-Water and Honey of Roſes; and if there is a Neceſſity for ſtronger Remedies, we may uſe Decoctions of Agrimony and Birthwort, and other vulnerary Plants, in White-Wine, in which we muſt mix Honey of Roſes or Oxymel Squills; if the Ulcer is ſordid and putrid, the Tincture of Aloes made with Spirits of Wine may be us'd, and the Green Balſam of *Mets*, if it is very deep.

After this Ulcer is deterg'd, we muſt dry it up, and cicatriſe it: for theſe Intentions, the Decoctions made of Plantain, Birthwort, Gall-Nuts, *&c.* are very much eſteem'd. The *Grenada*-Wine, deſcrib'd by *Devigo*, is an admirable Medicine. As theſe Medicines have no particular Quality in them, and as they are us'd in all ſorts of Inflammations and Ulcers; I ſhall not here explain their Operation: I ſhall only ſay this, that whilſt theſe are uſing, we muſt not neglect the general Remedies, which are a very great Help in the whole Courſe of theſe Diſeaſes.

To deſtroy the Worms, we make uſe of bitter Things to put into the Ear, as the Juices of Wormwood, of little Centory, the Decoction of Coloquintida, or elſe a few Drops of Oil of bitter Almonds, or of *Worms.*

Oil

Oil of Box. The *Journal des Scavans* of 1677, relates that Spirit of Wine is an infallible Remedy for Worms, which are form'd in the Ears. Thoſe of theſe Medicines, which are oily and thick, are excellent, becauſe they ſtop up the *Bronchiæ* of theſe Inſects, and ſuffocate them in an Inſtant.

And Fluxes of ſerous Humours.

As for thoſe Fluxes of ſerous Matter which we have term'd Suppurations, as they are for the moſt part indolent, and cannot be ſtopt without cauſing pernicious Effects, we ought not imprudently to ſtop 'em: In thoſe that are painful, we muſt have recourſe to the Remedies which have been already deſcrib'd, when we treated of Pain.

The third Diſeaſe of the auditory Paſſage is Obſtruction; it is occaſion'd by Extraneous Bodies.

The third Diſeaſe of the auditory Paſſage is Obſtruction; it moſt commonly ſucceeds an Inflammation, Abſceſſes and Ulcers, which uſe to ſwell this Part. Beſides this, it may happen from many other Cauſes. In the firſt place, from extraneous Bodies, which may be introduc'd into the Paſſage, ſuch as Peas, Shot, Nut, Kernels, *&c.* When they have been put a great way in, it is extremely difficult to extract them, becauſe they are inclos'd by the bony Paſſage, which is very oblique, and proceeds downwards towards the

Membrana

Membrana Tympani; beſides their being detain'd by the viſcous Wax, which is collected there, the greateſt Difficulty is in taking out Peas, and thoſe other Grains which ſwell in the Paſſage, and which may even bud there, as you may ſee in the Examples of *Fabricius Hildanus* and *Schenkius*.

2. The moſt frequent Cauſe of Obſtruction in the Paſſage, is the Wax which is inſpiſſated and retain'd in it: This Wax in thoſe that don't take care to clean their Ears, is collected in a great quantity, and grows ſo thick by its Stay, that it entirely ſtops up the Paſſage. It may alſo be ſometimes naturally very thick in People of a cold and pituitous Habit of Body, whoſe Humours are viſcous, and the Cold of the external Air may very much contribute to this Effect. There is alſo great reaſon to ſuſpect that this Wax may be petrified, and cauſe an incurable Deafneſs, which ſeems very likely from the Conformity there is betwixt it and the Bile, which is often petrified in the *Veſica Fellis*: and this may be confirm'd by the 45th Obſervation of *Bartholine*'s *Journals*, which relate, that his Wife having been a long time tormented with a Pain round her Ear,

2. The retain'd Wax.

Which petrifies ſometimes.

Ear, discharg'd small Stones thro' the auditory Passage which came out with the Wax, after which the Pain was assuag'd: However, it happens this Wax is often found very thick in the form of Plaister, which exactly fills up the bony and cartilaginous Passage, which I have observ'd in more than ten or twelve Subjects, during the time I was busy upon the Ear: I have consulted many skilful Surgeons about it, and I may say, I have more than thirty Observations which they communicated to me, which makes it evident that this sort of Deafness is the most common and most curable. And that famous Surgeon of *Mons*, who has made so much noise in the World for curing Deafness, undertook none but this sort of Deafness: to know this, he turn'd his Patient's Ear to the Rays of the Sun, and when he discover'd any Obstruction in the Passage, he made use of a particular Instrument to clean it, and after this manner he cur'd a great Number of deaf People.

Causes a sort of Deafness easy to cure.

3d. *A Membrane.*

There are sometimes Membranes form'd in the Inside of the Passage, which close it up exactly, and form a particular sort of Deafness. I have before, in my second Part, related that when I was examining

examining the Reaſon of Deafneſs in a Perſon of Merit after his Death, who had been afflicted with it a long time, I found in the right Ear, which was that with which he could not hear at all, a very thick and looſe Membrane, before which there was a conſiderable Collection of Matter like Plaiſter, which was certainly the cauſe of his Deafneſs; for the *Membrana Tympani* was in its natural State, and ſo were the other Parts of the Ear.

4. The fungous and fleſhy Excreſcences, which ſometimes ſucceed Ulcers of this Paſſage, or Excoriations which may be cauſed by cleaning the Ear with too ſharp an Inſtrument, may fill it, and cloſe it up exactly. 4. *Fleſhy Excreſcences.*

5. There is another Sort of Obſtruction in the Paſſage, which is produced when all the Glands which ſurround it are tumified, and are fill'd with an over-great Quantity of ſerous Matter, in the ſame manner as we know the ſpongy Membranes of the Noſe may be ſo much ſwell'd, that they almoſt entirely ſtop up the Paſſage of the Air: This Obſtruction is always accompanied with a Relaxation of the *Membrana Tympani*, and from hence it cauſes a Deafneſs, or at 5. *By the Glands which ſurround it becoming tumified.* *Which is commonly accompanied with a Relaxation of the* Membrana Tympani.

at leaſt a Thickneſs of Hearing, which diſſipates when this over-great Quantity of ſerous Humours are evacuated by the Ear, or by ſome other way, in the ſame manner as all Catarrhs are cur'd.

Cure for the Obſtruction caus'd by extraneous Bodies, and the Extraction of them;

In the firſt ſort of Obſtruction the whole Method of Cure conſiſts in extraneous Bodies: to ſucceed in this Caſe, we muſt firſt conſider whether they are Bodies that may grow ſofter, ſuch as Peas, or whether they are hard and ſolid, ſuch as Leaden-Shot, Fruit-Stones, *&c.* We muſt alſo obſerve whether theſe Bodies are enclos'd in the cartilaginous Paſſage, or whether they are intangl'd in the bony Paſſage. To extract ſoft Bodies which are got no farther than into the cartilaginons Paſſage, we muſt endeavour to break them, or to introduce the Scoop behind them, which may be effected in a ſupple pliant Part, ſuch as the Cartilage of the Ear is, and ſo draw them out of the Paſſage. Hard Bodies alſo which are in the ſame Place may be extracted with the ſame Succeſs; and this may be done either with the Scoop or the *Terebra*. As for thoſe Bodies which are in the bony Paſſage, it is extremely difficult to extract them, as we have before taken notice of, eſpecially when they

Which is perform'd by the Scoop, or the Terebra, when they are encloſed in the cartilaginous Paſſage.

entirely

entirely fill up the Paſſage; for then it is eaſy to conceive that neither the Scoop nor the *Terebra* can be of any great Service. Therefore in this Caſe I recommend the making an Inciſion into the back-part and top of the Ear, which may very ſafely be practis'd in this Place, where there are no conſiderable Veſſels, and where the Paſſage is cover'd with nothing but a glandular Skin, as may be ſeen in *Plate* III. *Fig.* II. By this means we partly avoid the Obliquity of the Paſſage, and make uſe of the *Terebra*; which is beſt to uſe in the Extraction of Shot. If a Fruit-Stone ſhould be inclos'd in the bony Paſſage, as it may be taken hold of by one of its Extremities, becauſe it is of an oval Figure, we then may make uſe of the Inſtrument call'd *Tenaculæ*, deſcrib'd in the 4th Obſervation of the 1ſt. Century, and which, to ſpeak properly, is but a double Scoop in the Form of Pincers: And for this Reaſon the Shanks muſt be made of a Plate of very fine Steel to have a Spring, and muſt be very thin. I ſhall not ſtop here to deſcribe all the Circumſtances of theſe Operations, nor to ſay it is neceſſary to drop ſome Oil of ſweet Almonds into the Ear to relax the Paſſage; becauſe I ſuppoſe theſe

Or when they are contain'd in the bony Paſſage, it is effected by an Inciſion into the back-part of the Ear.

From whence we extract Shot with the help of the Terebra,

And Fruit-Stones with Hildanus *his Scoop.*

these things are sufficiently known. In the second Sort of Obstruction, which is occasioned by the hardness of the Wax, we must break it, and bring it away by Injections made with warm Water, emollient Decoctions, Hydromel, Linseed-Oil mix'd with some Drops of Spirits of Wine; Oil of bitter Almonds, Oil of sweet Trefoil. Some make use of Mineral Waters, and all Galls of Animals are commonly us'd, and that with good Success. There are some that prefer warm Water to all other Liquids, and content themselves with adding to it Drops of Spirits of Wine, to render it more penetrating.

Cure for the Obstruction proceeding from the hardness of the Wax.

The Wax is loosen'd, and comes away sometimes in five Days, sometimes at the Expiration of the fifteenth Day; which plainly demonstrates that we ought not to grow weary of continuing Injections.

For the Membrane which stops up the Passage.

In the third sort of Obstruction, where there is commonly a Collection of Wax gather'd before the Membrane, which is form'd contrary to the Course of Nature, we must clean the Passage with the foregoing Injections, and afterwards pierce the Membrane; but Surgeons ought to take care at the same time not to damage the *Membrana Tympani*.

For

For to have a true Idea of the Cure of the fourth Sort of Obſtruction which is form'd by fungous and fleſhly Excreſcences, the reading of *Fabricius Hildanus*'s firſt Obſervation of the third Century will be almoſt ſufficient; wherein he gives a Deſcription of a fungous and ſchirrous Excreſcence, which happen'd in the Paſſage after an Abſceſs. Before he extirpated it, he carefully prepar'd his Patient's Body; after that, he cut away as much as he cou'd by the Ligature: but as the Root of the Excreſcence was very deep, and as his Inſtruments cou'd not poſſibly reach the bottom of the Paſſage, he was obliged to make uſe of ſome Cauſticks, which he apply'd to it by the help of a ſmall thin piece of Wax, for fear of prejudicing the Paſſage, in which he very happily ſucceeded. To make this manner of treating theſe Diſeaſes more plain, we muſt take notice that if the *Fungus* is large, and protrudes out of the Paſſage, we may either cut it off with the Point of the Sciſſors, or of the Inciſion Knife; or elſe tye all that we can take up with a Ligature; but I think cutting it is the beſt way, becauſe in cutting it we take more of it away. As we are afterwards oblig'd to ſtop the Blood, we

For Excreſcences.

Of which we muſt extirpate as much as we can by the Ligature.

And conſume the Remainder by Cauſticks.

make uſe of a little vitriol Stone fix'd to a Quill in the form of a Crayon, ſo that there appears but a ſmall Point of it out to hinder its touching any other Part but that where it is wanted, to ſtop the Blood by making an Eſchar, which alſo takes away part of the *Fungus*, and to conſume the reſt which lies deeper in the Paſſage. As there muſt be a great deal of Caution us'd not to prejudice the Membrane by the Cauſticks, the moſt us'd of which are Powder of Savin, burnt Alum, red Precipitate mix'd up with Wax and Turpentine; I wou'd not chuſe to make uſe of the ſmall thin Pieces of the Wax, but I think the Cauſticks may be very ſafely apply'd in the form of an Unguent, at the end of a Tent, which may be introduc'd into the Paſſage, after we have plac'd a ſmall leathern *Canula*, like the Finger of a Glove in it, into which we may eaſily puſh the Tent with the Unguent at the end of it, without being afraid of touching the Membrane which lines the Paſſage. Inſtead of Leather, we may make our *Canula* of Copper or Silver, which muſt be very thin, and curv'd in the ſame manner as the Paſſage is. After the Eſchar is made, we muſt dreſs it up with ſome Drops of Oil of

Which muſt be very carefully us'd, for fear they ſhou'd hurt the Membrane of the Paſſage.

of Eggs, or of Oil of ſweet Almonds, as much to give Eaſe to the Paſſage as to ſeparate the Eſchar: we muſt repeat the Application of theſe Medicines till the *Fungus* is conſum'd, and when it is, we muſt make Tents and ſpread them at the End with *Wourtz* Brown Ointment. Theſe Tents muſt be introduc'd, and puſh'd beyond the *Canula*, that the Ointment may reach the reſt of that ſuperfluous Fleſh, which remains in the Surface of the Paſſage, in which the *Fungus* was, to hinder it from ſprouting up afreſh, and alſo to procure a good Digeſtion. After which we muſt make uſe of deterſive and anodyne Medicines to incarn and cicatriſe the Ulcer; always taking care to mix with them every now and then, ſomething to ſtop the Regeneration of the *Fungus*. A little Vitriol diſſolv'd in a ſufficient Quantity of ſome vulnerary and deterſive Decoction, to give it a little Aſtringency, is very fit for this purpoſe; we may either inject it into the Ear, or paſs a little Lint dipt in this Liquor into it: the Lint is the beſt Method when it may be eaſily introduc'd, becauſe it preſſes upon the Ulcer, and hinders the *Fungus* from ſprouting up.

Cure of the Obſtruction proceeding from the Glands being tumefy'd.

In the fifth ſort of Obſtruction, which is occaſion'd by Tumefaction of the Glands of the Paſſage, the ſame general Remedies are preſcrib'd, which are us'd in all other Colds: We fumigate the Ear with the Steam of Carduus, or of Decoctions of Florentine Orris, Sweet Marjoram, Carduus, Wormwood, Baum, Calamint, Aniſeeds, Fennel, &c. The Decoction of Coloquintida in Oil is very much eſteem'd. *Barbette* makes uſe of a Decoction of Cloves in red Wine, ſome of which he drops into the Paſſage, which muſt afterwards be ſtopt up with a Clove. We find in *Platerus*, a particular Water for this purpoſe, which is ſaid to be very efficacious; there is another in *Mindererus*, which has been reform'd by *Zwelfer*, in his Remarks upon the *Auſbourg Pharmacopœia*, and we have a compound Spirit of Wine in *Amynſicht*. The Juice of Sweet Marjoram preſs'd out alone, is very much eſteem'd: And the Urine of a Hare is very much commended by it ſelf, or mix'd with Spirits of Wine, Aſh Water, and *Hungary* Water; it is alſo a good Method to keep the Ear ſtopt with a little Cotton perfum'd with Muſk. There are ſome People in whom the Membrane which lines the Paſſage, and

the

the *Membrana Tympani* are so fine, that we cannot inject their Ear with these sharp and spirituous Liquors; and then we must content our selves with dropping some upon some hot Bread, which may be held upon the Ear. It is also a good Method to hold these Liquors in the Mouth, because their spirituous Particles become elevated, and pass thro' the Aqueduct into the Ear; and therefore for the same reason Masticatories are us'd with Success.

It is very easy to explain the Action of these Medicines, since all of them being of a subtile and penetrating Nature, they open the Ducts of the Glands, and make room for the Evacuation of the superfluous serous Humours. To this I shall add an Observation, which was communicated to me by Mr. *Passerat*, a very skilful Physician and Surgeon, of a young Nobleman about eleven or twelve Years old, to whom it frequently happen'd in the beginning of the Spring and Autumn, that the Glands of the Passage were swell'd in such a manner that the Parts touch'd one another, and that it was impossible to introduce any thing into it. At first they us'd to drop some Oil of sweet Almonds into the Ear, to

assuage the Pain, afterwards they made use of a Decoction of Barley and Agrimony, which is detersive and desiccative; and by this means, the Ear after having discharg'd a Moisture which was almost like *Pus*, recover'd its pristine State.

The Diseases which the Membrana Tympani *is liable to, are, Relaxation.*

I come now to the Diseases of the *Membrana Tympani*, which are Relaxation, too great Tension, Schirrousness and Rupture. The Relaxation proceeds from too great an Humidity, which moistens the Membrane; this Symptom commonly accompanies that Obstruction of the Passage, which is produc'd by the swelling of the Glands, which we have already describ'd, and contributes in a great measure to the Thickness of Hearing, in those People who are subject to Fluxions from Catarrhs; and therefore, as Experience demonstrates daily, South Winds, Fogs and Rainy Weather diminish the Sense of Hearing.

Too great Tension.

The extraordinary Tension of the *Membrana Tympani*, produces a quite contrary Effect; so that it makes the least Noises become insupportable: this Tension happens in violent Pains in the Head, and in acute Fevers, because the Tensions and Irritations of the Membranes

branes of the Brain are communicated to all the neighbouring Membranes.

The Schirrousneſs of the *Membrana Tympani* proceeds from too great a Dryneſs, as it is viſible in old People; and beſides this, we know by an infinite Number of Obſervations, that the Membranes of the Body may become callous, and even bony: And this is what I have particularly obſerv'd in the *Dura Mater*, and in the Coats of many Arteries, which I have often found offified; which may make us imagine that the *Membrana Tympani* may ſometimes grow hard and cartilaginous, and ſo occaſion an incurable Deafneſs. *Schirrouſneſs.*

Laſtly, The *Membrana Tympani* is liable to be ruptur'd either by ſome external Cauſe, as by an Ear-Picker, which we may puſh too far in without thinking of it, or by ſome Strain in ſhutting the Noſtrils and Mouth, and forcing back the retain'd Breath with Violence; which Caſe happen'd to a Perſon of my Acquaintance. This Action of the Air is remarkable in Sneezing, in which we perceive that the Air which paſſes ſuddenly up the Paſſage, forces the *Membrana Tympani* outwards, and ſo cauſes a painful Tenſion. This may alſo *Rupture.*

imagines that the Paſſage which paſſes from the Ear to the Palate contributes not only to the renewing of the Air of the *Tympanum*, but alſo affords a Paſſage to the Air we breathe upon certain Occaſions; which Notion he has pretended to eſtabliſh upon the Obſervation of thoſe two Aſthmatick Perſons, we ſpoke of before, and upon the Opinion of *Alcmæon*, who, from the Account of *Ariſtotle*, imagin'd that there were ſome Goats, who breathe through their Ears. Moreover, the *Membrana Tympani* may be eroded by the Acrimony of the *Pus* which is retain'd in the *Tympanum*, or in the Inſide of the auditory Paſſage; we find many Examples of this in *Fabricius Hildanus*, *Schenkius*, and in many others. In what manner ſoever the *Membrana Tympani* be broke, it happens that in ſhutting the Mouth and the Noſtrils, the Air comes out of that Ear with Noiſe, and with ſuch a Force that it can extinguiſh a Candle. As for the Hearing, it is preſerv'd for ſome time, but it inſenſibly grows weaker, and is entirely loſt at laſt; which demonſtrates, when it is broke, that this *Membrana Tympani* is not abſolutely neceſſary to hear with, and that its principal Uſe is to tranſmit the

Theſe Cauſes do not occaſion an entire Privation of the Hearing at firſt: But only ſometime afterwards.

Vibrations to the Air contain'd in the *Tympanum*, and to the ſmall Bones, and to keep off the Injuries of the external Air. The external Air may alone ſuffice to agitate the little Bones, and the immediate Organ, and excite the Senſe of Hearing; but as it deſtroys all the Parts of the internal Ear by its Coldneſs, and its other exceſſive Qualities, it takes away at laſt the Senſe of Hearing.

Cure of the Relaxation. In the Relaxation of the *Membrana Tympani*, we muſt uſe the ſame Remedies which are us'd in the Obſtruction proceeding from a Catarrh. In the Tenſion beſides the Remedies proper for the Diſtempers from which it is produc'd, we muſt foment the Ear with Milk, Oil of ſweet Almonds, or with ſome emollient Decoction: The Schirrouſneſs and Rupture of this Membrane are incurable.

Of the Tenſion.

The Schirrouſneſs and Rupture are incurable.

The Diſeaſes of the Tympanum, *and of the Labyrinth, are*

As for the *Tympanum* and the *Labyrinthus*, as they are bony Parts cover'd only with a Membrane, I don't conceive how they can be liable to any other Diſeaſes than to a Caries of the Bone, and to Inflammation of the Membranes. The Caries of the Bone happens ſometimes after thoſe Abſceſſes of the auditory Paſſage which break in the back part of the Ear, and then it hath been remark'd that a

Caries of the Bones.

Fiſtula

Fistula hath been form'd above the *Processus Mammillaris*, which hath penetrated into its *Cavernulæ*, and has caſt off in Scales, the little *Laminæ* which compoſe them. This *Caries* is accompanied with a very offenſive Smell, and with very bad Symptoms, and it eaſily penetrates into the *Tympanum*, by the means of the Paſſage which has already been ſpoken of in the firſt Part, which deſtroying all the therein contain'd Parts, cauſe Deafneſs: But this very ſeldom happens; I have had but one or two Examples of it. *Which may cauſe Deafneſs,*

As for the Inflammation of the Membranes, I have often found in diſſecting the Ear, the *Tympanum*, *Veſtibulum*, the Semi-circular Canals, and the *Cochlea* fill'd with thick Matter, which might proceed from ſome Abſceſs of the Membranes which line theſe Parts. I don't doubt but that this may be the Cauſe of Deafneſſes as well as the Collection of other Humours, which may be form'd in all theſe Cavities: and what renders this Opinion more probable, is the Difficulty there is in the diſcharging this Matter out of the *Tympanum*, becauſe its Cavity is ſituated lower than the Oriface of the Paſſage which goes from the Ear to the Palate; and therefore theſe *Inflammation of the Membranes,* *And Abſceſs of the Membranes.*

Liquids can't fall into the Mouth without we bend down the Head in a particular manner: And before they can be discharg'd through the auditory Passage, they must first lacerate the *Membra* *Tympani*, which they cannot do exce they are very acrimonious. We m

Inflammation of the Lamina Spiralis.

also suspect that the *Lamina Spiralis* m be eroded by the Acrimony of the M ter, and that it may even become t

Which may grow carious.

lax or too callous, much in the same m ner as the *Membrana Tympani*, wh I don't positively assert, never having h an Example of it.

Cure of the Caries.

I can't recommend better Remed in treating of the *Caries* of the B which happens in the Ear, than th which have been described by Monsi *Deymier*, a very skilful Surgeon, fr whom I had this Remark: At first he lated the Entrance with a prepar'd Spon which made a pretty considerable Op ing, so that he cou'd apply his M cines upon the carious Bones; after t he made use of Lint dipt in the impe Water, in which he had dissolv'd a l Camphire; but as this incarn'd the S of the Ulcer too soon, and the *Ca* remain'd still, he had recourse to

phorbium

phorbium in Powder, which he made uſe of with good ſucceſs; this produc'd ſome little ſmarting but light Pains, which did not laſt long. The Uſe of this Powder produc'd the deſir'd Effect, that is to ſay, the Exfoliation of the Bone, in hindering the *Fungus* from ſprouting up. He made uſe alſo of *Euphorbium* in a Tincture with Spirits of Wine, to which he added ſome Myrrh and Aloes. The *Caries* being thus conſum'd, and the Bone exfoliated, he return'd to the Uſe of the imperial Water, till he made a perfect and entire Cure of it; and over the Lint he apply'd the Plaiſter of *Janua*, to which he added the Eſſence of Juniper and of Cloves, and a little Oil of Marigolds.

Cure of the Inflammation of the Membranes.

In the Inflammation of the *Tympanum*, and of the *Labyrinth*, topical Remedies are almoſt of no effect; in this Caſe we muſt keep to the internal and general Remedies, which alſo have no better Succeſs, becauſe the Abſceſſes break out in the Inſide of the *Tympanum*, and of the Cavities of the *Labyrinth*, from whence the Matter can't poſſibly be diſcharg'd: ſo that theſe Humours being collected together in theſe Cavities, occaſion an incurable Deafneſs.

The

The Diſeaſes of the auditory Nerve.

The Diſeaſes of the auditory Nerve are Obſtructions and Preſſure, when the whole Brain is overflow'd by ſerous Humours in an Apoplexy, and in any Palſy, it is evident that the Nerve will be obſtructed in the ſame manner as the others are. Beſides this, we may eaſily conceive that the Obſtruction of the Nerve alone, without any other Fault in the Organ of Hearing, may occaſion a Deafneſs, in the ſame manner as the Obſtruction of the optic Nerve produces a *Gutta Serena*. A Preſſure upon the Nerve produces the ſame Effect; it proceeds from many Cauſes, as from the Blood and from other extravaſated Fluids, as we find in the greateſt Number of Apoplexies, or from any Tumour. I find an Example of this laſt Caſe in Monſieur *Bonnet*, a celebrated Phyſician of *Geneva*, in his firſt Book of practical Anatomy, the 53d Obſervation of the ſecond Section; which relates, that Mr. *Drelincourt* found in the Brain of a Man that had dy'd of an Apoplexy, a *Steatoma* between the *Cerebrum* and *Cerebellum*, which at firſt caus'd a Blindneſs, afterwards a Deafneſs, and laſtly, an entire Privation of all the animal Faculties.

Obſtruction,

And Preſſure,

Which may proceed from Tumours happening upon the Brain.

It

It is easy to know this Obstruction, or this Pressure upon the Nerve, in the Eye where all the Parts are transparent and diaphanous; for when there is no Fault to be perceiv'd in these Parts, we have reason to suspect some Obstruction of the optic Nerve; but in the Ear all the internal Parts are hid from our Sight, so that we can scarcely judge whether the Fault is in the Organ, or in the Nerve. Nevertheless, if any Stupor or Palsy has preceded this Deafness, or else if there is any other Sense taken away at the same time, we may reasonably suspect that the Brain is affected, and the Nerve also, by Obstruction or by Pressure. In this Case, we must prescribe the same Remedies which are us'd in Palsies, frequent Purges, Emetics, cephalic Waters and Spirits, Sudorifics, Baths, Masticatories, and Sternutatories, *&c.* The Pressure which is caus'd by some Tumour is incurable.

It is difficult to know whether the Deafness proceeds from any Fault in the Nerve, or from any Defect in the Organ.

The Diseases which have been explain'd hitherto, take away quite or diminish the Sense of Hearing; but the Noise in the Ear is a Depravation of it; this Depravation consists in rendering the Ear sensible of Noises which are not in reality, or which are not external; so that it

The Noise in the Ear is a Symptom, the Causes of which are difficult to explain.

it being already attentive to one Sound, it is leſs capable of receiving the Impreſſions of external Sounds, except they are extremely violent.

The Ancients attributed it to the implanted Air.

The Ancients imagin'd that the true Reaſon of the Symptom conſiſted in the Motion and Agitation of the implanted Air in the Ear. They related that this Agitation was commonly caus'd by Winds and Vapours which came into the Ear from all the whole Body, as it happens in ſome Fevers, or from ſome Part of it, as from the Stomach or the Brain; or that it proceeded from ſome pituitous Fluid inclos'd in the Cavities of the Ear; they wou'd alſo have explain'd all the different Sorts of Noiſes in the Ear by the Quality, the Conſiſtence, and the Motion of the Fluids, or Air, which are collected in the Inſide of the Organs of Hearing. I ſhall not ſtop here to take notice of all that may be defective in this Explanation, one may judge pretty well of it by the Idea that I ſhall give of this Noiſe in the Ear; I ſhall content my ſelf with ſaying, that there is no Appearance that theſe different Sounds, which they imagine we hear, are caus'd by any thing which in reality ſtrikes upon the Ear, to produce the Sounds of Bells, murmurings of Waters,

and

and an infinite Number of other Sounds, which Persons subject to these Noises in the Ear are every day sensible of, and that it is credible, that the most part of these Buzzings in the Ear are but false Sounds, and that these Appearances of Noise may be produc'd without any Wind being in the Ear, or without Matter which strikes the Membranes externally, which compose the immediate Organ of Hearing, as I am going to explain it.

It is more reasonable to believe that it is commonly produc'd by the Vibration of the immediate Organ.

It is my opinion, that the Noise in the Ear, consists in the Perception of a Sound which is not in reality, or of an internal Sound. To explain how we can be sensible of a Sound which is not in reality, we must take notice that the Action of Hearing consisting in a Vibration of the immediate Organ, it is sufficient that this Vibration be excited to cause a Sound, without it's being necessary that this Motion be produc'd by the Air; for in the same manner that we conceive, how Vision, which depends on the manner in which the *Retina* is agitated by the visual Rays, may be perform'd without these Rays, when this Agitation is produc'd from any other Cause, as it happens when the Eyes see Sparks of Light in the dark, after having

ing

Which is produc'd by Causes enclos'd in the Membranes of the Organ.

ing receiv'd a Blow: we may also say, that when any other Cause than the agitated Air produces in the Organ of Hearing, I mean the Inside of the Substance of the Membranes, this Agitation, which is regulated in the same manner, that it commonly is by the Air which brings the Sound; the Ear seems to be struck by a Sound which in reality is no more than the Light of the before-mention'd Sparks is a true Light. But what renders this Comparison pretty just, is, that as these false Appearances of Light, which are not caus'd by external Objects, have nothing in them distinct and particular, but only a simple Light; the Sight of a more complex Object, requiring the Concurrence of too many Things: So it scarce ever happens, that the Noises in the Ear which we are treating of, have any Sound but what is confus'd; the Whistling and Tinklings which are the most distinct Noises in this Symptom, being but meer Sounds.

Which may be attributed to the Diseases which produce this Symptom.

For to determine what can be the Cause of this Agitation in the immediate Organ, we must examine the Distempers in which these Noises are found; these Distempers are Inflammations and Abscesses in the *Tympanum* and *Labyrinth*,

rinth, and the Diſeaſes of the auditory Paſſage. Inflammation and Abſceſſes in the *Tympanum*, and in the *Labyrinth*, neceſſarily cauſe Vibrations in the *Lamina Spiralis*, and in the Semi-circular Canals, either by the Tenſion of the Membranes, or by the Vapours which perſpire, and are mix'd with the Air in the *Tympanum*. Sharp Humours, Worms, extraneous Bodies, the Contraction of the Paſſage which ſucceeds the Swelling of the Glands, and in general every thing that cauſes Pain, and the other Symptoms in the auditory Paſſage, which I have before deſcribed, agitate the Membrane of the Paſſage, and the *Membrana Tympani*, which is ſufficient to communicate this Agitation to the immediate Organ.

Sometimes the Noiſe in the Ear proceeds from an external Impulſe; As when we ſtop our Ears with our Hands.

The ſecond ſort of Noiſe in the Ear is that in which we perceive a true, but an internal Sound. It is thus, we perceive a Buzzing when we ſtop our Ears; this Noiſe is caus'd by the Friction of the Hand, or by the Preſſure which rumples the Skin and the Cartilages, whoſe Particles may occaſion Agitations in this Place; the Elaſticity of the incloſ'd Air, and the Vapours which inceſſantly proceed from Bodies, may alſo contribute to them,

them, when those Vapours which proceed from the Hand, join'd with those which come from the Membrane of the Paſſage, being confin'd, ſtrike upon the *Parietes* of the Cavity, and produce Vibrations; which though they are very ſmall, yet they form a true Sound, which becomes ſenſible from the Proximity and Continuity of the Parts, and alſo by the help of the Reflections which are form'd in this inclos'd Cavity.

The Diſeaſes which cauſe this ſort of Noiſe in the Ears, are,

The Commotions of the Cranium.

The Commotions of the *Cranium*, and the Diſtempers which contract the Paſſage, may cauſe ſuch ſort of Noiſes in the Ear, if we ſuppoſe that the Shocks the whole *Cranium* receives, are communicated to the immediate Organ only by the Continuity of the *Os Temporale*; I mean, at the very Time of the Commotion: for as for thoſe which afterwards ſucceed, they muſt be attributed to the Diſorder of the Spirits, as we ſhall ſee in the Sequel. In the ſame manner, the ſwelling of the Membrane of the Paſſage may, in contracting it ſelf, produce a like Effect. Beſides this, it often happens that we perceive a Pulſation in the Inſide of the Ear, which makes us believe that we hear ſomething beat, and this Pulſation is ſometimes ſo ſtrong, that other

The beating which we imagine we hear in the Inſide of the Ear is caus'd by The Contraction of the auditory Paſſage.

People

People may hear it. I have made an Obſervation upon this, of a Lady of *Picardy*, who upon the leaſt violent Exerciſe perceiv'd ſo troubleſome a Pulſation, that it ſeem'd to her that ſhe had a *Pendulum* fix'd to her Head, and this Pulſation was alſo heard by thoſe who came near her. Now this beating is nothing elſe but that of a dilated Artery, becauſe it always perfectly agrees with the beating of the Heart; and this Perception of an internal Sound, appears to me abſolutely like that Symptom which is obſerv'd in imperfect Suffuſions. Thoſe Perſons who are ſeiz'd with this Diſorder, ſee Motes and Flies flying before the Objects; theſe Motes and Flies are nothing elſe but the viſcous and groſs Particles which begin to be amaſs'd in the aqueous Humour, which by their Motion agitate the *Retina*, and neceſſarily produce a Senſation. But, ſay they, if theſe are true Noiſes, and if the Organ diſtinguiſhes them ſuch as they are, why are they put in the Number of tinkling Noiſes in the Ear? I anſwer, that in reality theſe Noiſes are perceiv'd ſuch as they are, but that the Hearing is deprav'd in miſtaking theſe Noiſes as coming from ſome external Object, in the ſame manner that thoſe who have a Cataract beginning to be form'd, imagine theſe

And by the Pulſation of a dilated Artery.

theſe Appearances of Motes and Flies to be exernal Objects, and put out their Hands to catch him.

The immediate Vibration of the Extremities of the nervous Fibres, to their Origin in the Brain, may cauſe all the Appearances of Noiſes.

Beſides this, I imagine there may be a Perception of a falſe Noiſe without any Defect in the Organs of Hearing: Which happens every time that the Parts of the Brain, where the Filaments of the auditory Nerve terminate, are mov'd and agitated in the ſame manner that they us'd to be vibrated by Objects. What induces me to believe this, is, that I take notice of a great Number of Diſeaſes of the Brain which are accompanied with a Noiſe in the Ear: As for example, Deliriouſneſs, Phrenzy, Vertigoes, and thoſe Perſons which fall into Epilepſies and Swoonings, perceive theſe buzzing Noiſes in their Ears, which are as the Præcurſors of Paroxyſms. As there is an irregular and extraordinary Motion of the Spirits in all theſe Diſtempers, it is much eaſier to imagine that the agitated Spirits may ſtrike upon the Extremities of the auditory Nerve, and ſo by this means cauſe a Senſation of Noiſe, than to imagine that there is a Defect in the Organs of Hearing. This manner of explaining the Noiſe in the Ear, appears to me reaſonable enough; and methinks we may add, that

that as the Motion of the Spirits is very irregular and disorder'd in all these Distempers, so the Sounds and Noises in the Ear must in this Case be very confus'd and very different from the Sounds which we commonly hear. I shall without doubt be told, that this is a false Imagination, and not a Symptom of the Ear. I agree to it, and this is what I alledge: As it is thought that we can never hear without the Ear is struck upon, we attribute all Noises to this Organ; nevertheless it is indifferent whether the Fibres of the Nerves be shaken next the Ear, or next the Brain, there will still arise the same Sensation from it: and this is caus'd in the same manner as in the Vertigo, in which we know that the circular Motion of Spirits alone produces the same Effect as if the visible Objects had really this rotatory Motion; or in frantick Persons, who fancy they see Motes which are not in reality, which is caus'd only by the Agitation of the Fibres of the optic Nerve in the Inside of the Brain. As they also attribute the Symptoms of Suffusions and Phrenzy to a deprav'd Imagination, we must attribute the Noises in the Ear, which succeed the Distempers of the Ear, to the same Cause, although they very often

Which are not so much a Symptom of the Diseases of the Ear.

don't

don't in any manner depend on the Indispositions of the Organ of Hearing.

As of those of the Brain, which produce a second sort of Noise in the Ear.

We may after this manner lay down two Sorts of Noises in the Ear, one of which proceeds from the Disorders of the Brain, the other from the Disorders of the Ear; those which succeed the Disorders of the Ear are, as aforesaid, either true or false; and of these some are call'd Tinklings in the Ear, others Whistlings, others Buzzings, others Murmurings, *&c.* And in general we may say, that the hollow and buzzing Noises are produc'd by a slow Vibration, and the Whistlings and Tinklings by a close and strict Vibration, which is confirm'd by the remote Causes of these Symptoms: Colds, for example, and Suppurations, in which the Membranes are relax'd, commonly produce a Buzzing; and Inflammations and Pains in the Ear, in which these Parts are commonly tense and dry, Whistlings and Tinklings. We must also believe, that all these Noises make the same Impression upon the *Lamina Spiralis*, and upon the Semi-circular Canals, as grave and acute Sounds.

The Cure of the Noise in the Ear generally depends upon the Diseases of the Brain,

Brain, or of the Ear which produce it. To this I add, that in the Whiſtlings and Tinklings we muſt make uſe of very nigh the ſame Remedies, as thoſe which have been deſcrib'd in ſpeaking of the Pain proceeding from Heat, and of the Tenſion of the *Membrana Tympani*; and that in the Buzzings we may make uſe of thoſe which have been preſcrib'd for the Pain which is occaſion'd by Cold, and for an Obſtruction proceeding from a Catarrh. After which, it will be no difficult matter to chuſe the moſt convenient, if we conſider the Circumſtances which may afford us the neceſſary Indications for the Cure.

The Cure of the Noiſes in the Ear, is the ſame as that which is us'd for the Diſeaſes from which they are produc'd.

FINIS.

A

GENERAL TABLE

OF

The Organ of Hearing.

PART the First, containing the Structure of the Organ of Hearing.

THE *external Part of the Organ of Hearing call'd only the Ear,* Page 1. *is compos'd of a Cartilage,* 2. *of Skin, of Fat, of a nervous Membrane, of two Muscles,* id. *of Arteries,* 4. *of Veins,* 5. *and of Nerves,* 6. *The Hole of the Ear is divided into two Parts,* 1st. *The cartilaginous Part, which is broke off in many Places,* id. *and cover'd with a Skin, adorn'd with many little Glands,* 8. *and is connected to the* Os Temporum *by a Ligament,* id. 2dly, *the bony Part,* 10.

The cartilaginous and bony Part form the auditory Passage, id.
The external Part of the Organ of Hearing is separated from the internal, by the Membrana Tympani, id.
The first Cavity of the internal Ear call'd the Tympanum *or* Drum, 16. *has five remarkable Things in it, 1st. Two Passages, one of which passes into the Palate*, 18. *the other into the* Cavernulæ *of the* Processus Mammillaris, 22. *2dly. Two* Apertures *or* Fenestræ, id. *3dly. Four little Bones, the* Malleus, 25. *the* Incus, 26. *the* Stapes, 27. *the fourth little Bone*, 28. *4thly. Three Muscles, two of which belong to the* Malleus, viz. *the External*, 29. *and the internal Muscle*, 30. *and one to the* Stapes, ib. *5thly. A Branch of a Nerve*, 31.
The second Cavity of the internal Ear call'd the Labyrinth, is divided into three Parts, id. *1st. The* Vestibulum *which has nine* Foramina, 32. *2dly, The three* Canales semi-circulares, viz. Canalis semi-circularis Superior, 33. Inferior, id. Medius, id. *3dly, The* Cochlea, *in which two Things are to be taken notice of*, viz. 39. *1st, The semi-oval Canal*, id. *2dly, The* Lamina Spiralis, id. *Which is fix'd to the Canal by*

by a very fine Membrane, 40. *and which divides the Canal into two*, id. *and 3dly, The Arteries and Veins of the* Cochlea, 41. *and of the* Veſtibulum, id. *4thly. The implanted Air*, 42.

The other Parts of the Organ of Hearing, are the Canal of the auditory Nerve, id. *The* Nervus Auditorius *is divided into two Branches*, viz. *The* Portio Mollis, 43. *which is divided into three Branches, the largeſt of which is diſtributed into the Axis of the* Cochlea, id. *The two other Branches into the* Veſtibulum, *and into the ſemi-circular Canals*, 49. *the* Portio Dura, 50. *which produces as it paſſes out of the Cranium, a Ramification which is expanded over the back part of the Ear*, 51.

The Chorda Tympani *is a Nerve which is a Branch of the fifth Pair*, 53. *which is join'd to the Trunk of the* Portio Dura, id.

The ſecond vertebral Pair furniſhes a Branch to the Ear, 55.

There are many particular Things in the Ear of a Fœtus, 57. *1ſt. That part of the auditory Paſſage which is bony in Adults, is nothing but a Membrane in the* Fœtus, id. *2dly, There is a Circle which is not entire*, 59. *it is hollow in the Inſide like a Gutter*, 60. *This Circle*

cle is united to the bony Canal in Adults, id. it has the same Plan in the Fœtus as in the Adult, 61. 3dly, The Aqueduct is almost entirely membranous, id. 4thly, The Membrana Tympani is cover'd with a mucilaginous Matter, id. 5thly, The superior Semi-circular Canal, and a Portion of the Inferior, are visible without any Dissection, id. 6thly, There is a Fossa and Foramen in the Os Petrosum, 62. 7thly, The scaly Part of the temporal Bone is separable from the Processus Mammillaris, which is very minute, id. 8thly, The Ossiculæ and the Labyrinth are pretty nigh the same size in the Adult, and in the Fœtus, id.

The Trunk of the Portio Dura has two principal Branches, which are divided into many Ramifications, 63. The Ramifications of the first Branch are distributed to the Muscles of the Forehead, Temples and Eyelids, and pass into the Orbit, id. They also go to the Muscles of the Nose and Lips, id. And to all the Integuments of the Face, 64.

The Ramifications of the second Branch are distributed to the Muscles which are under the Jaw, id.

The fifth Pair furnishes a Branch to the Portio Dura, 65.

OF.

A General TABLE.

OF

The Organ of Hearing.

PART the Second, containing the Uſe of the Parts of the Ear.

THE *mechanical Structure of the Organs of Hearing, ſerve to diſcover the Uſe of them*, Page 67.

The external Ear performs the Office of the Trumpet, which deaf People make uſe of, 68. *Its Folds ſerve to augment the Force of the Air, which acts upon the Organs by the Refractions which they cauſe*, 69.

The Muſcles of the external Ear ſerve to contract and dilate it, id.

The Obliquity of the Paſſage is proper to preſerve the Membrana Tympani *from the Injuries of the Weather, and to render the Vibrations ſtronger by doubling its Refractions*, id.

The Wax ſtops extraneous Bodies, which might impair the Membrana Tympani, 70. *it may alſo be prejudicial to the Ear,*

when it is too thick and in too great quantity, id.

The Membrana Tympani *is necessary for the Preservation of the other Organs*, 71. *It is extended by the Muscles of the* Malleus, 72. *The Will is not the Cause of these Muscles acting, but the different Dispositions of the Objects*, 73. *and according to the Occasions which concur*, 74. *The* Membrana Tympani *is more or less relax'd according to the Diversity of Sounds*, id. *Which it does in putting on their Characters, by mechanical Motions which are difficult to explain*, 75.

The Agitation of the Membrana Tympani *is communicated to the other Organs of Hearing, not so much by the Help of the Air, which is in the Cavities of the Ear*, id. *as by the Assistance of the little Bones, which agitate the Labyrinth, and the Air which is inclos'd in it*, 76.

The Muscle of the Stapes *serves to extend the Membrane, which is fix'd to its* Basis, 77. *and to extend the* Stapes *it self*, id.

The Passage of the Processus Mammillaris *affords a Passage to the Air when it is over-press'd in the* Tympanum, 78.

The Aqueduct serves to bring the Air from without to it, and to renew that which is

is in the Tympanum, id. *and not to supply the Office of the* Membrana Tympani, 179.

The Feneſtra Ovalis *communicates the Vibrations of the Air to the Labyrinth*, 80.

The Feneſtra Rotunda *communicates them to the* Scala Inferior *of the* Cochlea, 81.

The immediate Organ of Hearing conſiſts of two Parts, which compoſe the Labyrinth, id. *the firſt of which is the* Cochlea, id.

The Lamina Spiralis *is eaſily vibrated*, id. 1*ſt. Becauſe of its Subſtance*, id. 2*dly. Becauſe it is very much extended*, 82. 3*dly. Becauſe in dividing the Semi-oval Canal into two* Scalæ, *it receives Pulſations from the upper and the under one*, id. 4*thly. Becauſe its ſpiral Figure is the Cauſe of its being vibrated in many Places*, 83. 5*thly. This* Lamina *receives all the different Vibrations of the Air, becauſe of its unequal Figure*, id.

The ſecond Part of the immediate Organ comprehends the Veſtibulum *and the three Semi-circular Canals*, 84.

The Cochlea *is not to be found either in Birds or in Fiſhes, the Semi-circular Canals alone perform the Office of the immediate Organ in theſe Animals*, 85.

There are Nerves and Membranes which

are

are the Cauſe of theſe Semi-circular Canals, forming part of the immediate Organ, id. *Their Windings ſerve to augment the force of the Air, by the Refractions which they cauſe,* id. *Theſe Canals receive the different Characters of Tones as well as the* Lamina Spiralis, 86. *becauſe they are made like Trumpets,* 87. *and their Subſtance is eaſily vibrated,* id.

It is by the Communication of the auditory Nerves with thoſe of the Voice, that the Sympathy between the Voice and the Hearing is caus'd, 88. *and by the Communication of the ſecond vertebral Pair, that the Affinity that there is between the Tones of Hearing and the Motions of the Body are produc'd,* 89. *and that of the Pulſe,* id.

OF

A General TABLE.

OF

The Organ of Hearing.

PART the Third, containing the Diſorders of the Organ of Hearing.

THE Knowledge of the Diſtempers of the Ear depends upon that of its Parts, which are aff[illegible], Page 90.
The Diſorders of the auditory Paſſage which cauſe extreme Pain, and remain in this Part, proceed from, 91. *the Solution of Continuity*, 92. *caus'd by the Wax, which is in the Inſide of the auditory Paſſage*, 93. *The external Cold increaſes the Acrimony of it by the Obſtruction of the excretory Ducts of the Glands*, id. *which render the ſaline Juices more pungent*, 94. *by Heat, which looſens and diſſolves theſe ſaline Juices*, id. *or by the ſharp, ſaline and ſerous Humours, which ſometimes come out of the Glands of the Ear*, id.

The

A General Table.

The different Solutions of Continuity cauſe the different Senſations, 95. *of pungent Pain*, id. *of Erоſion*, id. *of Tenſion, of Weight, of Pulſation*, id.

This Pain is very violent, 96. *becauſe the Membrane of the Paſſage is compos'd of a fine nervous Texture*, id. *and receives a great number of Nerves*, id. *and is fix'd cloſe upon the Bone*, id. *and connected with other very ſenſible Membranes*, 97. *And this often cauſes an acute Fever*, 98. *by the Agitation of the Spirits*, id. *and by the Fermentation of the Blood*, 99. *A Watchfulneſs*, id. *Delirium*, 100. *Convulſions*, id. *and Swooning*, id. *A Hiſtory upon this Subject*, 101. *Remarks upon this Hiſtory*, 102.

Remedies to be us'd for the Pain caus'd by Cold, 104. *for the Pain proceeding from Heat*, 105. *for the Pain caus'd by ſerous Humours*, 106.

The Cauſes which produce an Inflammation in the auditory Paſſage are, id. *the Obſtruction of the Glands*, 107. *the Acrimony of the Wax*, id. *which cauſe Abſceſſes and Ulcers, which are difficult to cure*, id. *We ſometimes meet with Worms in the Paſſage*, 108.

The

A General TABLE.

The Causes of the Suppuration and the Flux of Blood, which apparently does not come from the Brain, 109.

Cure of the Inflammation, 112. *Abscess*, id. *Ulcer*, id. *Worms*, 113. *and Fluxes of serous Humours*, 114.

The third Disorder of the auditory Passage is Obstruction, it is occasion'd by, id. *extraneous Bodies*, id. *2dly. The retain'd Wax*, 115. *which petrifies sometimes*, id. *and causes a sort of Deafness easy to cure*, 116. *3dly. By a Membrane*, id. *4thly. By fleshy Excrescences*, 117. *5thly. By the Glands which surround it becoming tumified, which is commonly accompanied with a Relaxation of the* Membrana Tympani, id.

Cure of the Obstruction caus'd by extraneous Bodies, and the Extraction of them, 118. *which is perform'd by the Scoop, or the* Terebra, *when they are inclos'd in the cartilaginous Passage*, id. *or when they are contain'd in the bony Passage, it is effected by an Incision into the back part of the Ear*, 119. *From whence we extract Shot with the* Terebra, id. *and Fruit-Stones with* Hildanus *his Scoop*, id.

Cure

Cure for the Obſtruction proceeding from the Hardneſs of the Wax, 120. *For the Membrane which ſtops up the Paſſage*, id. *for Excreſcences, of which we muſt extirpate as much as we can by the Ligature*, 121. *and conſume the Remainder by Cauſticks*, id. *which muſt be very carefully us'd, for fear they ſhou'd hurt the Membrane of the Paſſage*, 122.

Cure of the Obſtruction proceeding from the Glands being tumified, 124.

The Diſeaſes which the Membrana Tympani *is liable to, are Relaxation*, 126. *too great Tenſion*, id. *Schirrouſneſs*, 127. *and Rupture*, id. *or at leaſt diſunion from the Bone, to which it was before united*, 128.

Theſe Cauſes do not occaſion an entire Privation of the Hearing at firſt, but only ſome time afterwards, 129.

Cure of the Relaxation, 130. *and of the Tenſion*, id. *the Schirrouſneſs and Rupture are incurable*, id.

The Diſeaſes of the Tympanum *and of the Labyrinth, are* Caries *of the Bone*, id. *which may cauſe Deafneſs*, 131. *Inflammation of the Membranes*, id. *and Abſceſs of the Membranes*, id. *Inflammation*

flammation of the Lamina Spiralis, *which may grow carious*, 132.
Cure of the Caries, id.
Cure of the Inflammation of the Membranes, 133.
The Diseases of the auditory Nerve are Obstruction and Pressure, 134. *which may proceed from Tumours happening upon the Brain*, id.
It is difficult to know whether the Deafness proceeds from any Fault in the Nerve, or from any Fault in the Organ, 135.
The Noise in the Ear is a Symptom, the Causes of which are difficult to explain, id. *the Ancients attributed it to the implanted Air*, 136. *It is more reasonable to believe, that it is commonly produc'd by the Vibration of the immediate Organ*, 137. *which is produc'd by Causes inclos'd in the Membranes of the Ear*, 138. *which may be attributed to the Diseases which produce this Symptom*, id.
Sometimes the Noise in the Ear proceeds from an external Impulse, as when we stop our Ears with our Hands, 139.
The Disorders which cause this sort of Noise in the Ear, are the Commotions of the Cranium, 140.

The

The Beating which we imagine we hear in the Inside of the Ear, is caus'd by the Contraction of the auditory Passage, id. *and by the Pulsation of a dilated Artery,* 141. *The immediate Vibration of the Extremities of the nervous Fibres to their Origin in the Brain, may cause all the Appearances of Noise,* 142. *which is not so much a Symptom of the Diseases of the Ear,* 143. *as of those of the Brain which produce a second sort of Noise in the Ear,* 144.

The Cure of the Noises of the Ear, is the same as that which is us'd for the Dis-
ease from which they are produc'd, 145.