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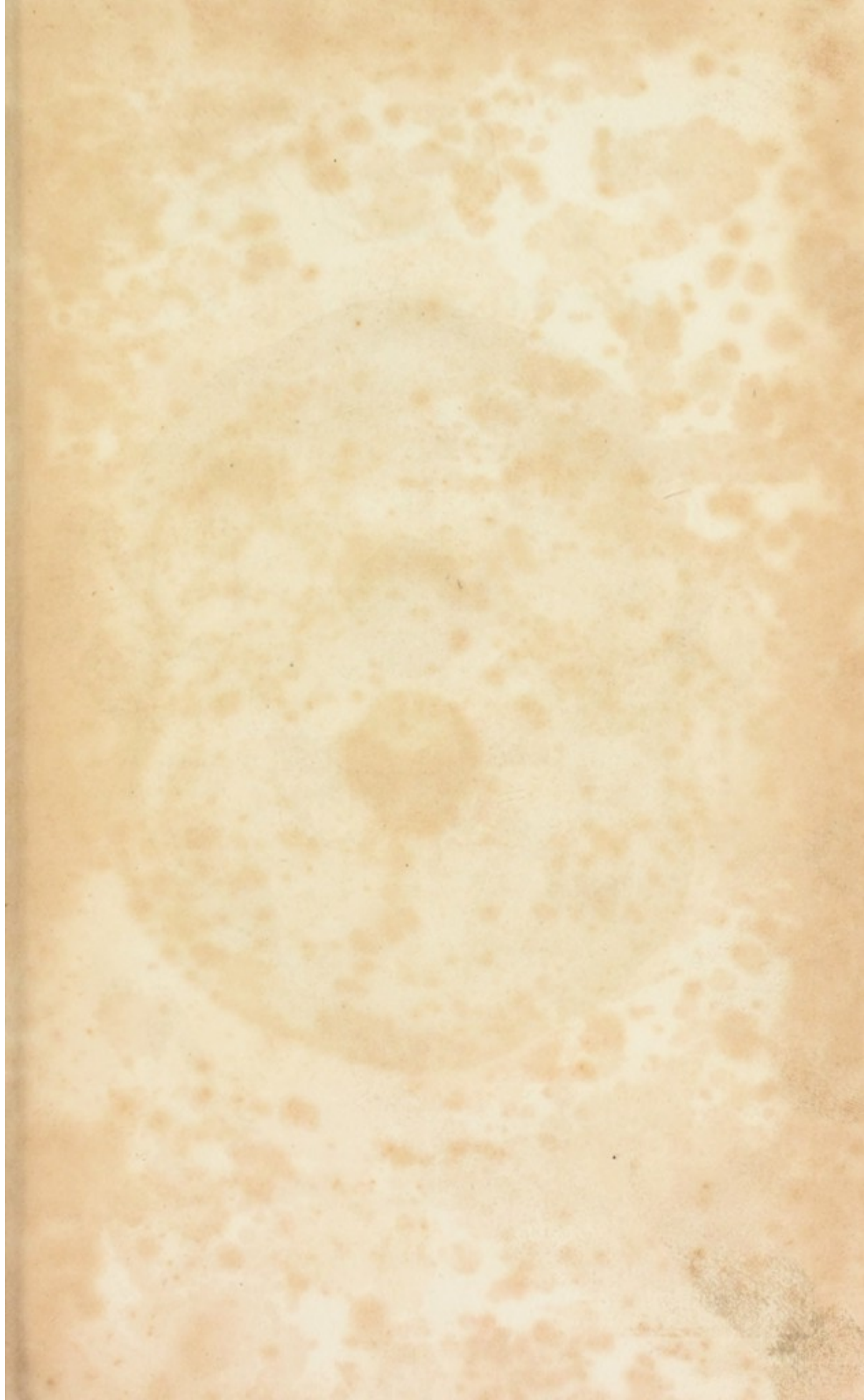
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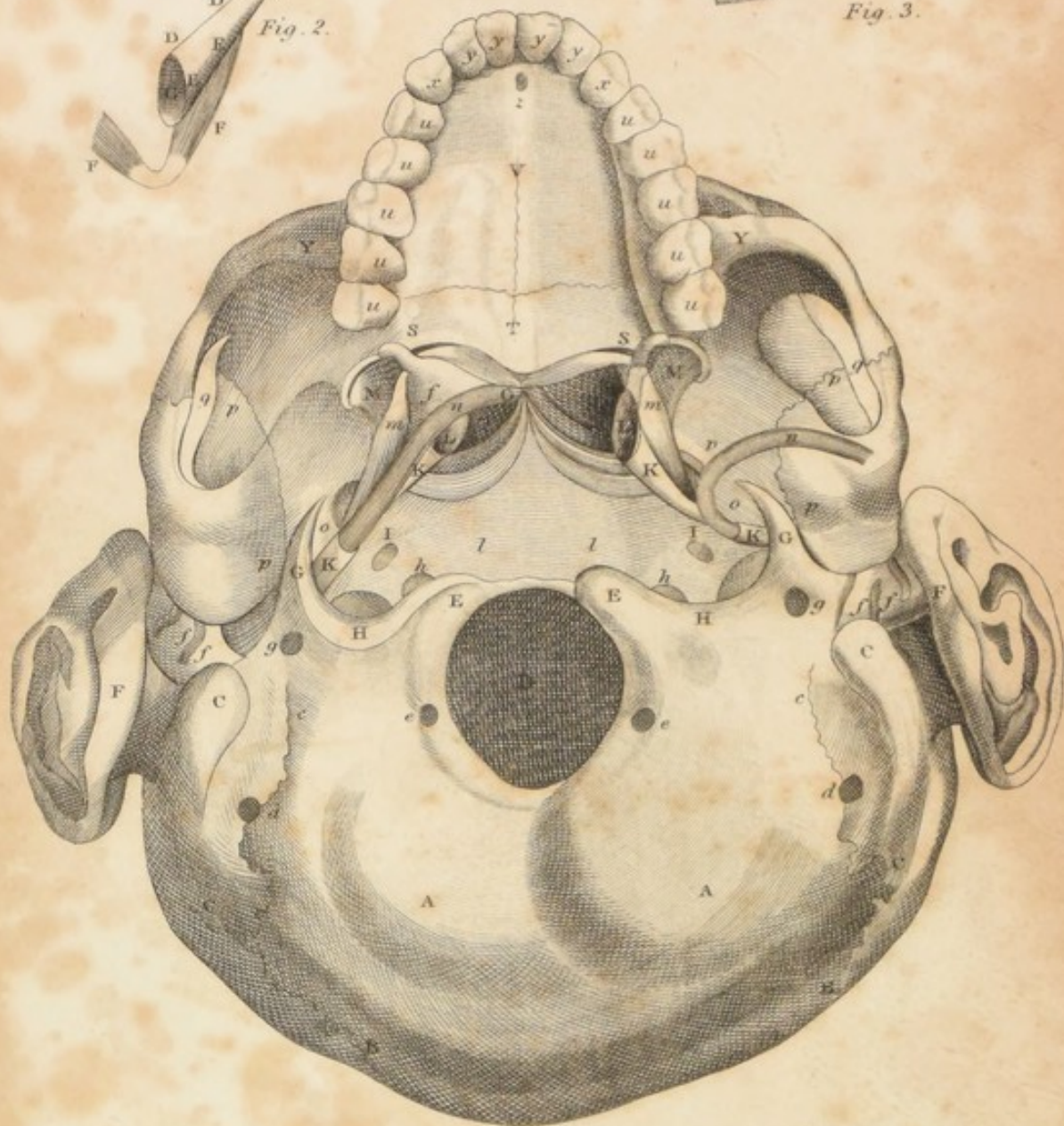
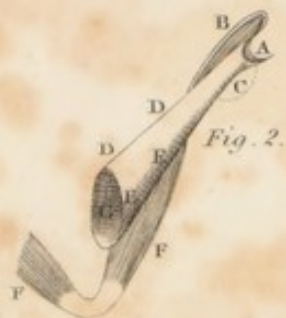
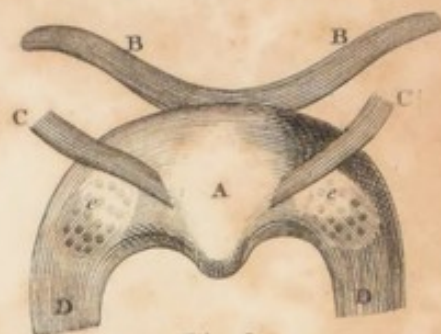


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PREFACE.

THE state of the Deaf and Dumb has of late become a subject of more interest than formerly, and has now assumed that degree of importance it is entitled to, among the numerous efforts in which science, benevolence, and liberality, are exerted to improve the condition of the unfortunate portion of the community. An opinion had long prevailed, that this kind of affliction was of comparatively rare occurrence; and it was not until public sympathy was more recently excited, by the promulgation of statements shewing the large proportion of persons in the United Kingdom labouring under partial or total privation of hearing and speech, that the subject has attached to itself sufficient importance. Several institutions have been founded in this country for the reception,

education, and maintenance of persons labouring under the privation of hearing and speech, but they have proved, in every instance, inadequate to the preparation of the deaf and dumb for general intercourse with society.

The chief cause of their failure in accomplishing those objects which institutions of this description ought to have in view, is the circumstance of their proceeding in all cases upon the unfounded assumption, that those brought to them for admission are totally deaf, and incapable of experiencing any restoration of the sense of hearing.

Having been led to the consideration of the subject by observing the number of applicants for admission into these institutions,—by a knowledge that cases are admitted without inquiry, or any medical investigation having been previously instituted,—by the too far advanced age at which only they are admissible,—and by the well-known fact, that, after admission they are not subjected to any examination or medical treatment,—from these circumstances I was induced, as early as 1817, to propose what

I conceived a better system of procedure to the Governors of the London Deaf and Dumb Asylum.*

I adopted this measure at that time from a firm persuasion that there exist numerous cases in which there is no malformation of the organ of hearing, but merely that state of its function which admits of remedy; and, consequently, that many children so circumstanced would, under proper treatment, obtain the faculty of speech. This opinion has been fully confirmed by subsequent extensive experience; and I am happy to perceive that it has received the support of the eminent and experienced M. Itard, of Paris, who, in one of his memoirs to the Minister of the Interior, states that absolute deafness is comparatively rare, and that not more than one-fifth of the cases of deafness and dumbness which have come before him, have presented a state of total deprivation of the sense of hearing.

When we reflect upon the insufficiency of

* Vide my Letter, page 195.

institutions for the admission of all, or even a large portion, of congenital cases of deafness and dumbness,—upon the number of those cases actually existing in the community,—and upon the fact of three, four, five, and in some instances even seven children in one family* being so afflicted,—the propriety, nay, the moral necessity, of having recourse to some enlightened means of inquiry into the state of particular cases, before admission into these institutions, must become apparent; and even still more apparent must it be, when we consider that the education to which applicants when admitted are subjected, is not one which will in

* According to the last report of the London Deaf and Dumb Asylum, Jan. 12th, 1829, it appears that a list of sixty-four candidates was presented to the governors, out of which they were under the painful necessity of electing only twenty-one, though all seemed to have powerful, if not equal, claims to their notice. By the same report it will be seen, that in seventeen families, containing one hundred and thirty-six children, there are no fewer than seventy-eight deaf and dumb.

any way tend to restore the sense of hearing and faculty of speech, but only to furnish them with very imperfect substitutes for both. It was with this view that, on the occasion alluded to, I recommended, as a measure of primary importance, a minute examination of all deaf and dumb children, and that none should be presented for admission into asylums unless accompanied with certificates of such examination by competent professional men, stating that every medical means of restoring or improving the sense of hearing had been employed without success.

If a plan of this kind were resorted to, institutions for the deaf and dumb would fulfil the rational objects of their founders,—would be appropriated solely to those who are incurable,—and the number of applications would thus be reduced within the means and legitimate scope of these charities. Another very important advantage would result, namely, that opportunities would be furnished to medical men for experience, and for ascertaining the best means of administering relief in cases

where benefit, or a complete cure, is to be hoped for; and patients would not be deemed incurable, and subjected to all the consequences of such an unfavourable decision, without having been submitted to a rational mode of treatment.

It should be recollected, that to restore to society one who suffers merely from remediable defects, and to render him useful by the scientific developement of his senses and natural powers in that vocation to which his station in life may introduce him, is much more laudable than to lead him through the indirect and imperfect forms of a symbolical education, however favourable such means may be with regard to those cases for which all practicable resources have been tried and have proved unavailing.

In offering the above observations, as confirmed by daily experience, I have no hesitation in declaring, that the more I see of cases of deafness and dumbness, the more I am convinced that much relief may be administered; and that not one should be relinquished as hopeless until all means have been

tried to restore or to improve the sense of hearing.

Notwithstanding the general advancement of medicine and surgery, and the improved methods of cure for various diseases, it is to be regretted that those of the ear are attended with more inconvenience than any other. In considering the chief obstacles that present themselves, it is to be observed, in the first place, that the structure of the ear is extremely complicated, the parts that compose it are principally internal, and the diseases that assail it chiefly concealed from view. Hence, in very many cases, arise the uncertainty of diagnosis, and the difficulty of adopting a proper course of practice. In the second place is to be noticed the extraordinary prejudice which, ascribing all congenital deafness to malformation of the organ of hearing, denounces the disease as incurable, and depreciates all attempts at relief as at once nugatory and fallacious, or at least painfully uncertain. A third objection which has been often urged is, the difficulty of applying remedies immediately to the

parts affected. Yet means of relief may be employed without inconvenience, and often with success. Congenital deafness, and that which is observable soon after birth, frequently depends upon casual circumstances only. In the ear, as in every other organ of the body, cases of defective formation may present themselves, and in these instances deafness is incurable; but happily such cases form not the majority of those which usually present themselves to our notice. The necessity of the treatment I propose in early infancy, before the disease is permanently confirmed by time and habit,* will be more apparent from the fact, that the number of cases of deaf and dumb has much increased of late years.

Since I published the first edition of my *Treatise on the Physiology and Diseases of the*

* Children are not eligible to the London Deaf and Dumb Asylum until nine years of age, and are received under eleven years and a half. Although the number of deaf and dumb is so great, this institution does not admit more than forty or fifty yearly, and these not selected from the worst cases, but merely by a plurality of votes.

Ear, and devoted my attention to the defects of that organ, I have daily found reason to be satisfied that I have been the instrument of relieving many forlorn individuals, who would have been excluded from society but for the relief I was fortunate enough to afford them. From that period (1817), among the patients who have attended me at the public dispensary, and been under my care in private practice, there have been not a few who are in one of the most miserable of all situations, that of being both deaf and dumb. Though I formerly mentioned this in my work, yet I had not then so fully considered the subject in all its important aspects, nor weighed the circumstances connected with it in the manner in which I am persuaded they so much require. Well knowing that a very great proportion of the interesting and distressed objects applying for admission into the institutions formed for the deaf and dumb cannot be admitted into them, and that the advanced age at which they are admissible is an unfavourable circumstance as regards the medical treatment of such cases,—I directed

my attention with much earnestness to the means of improving the sense of hearing and of developing the faculty of speech, and thus rendering the sufferers independent of such establishments, by fitting them to become useful members of society before they arrived at the age assigned for admission.

In attending to this subject, I have perused almost every publication that could be traced on these defects,* and particularly some rare

* The first complete account of the structure of the ear was given by Duverney, in the year 1683; the work contains a number of plates: see *Mem. Acad.* tom. i. pp. 256—9. In the following year a valuable treatise on the ear was published by Schelhammer.—Valsalva's treatise, *de Aure Humanâ*, is regarded as one of the most accurate productions of the anatomists of the seventeenth century; it comprehends a very full account of all that was known respecting the ear at the time of its publication, 1704.—Eustachius's letter, *de Auditûs Organis*, written in 1562, contains an account of the tube which bears his name, *Opusc. Anat.* pp. 138—40.—Fallopianus, in his *Observ. Anat.* pp. 364—6, briefly describes the ear; and Fabricius more copiously in his treatise, *De Aure*, *Op.* p. 249, et seq. To these we may add the following works as deserving our attention:

and scarce tracts, which shew much ingenuity, and which I have endeavoured to present to the reader in the present work. By this it will appear, that the symbolical mode of education

Perrault on the organ of hearing, in *Mem. Acad.* tom. i. pp. 158—161; Winslow, *Anat.* sect. 10. art. 4. vol. ii. p. 312, et seq.; Boerhaave, *Prælect.* sect. 547—565. tom. iv. pp. 139—201, cum notis; Haller, *El. Phys.* lib. xv. in the three sections of which are considered the structure of the organ, the theory of sound, and the sense of hearing; Cassebohm's five treatises, accompanied with numerous figures; Martin's description of the ear, in his *Philos. Brit.* vol. ii. pp. 219—224.—Sabatier on the internal ear, in his *Anatomie*, tom. ii. pp. 127—148; Boyer on the same, in his *Anatomie*, tom. iv. pp. 136—169; Scarpæ *Disquisitiones de Auditu et Olfactu*; Monro secundus, in his three treatises; Bichât, *Anat. Des. de l'Oreille et de ses Dependances*, tom. ii. p. 472, et seq.; Caldani, *Icon. Anat.* pl. 96—100, several of these are original; Bell's *Anat.* vol. iii. part 2. book ii. ch. iv. p. 399, et seq.; Young's *Lect.* pl. 25. fig. 349—351; and the elaborate plates of Sæmmering, *Icones Org. Aud. Hum.*

For the comparative anatomy of the organ, see Cuvier *Lec. d'Anat. Comp.* No. 13. tom. ii. p. 446, et seq.; and Pohl, *Expositio Anat. Org. Aud. per Classes Anim.*—Gough, on the method of judging of the positions of sonorous bodies, *Mach. M.* v. 622, thinks the bones of the head assist us in

was known long before the time of the Abbé de l'Epée, the celebrated French teacher, who deserves much credit for his undivided attention to this subject. I have also had much pleasure

forming the judgment; a sound just audible at 240 feet was distinguished as being nearer at 40 feet than at 42; a horizontal angular difference of 8° was perceptible, an elevation of 10° .—On the invisible girl, Nich. 8. iii. 56, sound conveyed by pipes which open in a crevice of the moulding of a frame.—E. Walker's apparatus for conducting sound, Nich. 8. iv. 69.; Gibb. xiv. 220.—Viettes' acoustic observations, Gibb. xvii. 117, asserts that there is a point precisely in the axis of hearing where the sound is not audible.—Darwin's *Zoonomia*, ii. 487.—Dr. Young's *Natural Philosophy*, vol. ii. p. 271.

Ear and hearing instruments for hearing: Perrault on the organ of hearing, A. P. i. 158.—Acc. by Douglas, Ph. Tr. 1705. xxiv. 1978.—Duquet's hearing trumpet, Mach. A. ii. 119.—Duquet's chair for the deaf, Mach. A. ii. 129.—Blair on the organ of hearing in elephants, Ph. Tr. 1718. xxx. 885.—Mairan on the effect of sound on the ear, A. P. 1737. 49. H. 97.—Leprotti on the perforation of the membrana tympani, Coll. Acad. x. 518.—On a perforated membrana tympani, C. Bon. i. 350.—The hearing unimpaired, Rivinus called it his foramen.—Martiani's model of the ear, A. P. 1743. H. 85.—Nollet on the hearing of fishes, A. P. 1743.

in perusing the writings of many of the most celebrated German and French physiologists, who have, within these few years, thrown much light on this long-neglected but most interesting and important science.

189.—Brocklesby's extract from Klein on the hearing of fishes, Ph. Tr. 1748. 233.—Arderon on the hearing of fish, Ph. Tr. 1748. 149, thinks that river fish have no hearing; observes that sound is transmitted but faintly through water; a hand-grenade bursting under water produced prodigious tremors.—Geoffroy on the hearing of reptiles, S. E. ii. 164.—Haller, *Physiol.* v.—Camper on the hearing of fishes, S. E. vi. 177.—Elliot on vision and hearing, viii.—Vicq. d'Azyr on the ear of birds, A. P. 1778. 381. H. 5.—Hunter on the organ of hearing in fish, Ph. Tr. 1782, 379; shews that they hear.—Galvani on the ear of birds, C. Bon. vi. O. 420.—Scarpa de auditu et olfactu, f. Pav. 1789.—Comparetti de aure internâ, 4 Pad. 1719, R. S.—Extv. Roz. xi. ii. 344.—Brunelli on the hearing of reptiles, C. Bon. vii. O. 301.—Lentin on deafness, *Commentat. Gott.* 1791. xi. Ph. 39.—Caldani sulla membrana del timpano, 8 Pad. 1794, R. S.—Home on the membrana tympani, Ph. Tr. 1800, Nich. v. 93.—Cooper on the operation of perforating the membrana tympani, Ph. Tr. 1800. 151, Nich. 8. i. 102.—On hearing by the teeth, B. Soc. Phil. n. 41, Nich. iv. 383.—Beaumont's hearing instrument approved, M. Inst. iv. Gibb. x. 567.

In order to render the subject familiar to the reader, I have introduced a short description of the anatomy of the ear, and of the different parts connected with hearing and speech; I have inquired into the probable causes of deafness in young children, and then proceeded to the investigation of its natural consequence, dumbness. The various modes of giving relief have been afterwards explained, with the medical treatment. My great object in this work is, to demonstrate the necessity of the inspection of children in early infancy, in order to ascertain the nature of, and to relieve, such imperfections. Having been fortunately successful in a number of cases, I conceive it a duty I owe to the profession and the public to record my experience on this subject, and to invite the aid of my professional brethren in collecting and imparting such facts as may come within their knowledge, and thus render my labours more useful to society. Whoever reflects on the difficulty that attends the investigation of the organs of sense, will be satisfied that every aid is required on such intricate

parts of the animal economy: in this age of liberality, science, and improvement, when the public good is at stake, no apology will be necessary to a liberal professional mind for my endeavouring, by this appeal, to influence every enlightened individual who has regard for the cause of suffering humanity.

It must be allowed, that there are many difficulties in imparting speedy relief in cases of deafness and dumbness; and this will be more apparent when we reflect upon the numerous causes of these defects, and consider the long infancy and slow growth of man.

I have candidly stated my opinions respecting the utility of establishments for the education of the deaf and dumb, and have pointed out the circumstances under which they should be resorted to, as well as the extent of their province. I have shewn that a symbolical mode of education only is adopted in them, without the least attempt at any rational mode of cure. The chief objection to such education is, that it is attended with much difficulty, must proceed for a great length of time, and is, in the

end, very incomplete. In proposing, therefore, a medical education, or rather treatment, this advantage will be attained, namely, that it can in no way interfere with the other mode of education, but, indeed, may be combined with it, both plans proceeding at the same time. The benefit resulting from this procedure is, that if the case should prove irremediable, the method which appropriately belongs to unfavourable cases will not have been delayed. Whilst we thus remedy the state of the imperfect organ, or develope its powers by medical treatment, the child should, as soon as possible, be sent to a common school, where he will naturally associate with the other children, and where he will be led to imitate them in the observation of their gestures and sounds, instead of being confined with those of his own unfortunate class. The good effects of this method have been verified by experience, and they are therefore the more entitled to attention.

Until my first work on the Diseases of the Ear appeared, which contains several cases of deafness and dumbness successfully treated,

nothing on the subject of the deaf and dumb had been published, either to interest the reader or to point out any means of relief. Since that time, my professional brethren on the continent have taken up this too long-neglected subject of pathology with much earnestness and zeal: among them may be mentioned Alard, Itard, Deleau, Saissy, &c. The work of the last-named author deserves much attention; on the facts contained in which I have made some remarks. To these I may add Professor Robbi of Leipsic, who, in translating my different works, has added a number of valuable observations in confirmation of the opinions I formerly delivered.

From the abstract of a report made by M. Husson to the Royal Academy of Medicine in Paris, on the method adopted in that metropolis by M. Itard for the cure of the deaf and dumb, it appears, that M. Itard has presented to the Minister of the Interior three memoirs: the first relating to the various methods hitherto employed for the cure of congenital deafness, including those pursued

by the author himself during a long course of practice; the second containing a detail of experimental treatment adopted in nearly two hundred cases, with a view of determining the advantages and disadvantages of injections through the Eustachian tube into the internal ear,—an expedient apparently recommended to public confidence in a recent report of the institution; and the third adducing arguments against the last-mentioned process, and proposing one which M. Itard considers as exclusively entitled to preference, being a medico-physiological method, calculated, in his estimation, to afford relief in very many cases of congenital deafness.*

It is singular to observe, that while the knowledge of the ear has engaged the study of the most ancient anatomists and philosophers, their researches have produced so little in a practical point of view. Alcmaëon, an illustrious Crotonian philosopher, paid much attention to this organ; Hippocrates, who flourished

* Vide pp. 200 *et seq.*

400 years before the birth of Christ, was no less attentive to it; and Aristotle, at a later period, though he was particular in his description of it, was not thoroughly acquainted with its structure and functions. It was not till of late years that the anatomy and physiology of the ear were fully investigated; and for this we are much indebted to the celebrated Dr. Monro, and Dr. W. and Dr. J. Hunter.

Thus have I endeavoured to take advantage of the light which has been thrown upon this difficult and interesting field of research by the able inquirers, both ancient and modern, whose views I have subjected to the test of my own experience. My desire has been to benefit those who labour under this distressing defect, by collecting and comparing the facts derived from those extensive sources of observation of which I am possessed, as well as from the recorded experience of those who have been labouring in a similar field of practice to myself.

The result to me has been highly satisfactory: I am now fully aware of what cases of deaf and

dumb can be cured, and what only admit of alleviation by mechanical means, or a symbolical education. In objecting to the latter, it is only from a wish that every thing should be tried before having recourse to this forlorn expedient, and not from any opposition to the ingenious men who have laboured on this part of the subject. To the French we are particularly indebted for their attention to the organ of hearing, and also to the continental writers in general.

For much useful information on the art of teaching the Deaf and Dumb, the following works may be consulted:—

De l'Education des Sourds-Muets de naissance. Par M. Degerando.

Duleau, *l'Ouïe et Parole.*

Soemmering, *Iconologie de l'Organe de l'Ouïe.*
Traduit du Latin par A. Rivalie.

AN ESSAY,

ETC.

CHAPTER I.

OF THE EAR.

To no part of the human structure has so little attention been paid as to the organ of hearing. It does not appear that any sufficient reasons have been assigned for neglecting thoroughly to investigate the anatomy of this very important part.

Other parts, of a more minute and complicated formation, have occupied the time and assiduous attention of the anatomist, and have not been considered as unworthy of his labour.

The mechanism of the acoustic organ is highly complex; its situation conceals it from the sight; yet, from observing it in the larger animals, we are by analogy enabled to explain its principal and accessory parts in man. In all physiological inquiries it is of the utmost importance to bear in mind that it is by patience and persevering attention only that we can ever expect to arrive at truth.

It was by careful examination and attentive study of the structure and functions of the heart and veins in animals, that the immortal Harvey was led to his grand conclusions respecting the circulation of the blood, contrary to the opinions of the ancients, and by

which he established the most certain means of detecting the presence and nature of diseases in the human frame.

Many discoveries, it is true, have been fortuitous ; but none of these are connected with anatomical science : industry and careful inspection are here the only means by which we can extend the limits of our knowledge ; by these means the subject of our study becomes familiar to us, and light increases upon it as we proceed.

The anatomist, at every stroke of his knife, feels a new impulse urging him forward ; one fact leads to another, until the intricate and wonderful fabric is unfolded before him, displaying beauty, harmony, and design, which he had never previously perceived, and affording the clearest evidence of infinite wisdom and power.

Of the organs of sense, none is equal to the ear in its importance to man : it warns him of the approach of danger, by which he is led to evade insidious attacks, and to escape from situations of peril ; it is a principal channel of knowledge, and essential to the enjoyment of the inestimable blessing of social intercourse.

Every thing respecting the ear must be acknowledged to be highly interesting, when we consider it in connexion with our personal safety, our external relations, and social happiness.

Such being the case, it cannot fail to excite surprise and wonder that it should not have received an equal share of attention with other parts of the structure which can by no means lay claim to such extensive utility.

These observations it is necessary to state previously to entering upon the description of the organ: in this the most simple and clear method will be adopted: its divisions will be so arranged, that the parts and functions of each may be fully understood.

The ear is an organ destined to receive sound, and to convey a sensation of it to the mind. It may be divided into three principal parts—for the collection, the transmission, and the reverberation, of noise from sonorous bodies, or such as are calculated to make impressions on its mechanism and ultimate nervous arrangement. The first part, for the collection of sound, is termed the *external ear*. The second part, for its transmission, is called the *intermediate ear*. The third part, for the reverberation of noise, is the *internal ear*.

A DESCRIPTION OF THE EXTERNAL EAR.

The form of this part of the organ is that of a shell; it is situated externally, and furnished with hollows and sinuosities, to detain the pulses of air passing onwards, and for directing them internally in their passage, in order that they may reach the sentient extremities of the auditory nerve: it has received the name of the auricle, but the term is not important; it is placed on the side of the head, and is joined by its root to the os temporis.

The margin of that side, which is turned from the head, is considerably elevated; and the general concavity within the margin is, by elevations of the sur-

face, subdivided into certain curvilinear grooves, all of which are directed towards a canal formed in the root of the auricle—the meatus externus. The concha, the deepest and largest depression of the auricle, is situated at the entrance of the meatus externus. The boundaries of the concha are formed by four eminences, viz. the tragus, helix, antihelix, and antitragus. The tragus and helix bound it anteriorly, the antihelix and antitragus posteriorly. The tragus is placed immediately behind the condyle of the lower jaw; it rises into a little knob, and lies on the forepart of the meatus externus. The helix arises from the concha, which it partially divides into a superior and inferior depression; it advances from its origin a little before the tragus, is soon reflected in the form of a curve, and, in its descent gradually becoming less distinct, is lost in a soft pendulous substance, called the lobe. The antihelix is situated within and opposite to the helix, and is formed with a similar curve: above it consists of two ridges, which unite, and the eminence formed by their union is continuous below with a little projection, called the antitragus, from its position being directly opposite to the tragus. Between the helix and antihelix is a considerable groove; it increases in depth as it approaches the concha, in which it terminates. Another groove, placed between the two ridges of the antihelix, joins the former just before its termination. These are the most remarkable appearances on this side of the auricle.

The opposite side of the external ear possesses little requiring particular attention: it may be said to

be convex, but in the general convexity the projections of the concha, helix, and antihelix, are very apparent.

The auricle consists of an elastic cartilage and the common integuments : it owes its figure chiefly to the cartilage, in which the eminences and depressions already mentioned are formed, except the lower part of the helix, and the lobe ; these are merely duplicatures of the skin, containing a portion of fat. The root of the auricle is disposed in the form of a tube ; but the cartilage itself does not complete the circle. This is effected by the union of the tragus to the helix, by means of a ligamentous fascia, and the common integuments. This tubular part of the auricle is adapted to a tubular part of the os temporis, and, thus united, they form the meatus externus, a canal leading to the interior parts of the ear. This canal is observed to vary in length in different subjects, from an inch and a quarter to an inch and a half ; its area gradually diminishes as it approaches its termination ; its shape is rather elliptical than cylindrical, its direction inwards, with a slight declination ; it is not rectilineal, but winding ; it is first turned upwards, then downwards, and is again slightly bent near its termination ; its lower part is longer than the upper, for it terminates, as it were, by an oblique section, which is closed by the membrana tympani, in such a manner that this membrane makes an obtuse angle with the canal above, an acute angle below. The common integuments, having covered the cartilage of the auricle, enter the meatus externus ; and having reached the bony portion of this canal, they become extremely thin. They form a lining to the

meatus, and terminate in a pouch placed in contact with the exterior surface of the membrana tympani.

In the skin of the auricle, and that of the meatus externus, are numerous small perforations, which are the orifices of sebaceous follicles in the former, and of the ceruminous ducts in the latter. The ceruminous glands themselves are placed exteriorly to the cutis of the meatus externus, in the interstices of a reticular membrane. They are about the size of millet-seed, approach to a spherical or oviform figure, and are of a slight yellow hue, which colour they receive from their cerumen. From each little gland proceeds a small duct, that opens into the meatus externus, and discharges the cerumen, by which the membrana tympani is lubricated.

The auricle is retained in its situation by the ligamentous connexion of the cartilage with the bone of the meatus externus, and by a strong ligament, that passes from an acute point of the helix to the zygomatic process of the os temporis.

The description just given is that of the adult ear. The parts in the foetal ear are less perfect; in it the meatus externus is almost entirely cartilaginous and membranous. Instead of a process of the os temporis forming a considerable part of the meatus externus, nothing more is observable than a slender piece of bone, of an elliptical figure, but not making a complete ring: it contains the membrana tympani, and adheres to the rest of the os temporis by its extremities only. The space between the tragus and this ring of bone is occupied by a very dense membrane, that seems placed there as a kind of bed, in which bone is afterwards

deposited. As ossification extends, the different parts of the os temporis are consolidated; indeed, soon after birth, the fœtal ring is united to the rest of the bone, and is gradually elongated during the progress of growth, until it occupies the place of the membranous substance just mentioned. It has already been said that the meatus externus terminates obliquely, and that its lower part is longer than the upper. A little groove, making three-fourths of an ellipse, is formed in its extremity; it contains the membrana tympani. The membrana tympani is the partition between the external and intermediate part of the ear, and is so called from its closing the orifice of a cavity named the tympanum.

A DESCRIPTION OF THE INTERMEDIATE EAR.

The intermediate ear is that part which enters from the external division, and terminates with the peculiar mechanism situated in the organ; it is in this part or opening that the sound is received from the cavities of the external ear, forwarded by the action of the atmospheric air into the cavity, in order to be impressed on the internal sense: it may be considered as the reservoir for concentrating sound, and detaining it for its different uses.

The principal part in this division is the tympanum, which is the cavity immediately placed at the bottom of the meatus externus. It is formed between the squamous and petrous portions of the os temporis. Its figure, although irregular, approximates to the spherical. The regularity of the bony superficies in which the tympanum is placed, is interrupted by

numerous little pits, spiculæ, and foramina. The depth of the tympanum is not equal in all directions. Its greatest depth is opposite to the aperture of the vestibule, the least to the apex of the cochlea: the former scarcely exceeds three lines, the latter is hardly two. The length and breadth of the tympanum are nearly equal, each measuring about the third part of an inch.

The mastoid cells are placed behind the tympanum. They are large and numerous, freely communicate with each other, and open by a large aperture in its posterior and superior part. They may be considered as a part of the tympanum; for the communication is perfectly free, and they are both lined with a delicate and vascular membrane, which secretes a fluid to moisten the internal surface, at the same time that it answers the purpose of a periosteum to the bony superficies.

In the anterior and lower part of the tympanum is placed the aperture of the Eustachian tube. The Eustachian tube proceeds from the tympanum, passing obliquely forwards and inwards by the side of the internal ala of the pterygoid process of the os spheroides, and opens in the superior and lateral part of the pharynx above the velum palati mollis. The Eustachian tubes reach their termination in the pharynx with so great a degree of convergency, that if they were produced, they would meet each other at the back of the vomer. The Eustachian tube is composed of bone and cartilage. The bony portion is lined with the same membrane as the tympanum; the cartilaginous with a reflection of the membrane of the pharynx, which is blended so intimately with the

former, that no line of distinction is perceptible. The bony portion is an elongation of the tympanum, and ends in a scabrous extremity, that receives the cartilage. The cartilaginous portion, as it is called, is not entirely composed of cartilage. It consists, on the fore part, of a dense membranous substance, which, together with the cartilage, affords a surface for the origin of two muscles, the levator palati mollis and circumflexus palati. The two portions, united, constitute a tube about an inch and a half, or an inch and three quarters, in length, of an elliptical figure, the major axis of which is vertical. The magnitude of this tube varies much in different places. Its orifice in the tympanum is about two lines in its major axis: hence it gradually lessens, until it does not exceed one. This magnitude it preserves for a short space, but at the junction of the bony portion to the cartilaginous it suddenly enlarges, and continues to increase until it terminates in the pharynx, where it opens by an orifice large enough to admit a goose-quill.

Besides the apertures already mentioned, viz. the aperture of the mastoid cells, and that of the Eustachian tube, two others are found in the interior superficies of the tympanum. These are the aperture of the vestibule, and the aperture of the cochlea,—the former called the fenestra ovata, the latter the fenestra rotunda. The fenestra ovata is placed in the superior part of the internal superficies of the tympanum, in an oblique direction, but parallel with the plane of the membrana tympani: it is not perfectly elliptical; its upper part is the segment of an ellipse; the lower a straight line, connecting the extremities of the seg-

ment. It exactly resembles the base of the stapes, a bone hereafter to be described, which shuts it up; and therefore, in the recent state, this aperture is not apparent, unless this bone is displaced. The fenestra rotunda is lower than the fenestra ovata, and nearer the mastoid process. This aperture is also closed in the recent state by a membrane of an oval figure, similar to the membrana tympani, and, like that, convex internally. It is placed some way within the fenestra rotunda, and is not discoverable without dissection even in the foetal ear, in which the bone is less evolved.

The tympanum is separated from the meatus externus by the intervention of the membrana tympani. The membrana tympani is pellucid, and of an elliptical figure. Its major axis is placed neither vertically nor horizontally, but obliquely. It is fixed in the elliptical groove, at the termination of the meatus externus, except in the posterior and superior part, where the groove is deficient: there it is attached to a rough surface of the bone. From what has been already said of the oblique termination of the meatus externus, it must be evident that the membrana tympani is very much inclined, and that its superior and posterior part is not so far distant from the orifice of the meatus as the inferior and anterior. It is a thin pellicle of membrane, strengthened without by the cuticle of the meatus externus, and within by the lining of the tympanum. Although always in a certain state of tension, yet it is not a plane; on the contrary, it is very convex towards the tympanum, and the convexity is of a conical figure, the apex of which

is in the centre. To this the manubrium of the malleus is attached. The membrana tympani is exceedingly vascular. Numerous little vessels descend along the manubrium of the malleus, from which diverging twigs proceed. These form beautiful and intricate inosculation, with a plexus of vessels ranged in the margin of the membrane.

The tympanum contains four little bones, articulated with each other, and forming a chain of communication between the membrana tympani and the membrane of the internal part of the ear, in which the sense of hearing is seated. They are the malleus, incus, os orbiculare, and stapes. The first of these is the malleus, which may be divided, for the purpose of description, into three portions, namely, the manubrium, the head, and processus gracilis. The manubrium adheres to the membrana tympani: it is incurvated, particularly at its extremity, which reaches the centre of the membrana tympani, and draws it into its convex state. The head is joined to the manubrium by a slender portion of the bone, which some have called the neck: it makes a considerable angle with the manubrium, and its direction is obliquely upwards and backwards. It is of a globular form; but on one side the surface is irregular, to fit it for a firm articulation with the incus. The processus gracilis passes off just between the head and manubrium, with which it makes almost a right angle. It is articulated in a particular groove of the os temporis, and is fixed by a ligamentous substance, which some anatomists have considered a muscle. It turns in this groove, and is in fact a pivot, on which the motions of

the malleus are performed. The second bone is the incus. It may be divided into the body, and two crura. In the body of the bone is the irregular articular surface, by which it is so firmly connected with the malleus as to be almost immovable. The two crura differ in length. The shorter crus is thicker than the other, and is placed almost horizontally. It articulates in a little depression near the aperture of the mastoid cells. The ligaments which retain it in this articulation allow a considerable degree of motion. The longer crus descends from the body of the bone, is more slender than the other, and bent at its extremity towards the stapes, with which it articulates, by the intervention of the os orbiculare. Its direction in the tympanum is parallel with the manubrium of the malleus, and consequently with the membrana tympani. The third bone, the os orbiculare, is about the size of a small millet-seed. Although named the os orbiculare, its figure is oval. It may be considered as an inter-articular bone between the incus and stapes, connected with both, but more firmly with the former, to which it generally adheres when the bones are separated. The fourth bone is the stapes. It consists of a base and two crura, that coalesce to form the head, which is of an oval figure. To this the os orbiculare is attached. The two crura are curved, and that which is nearest the mastoid process is more incurvated than the other. They are grooved on the inside; and a membrane, occupying the area of the stapes, is fixed in the grooves. The base of the stapes exactly fits the fenestra ovata, which it closes. It is kept *in situ* by the membranous lining of the tympanum and the membrane of the

vestibule, but enjoys a certain degree of motion. The stapes passes from the extremity of the incus to the fenestra ovata, in an oblique direction, so that the base is a little higher than its head, and the sides are between the vertical and horizontal line. These bones are articulated with each other by capsular ligaments, of a degree of delicacy adapted to their minuteness. They are covered with a fine vascular membrane, which may be considered as their periosteum, from which numerous little vessels proceed, that penetrate their substance, and are their nutritious vessels.

The mechanism of the bones of the tympanum is regulated by the action of two muscles, the tensor membranæ tympani, and the musculus stapedeus. The tensor membranæ tympani is contained in a small bony canal, parallel with the Eustachian tube, from the cartilage of which its fibres are derived. These fibres are collected into a long round muscle, that passes through this canal, and enters the tympanum by a slender round tendon. The tendon, passing through a small aperture at an obtuse angle to the line of the muscle, is gently deflected towards the manubrium of the malleus, and is inserted into its upper part. The action of this muscle retracts the tendon into the aperture of the bony canal. By this the manubrium of the malleus is drawn inwards, and the membrana tympani, which is attached to it, put upon the stretch. A similar effect is produced on the membrane of the vestibule by the contraction of the musculus stapedeus, the fleshy belly of which is contained in a canal of bone contiguous to the stylo-mastoid canal. It sends a small round tendon through

an aperture of the bone, which is directed obliquely upwards to the head of the stapes, into which it is inserted.

What remains to be described of the intermediate part of the ear, is the little nerve of the tympanum, well known by the name of the chorda tympani. As the portio dura of the auditory nerve passes through the stylo-mastoid canal, between the tympanum and mastoid process, it sends a small branch through a particular canal, which opens in the back of the tympanum, near the groove that contains the membrana tympani. The chorda tympani traverses the tympanum, lying between the manubrium of the malleus and longer crus of the incus, and enters another little canal nearly opposite to the former. It then continues its course forwards and downwards, between the pterygoid muscles, and joins the lingual branch of the inferior maxillary nerve. This extremity of the chorda tympani is larger than that which is joined to the portio dura, whence some have considered it as a branch of the lingual nerve. It is, in a word, a nerve of communication, which belongs equally to both, and is connected with the trunk of each at an acute angle.

A DESCRIPTION OF THE INTERNAL EAR.

The internal ear may be considered as the actual seat of the organ of hearing: it consists of a nervous expansion of high sensibility; and, in consequence of the intricacy of its structure, it has received the name of the labyrinth, every part of which has its particular use and nice adjustment for its grand design. It

comprehends the vestibule, semicircular canals, and the cochlea, which are incased in the petrous portion of the os temporis.

The vestibule is the central cavity, and communicates both with the semicircular canals and the cochlea, the latter lying in the extreme point of the petrous portion of the os temporis, the former towards the mastoid cells. The shape of the vestibule is irregularly spherical. However, on examination, when it is properly laid open, two distinct depressions are apparent, one semi-elliptical, and situated above, the other hemispherical, and placed below. Both are opposite to the meatus internus,—a canal soon to be described,—and the bony partition is thin, and has numerous small perforations, through which fibres of the auditory nerve are transmitted. The vestibule in the prepared bone is open towards the tympanum; but, as we have already stated, the fenestra ovata is, in the recent state, closed by the base of the stapes. Six other apertures present themselves in the vestibule; five of which belong to the semicircular canals, and the sixth is the beginning of one of the scalæ of the cochlea.

The semicircular canals, although universally so called, are all more than semicircles. They make at least three-fourths of a circle; their calibre is small, about the size of a common pin, and of an elliptical figure. The smallest part of each canal is about the middle of its curve; they enlarge as they enter the vestibule, but one extremity of each canal is particularly dilated, and is called ampulla. The semicircular canals are three, and are distinguished from each other by names given to them from their position or direc-

tion. They have been called the vertical, the oblique, and the horizontal. The vertical canal describes its curve in the summit of the petrous portion of the os temporis, and crosses it with its convex side above. The oblique, on the contrary, describes its curve in the occipital side of the os temporis, and its convexity is placed below. The horizontal canal is bent with its convexity towards the mastoid process, and is directly above a portion of the stylo-mastoid canal. The three semicircular canals enter the vestibule only by five apertures, for the smaller extremity of the vertical canal joins the smaller extremity of the oblique, and their orifice is common.

The cochlea derives its name from its resemblance to the shell of a snail. The similitude is merely external, and is only discernible in the cochlea of the foetus during the first months: for, as ossification advances, the bony substance of the cochlea is blended with the rest of the petrous portion of the os temporis. However, the proper substance may be discovered even in the adult, by its greater brittleness and yellow colour. The cochlea is constructed with a modiolus, or central pillar, on which a spiral tube is wound, and a spiral lamina wound on the same modiolus, lying within the spiral tube, and dividing it into two: its figure is conical, and position oblique; it is placed in the anterior part of the petrous portion of the os temporis, contiguous to the canal that lodges the internal carotid artery, with its base towards the meatus internus and the apex, which is lower than the base, towards the tympanum.

To facilitate the description of the cochlea, it will

be advisable separately to consider the three parts by which it is formed; that is to say, the modiolus, the spiral tube, and spiral lamina. The modiolus commences at the bottom of the meatus internus, by a concave plate, perforated with numerous foraminula, the extremities of small bony tubes that freely communicate with one another, and are continued from the base towards the apex. The modiolus itself consists of these little bony tubes, blended into a mass of a conical figure. The interior fasciculi of tubes are the shortest, and they lengthen towards the centre, in which the longest and largest, which reaches the apex of the cochlea, is placed. They terminate on the sides of the modiolus, at different distances. At their terminations they bend at right angles towards the spiral tube, and their orifices describe about the modiolus a spiral tract, corresponding with the tube in direction. In proportion as they terminate, the modiolus diminishes, and its apex is exceedingly slender. The spiral tube is wound on the modiolus, and adheres to its sides. As it runs towards the apex, the curve which it makes is constantly diminishing. It makes two turns and a half from the base to the apex, and gradually decreases in its capacity. The spiral lamina arises from the vestibule, and winds round the modiolus within the spiral tube. Its greatest breadth is at its origin, whence it gradually becomes narrower, as it approaches the apex of the cochlea. Two thin plates of bone compose it, and appear to unite at their margin, from which a membranous substance proceeds, and is reflected on each side. The spiral lamina with the

aid of this membrane makes a complete septum, and divides the spiral tube into two canals, one of which is called the scala tympani, from its having an aspect towards the tympanum; the other, the scala vestibuli, from its arising in the vestibule. The scala tympani is nearest the base of the cochlea, and begins from the fenestra rotunda; but is prevented from communicating with the tympanum by the membrane which closes this aperture. The scala vestibuli begins by an oval orifice between the fenestra ovata and the ampulla of the vertical canal. The two scalæ run parallel with each other, but have no communication except at the apex of the cochlea.

When the cochlea is cut obliquely from the base to the apex, at a proper distance from the modiolus, the section exhibits the appearance of three successive compartments, each containing a portion of the septum of the scalæ. The half turn of the septum occupies the last compartment, and as it joins the extremity of the spiral tube a little hole is left. This is the hole by which the scalæ communicate.

To obtain a view of this aperture of communication, it is necessary to preserve the membranous part of the septum, for the spiral lamina itself does not reach the extremity of the spiral tube. This may be ascertained by examination of the macerated cochlea, in which when a similar section is made, the extreme point of the spiral lamina may be perceived just rising into the last compartment and perfectly detached; but in the recent state, the membrane, which goes off from the spiral lamina to complete the septum, passes also

from its point to the extremity of the spiral tube, where it is so attached as to leave the little hole already mentioned.

In the occipital side of the *os temporis*, contiguous to the vestibule and cochlea, is the canal through which the auditory nerve passes. It is named *meatus internus*, is oval in form, and about the third of an inch in length. The extremity towards the labyrinth is closed, except at the upper part, where a small foramen, which is the beginning of the stylo-mastoid canal, appears. Immediately below this foramen, two cribriform plates are placed, the upper opposite to a portion of the semi-elliptical cavity of the vestibule, the lower to the hemispherical. A little lower, and separated by a slight ridge, a cribriform sulcus is continued to a round concave cribriform plate, the base of the *modiolus* of the cochlea. The vestibule, semicircular canals, and the cochlea, are lined with a delicate periosteum. They contain also a membranous texture, formed into sacs and tubes, and filled with a transparent fluid, similar to the aqueous humour of the eye. The membranous sacs and tubes are smaller than the osseous cavities which contain them, but exactly correspond in shape. They adhere very slightly to the periosteum of the osseous cavities by an exceedingly fine cellular membrane.

The vestibule contains two membranous sacs, one seated in the hemispherical depression, the other in the semi-elliptical. I shall call them by the names of the depressions in which they are lodged. The semi-elliptical sac is larger than the hemispherical, and is that

in which the membranous semicircular canals and scalæ vestibuli centre.

Although the cavities of these sacs are distinct, the sacs themselves cannot be separated, because their sides are in contact with each other, adhere, and are too delicate to admit of division by dissection. The membranous semicircular canals exactly resemble the osseous tubes in which they are placed. They open in the semi-elliptical sac. The membranous tubes of the cochlea correspond with the scalæ. One arises from the semi-elliptical sac of the vestibule; the other from the membrane of the fenestra rotunda, to which it adheres. They communicate in a manner similar to the two scalæ in the apex of the cochlea. The cavities of these membranes by their interior surface secrete the fluid they contain, in the same manner as the pericardium secretes the liquor pericardii. A considerable degree of vascularity seems necessary for their secretory functions. The vessels which supply them pass from the periosteum in a serpentine direction, and so far are easily discovered; but when dispersed on the peculiar structure of the membranes, they are too minute to admit the red globules of the blood.

The membranous texture just described, is destined to receive the ultimate distribution of the auditory nerve or portio mollis of the seventh pair, which arises from the tuberculum annulare in the ventricle of the cerebellum, and the crus cerebelli. As it turns round the medulla oblongata, it is joined by the portio dura, which it partially receives in a species of groove, and

both enter the meatus internus, being connected by a fine cellular membrane. The portio dura quits the portio mollis at the bottom of the meatus internus, and continues its course through the stylo-mastoid canal, and is no otherwise connected with the organ of hearing, than by receiving the chorda tympani. The portio mollis consists of two fasciculi, nearly equal in size, one of which supplies the vestibule and semicircular canals, the other the cochlea. The nerve of the vestibule and semicircular canals subdivides into three branches, after forming a gangliform enlargement. The largest branch sends its fibrils through the cribriform plate opposite to the semi-elliptical sac of the vestibule. They pass in a distinct plexus upon the sac, and are lost in a pulpy substance, which vanishes in the ampulla of the vertical and horizontal membranous canals. The second branch, passing through the inferior cribriform plate, is dispersed in a similar substance on the hemispherical sac. The last branch also passes through a small cribriform plate, and is lost on the ampulla of the oblique membranous canal. The fasciculus of the cochlea is twisted; an appearance which arises from the mode in which its fibres enter the modiolus. As they pass through its substance, they form plexuses through the communicating holes of the bony tubes. Some of the fibres issue from the modiolus through the foraminula of the spiral lamina; but the greater number and the largest pass through the foraminula, between the spiral lamina and the junction of the spiral tube to the modiolus. As the nerve detaches its fibres along the spiral tract of the

foraminula, it becomes smaller towards the apex, in a manner similar to the modiolus; but its central filament passes straight through the central foramen of the modiolus, and ramifies on the half turn of the spiral lamina. As the fibrillæ of the nerve pass into the scalæ of the cochlea, they may be very distinctly observed making a distinct plexus on the spiral lamina, in the edge of which a perfect net-work is formed. This net-work appears to be continued in a semi-pellucid pulpy substance, which goes from the edge of the spiral lamina on the membranes of the scalæ.

The arteries of the external ear come anteriorly from the arteria temporalis, and posteriorly from the occipitalis. The veins are branches of the external jugulars. The portio dura of the auditory nerve having passed out of the cranium, through the foramen stylo-mastoidæum, gives off a branch which runs up behind the ear, whence it sends off several filaments to the meatus and fore-side of the ear. The second vertebral pair send also a branch to the ear, the ramifications of which communicate with those of the other branch from the portio dura.

DESCRIPTION OF THE PLATES.

PLATE I.—FIG. 1.

- A A The occipital bone.
- B B The lambdoidal sutures.
- C C Mammillary processes.
- c c Sutures of the temporal bones.
- D The foramen of the occiput through which the spinal marrow and vertebral arteries pass.
- d d The openings for the occipital veins within the cranium.
- E E The two processes of the occipital bone by which its articulation with the first vertebre of the neck takes place.
- e e The opening for the vertebral veins.
- F F The external ears.
- f f The cartilages of the auditory passages laid open.
- G G The stylo-form processes.
- g g The openings forming the extremity of Fallopius's aqueduct, through which the portio dura of the auditory nerve passes on each side.
- H H The openings for the jugular veins.
- h h The openings for the passage of the ninth pair of nerves.
- I I The openings for the entrance of the carotid arteries.
- i i The internal membrane of the nose.
- K K The Eustachian tubes.
- L L The extremity of the tubes.
- M M The external part of the pterygoid processes.
- m m The muscles of the Eustachian tube.
- n n The salpingo-pharyngeus muscle, anterior view.
- O Posterior view.
- o o The openings for the arteries of the dura mater.
- P P The openings for the large branches of the fifth pair of nerves.
- p p The sutures of the temporal bone with the sphenoid bone.
- Q Q Internal passages of the nose.
- q q The sutures of the processes of the temporal bones, with part of the upper jaw.
- r r The posterior part.
- s s The openings for the course of the blood-vessels to the palate.
- T The superior portion of the upper jaw.

- V The fornix of the palate.
u u The dentes molares.
x x The dentes canini.
y y The dentes incisiores.
z The opening for the passage of the secretion, which comes from the cavity of the nose to the palate by two small ducts.

FIG. 2.

The Eustachian tube viewed from its posterior part, with the osseous canal.

- A The commencement of the tube.
 B The osseous canal.
 C The bony part of the tube.
 D The cartilaginous part.
 E The membranous part.
 F The muscle of the tube.
 G The extremity of the tube.

FIG. 3.

- A The uvula.
 B B The salpingo-staphilinus muscle.
 C C The stylo-glossus muscle.
 D D The stylo-pharyngeus muscle.
e e The tonsils.

FIG. 4.

Ceruminous glands of the meatus, exhibited purposely on a larger scale than natural, that they may appear more distinct.

PLATE II.—FIG. 1.

- | | |
|--|--|
| <i>b</i> Lobulus. | <i>i</i> Fossa innominata. |
| <i>c</i> Concha. | <i>m</i> Meatus auditorius. |
| <i>a</i> Zygomatic process of temporal bone. | <i>m</i> Mastoid process. |
| <i>c</i> Antihelix. | <i>n</i> Fossa navicularis. |
| <i>z</i> Eustachian tube. | <i>o</i> Antitragus. |
| <i>a</i> Helix. | <i>p</i> Cartilaginous portion of auditory tube. |
| <i>c</i> Crura of antihelix. | <i>q</i> Styloid process. |
| <i>e</i> Tragus. | <i>r</i> Membrana tympani. |

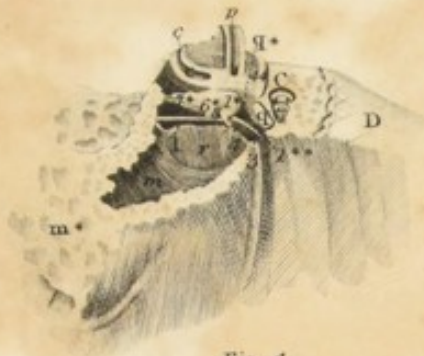


Fig. 4.



Fig. 7.



Fig. 6.

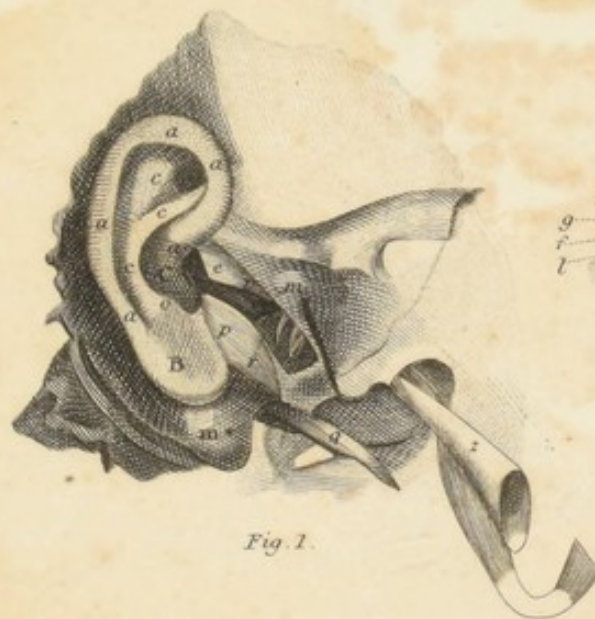


Fig. 1.



Fig. 5.



Fig. 2.

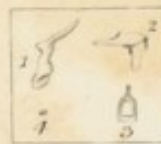


Fig. 3.



Fig. 8.

*A View of the External, Intermediate,
(and Internal parts of the Ear
in a Young Subject.*



FIG. 2.

- | | |
|--|----------------------------------|
| <i>a</i> Tympanic cavity and auditory ring of temporal bone. | 5 Handle of malleus. |
| <i>r</i> Membrana tympani. | 6 Body of incus. |
| <i>u</i> Base of stapes. | 7 Short crus of incus. |
| 1 Head of malleus. | 8 Long crus of incus. |
| 3 Long slender process of malleus. | 9 Short anterior crus of stapes. |
| | 10 Long anterior crus of stapes. |
| | 17 Apex of stapes. |

FIG. 3.

- | | |
|------------|------------------|
| 1 Malleus. | 3 Stapes. |
| 2 Incus. | 4 Os orbiculare. |

FIG. 4.

- | | |
|---|---|
| <i>c</i> Cochlea. | 9 Tensor tympani muscle. |
| <i>a</i> Petrous portion covered with dura mater. | 9 Tendon of tensor tympani muscle. |
| <i>l</i> Levator tympani minor muscle. | <i>c</i> External or horizontal semicircular canal. |
| <i>m</i> Mastoid cells. | <i>m</i> Meatus auditorius externus. |
| <i>p</i> Petrosal twig of vidian nerve. | <i>l</i> Head of malleus. |
| <i>p</i> Superior or vertical semicircular canal. | <i>l</i> Semi-osseous canal of tensor tympani muscle. |
| <i>r</i> Membrana tympani. | 3 Long slender process of malleus. |
| <i>v</i> Vidian nerve. | 6 Body of incus. |
| 1 Twig of vidian nerve assisting to form the great intercostal nerve. | 7 Short crus of incus. |
| <i>p</i> Cuneiform process of sphenoid bone. | 8 Long crus of incus. |
| | 44 Facial nerve. |

FIG. 5.

- | | |
|--|--|
| <i>a</i> The sac in which the semicircular canals and scala vestibuli terminate. | <i>g g</i> The portio dura. |
| <i>b</i> The vertical canal. | <i>h</i> The branch of the portio mollis supplying the sac of the semicircular canals. |
| <i>c</i> The oblique canal. | <i>i</i> The branch of the hemispherical sac. |
| <i>d</i> The common termination of the vertical and oblique canals. | <i>k</i> The twig supplying the ampulla of the oblique canal. |
| <i>e e</i> The terminations of the horizontal canal. | <i>l</i> The fasciculus of the cochlea. |
| <i>f</i> The portio mollis. | |

FIG. 6.

- | | |
|--|---|
| <i>a g</i> The labyrinth. | <i>g</i> The fenestra rotunda. |
| <i>a b c</i> The three semicircular canals: <i>a</i> , the superior or vertical; <i>b</i> , the exterior or horizontal; <i>c</i> , the posterior or oblique. | <i>h</i> The margin to which the squamous portion of the temporal bone was connected. |
| <i>d</i> The vestibule. | <i>i</i> Part of the tympanum. |
| <i>e</i> The cochlea. | <i>k</i> The jugular fossa. |
| <i>f</i> Fenestra ovalis. | <i>l</i> The canalis caroticus. |
| | <i>m</i> Part of the Eustachian tube. |

FIG. 7.

- | | |
|---|--|
| <i>c</i> Cochlea. | <i>f</i> Aqueduct of vestibule. |
| <i>g</i> Pyramid of vestibule. | <i>p</i> Vertical or superior or semicircular canal. |
| <i>h</i> Cavitas hemispherica. | <i>p o</i> Tubulus osseus communis. |
| <i>v</i> Vestibule. | <i>s</i> Cavitas sulciformis. |
| <i>c</i> External or horizontal semicircular canal. | <i>t</i> Aqueduct of cochlea. |

FIG. 8.

- | | |
|---|--|
| <i>a</i> Aqueduct of Fallopius. | <i>o</i> Oblique or posterior semicircular canal. |
| <i>c</i> Cochlea. | <i>p</i> Vertical or superior semicircular canal. |
| <i>v</i> Vestibule. | <i>p o</i> Tubulus osseus communis. |
| <i>r</i> Foramen rotundum. | <i>w</i> Aperture leading from the vestibule to the cochlea. |
| <i>c</i> External or horizontal semicircular canal. | |
| <i>l</i> Lamina spiralis. | |

CHAPTER II.

OF THE TONGUE.

THE tongue is an oval-formed fleshy mass almost entirely composed of muscles: it consists of three parts,—the base, the body, and the apex. It is situated in the inferior part of the mouth, and movable in every direction. The base is the thickest and posterior part, placed very low down in the throat; the anterior part, or tip, is the apex; and all the intermediate portion is called the body. From the base the tongue proceeds upwards and forwards, under the uvula and roof of the mouth, resting upon that part of the mouth which is bounded by the lower jaw. The power of speech, and the sense of taste, have been attributed to the apex; but, as respects the sense of taste, this part is certainly not so sensible as the other parts of the tongue; in fact, the nervous papillæ are more numerous in the body, and still more so at the base,—from which fact it will readily be perceived, that the apex has no such superiority over the other parts of the organ. In cases where the apex and body of the tongue have been lost, the taste is not destroyed.

In respect to speech, by which is implied articulated sound, or voice, the tongue is not the only organ concerned: in this faculty, the lips, the teeth, and roof of the mouth, are important auxiliaries; the two latter for the necessary resistance of the tongue,

and the lips for the articulation and pronunciation of many letters of the alphabet. This will be proved by the following remarks.

A little attention will shew, that the tongue expresses some letters with its apex, and some by means of its root. Those letters which may be considered proper to the apex, are only the five following, viz. D, L, N, R, T. In the letters C, G, S, X, Z, it only assists; these letters can be performed by the teeth alone. The lip-letters are B, F, M, P, and those pronounced by the base of the tongue are K, Q, X. The aspiration H, and the vowels, are chiefly expressed by means of the lips modifying expiration.

In a case in which the apex and body of the tongue were deficient, the person, a female, could distinctly articulate all the letters except those which have been mentioned above as proper to the apex; the lips assisted her in pronouncing even these letters, which she did well enough to be plainly understood in her conversation.

This case shews that the lips are better substitutes for the apex of the tongue than that part would be for the lips were they deficient. We cannot but admire this wise and merciful arrangement of the beneficent Creator, who has provided such beautifully adapted means to meet and to remedy those accidents by which that noble and peculiar faculty of man may be impaired. This woman, in fact, might be said to speak without a tongue.

This organ is supplied by the ninth nerve, which is dispersed amongst its muscular fibres, and by the gustatory, a ramus of the ganglionic portion of the

third division of the par trigeminum, or fifth pair, which is diffused not merely amongst the muscles of the tongue, but is also carried to its mucous surface, and to two of the salivary glands, by the glosso-pharyngeal nerve, which sends rami to the surface of the base of the tongue.

If in dogs or rabbits the ninth nerve be divided on both sides, the tongue will lose the power of motion, so that when it is drawn a little way out of the mouth it will remain protruded; and it will not retract when acrid substances are applied to it, although sensation is evidently excited by their application.

If the gustatory nerve of animals be divided immediately after death, no motion will afterwards be perceived in the fibres of the tongue; but if the ninth nerve be compressed suddenly, the muscles of the tongue will become convulsed; and this will occur when several times repeated. In a case in which every portion of the fifth nerve had lost its power, the root of the tongue retained its peculiar sensibility; when pressure was made upon it, the patient had a weak sensation of touch, attended with nausea and an effort to vomit.

If in animals, immediately after death, the glosso-pharyngeal nerve be pinched, no spasmodic action of the muscles of the tongue follows.

The two following curious cases are taken from the *Philosophical Transactions*; the one of a gentleman,* given by himself;—"From my birth I had two tongues, each of the same form and size; the woman who assisted at the labour insisted upon having the

* The Rev. H. Wharton, Chaplain to Archbishop Sancroft.

lower one cut off, but my mother would not consent. The lower tongue withered by degrees, and became reduced to a substance not larger than a pea, which still continues. The upper tongue, however, grew to its proper magnitude, although marked with several long and deep furrows, which run parallel with the length of the tongue."

The other is that of a clergyman's lady, who had a stone under her tongue:—In July 1748, this lady voided a substance apparently an earthy concretion, stone or chalk, from under the roof of her tongue, just on the left side of the frænum, among the blood-vessels: it was lodged in a cell formed by itself; the excavation it had left exactly corresponded with it in form and size; it came away without pain or effusion of blood. The patient began to feel some uneasiness in the part affected about eleven months before the discharge; the pain extended itself sometimes along the jaw almost to the ear, the glands being at that time swelled, and a salt discharge flowing into the mouth. The swelling of the part gradually increased to about the size of a large nutmeg, and being felt by the finger was hard. About a fortnight before the discharge occurred, some white specks appeared, upon which it was supposed that pus was forming; and being still hard, a common poultice of bread and milk was applied, and then it presently dislodged itself, without any other application. The patient remained ever afterwards free from complaint. The stone is in the museum of the Royal Society. A similar case occurred to the author's father, Dr. Curtis, in a Mr. Dyche, of Drayton.

OF HEARING.

Hearing may be defined, the function intended to acquaint us with the vibratory motions of bodies. It is the exercise of that faculty, or sense, by which we appreciate and estimate all vibrations from sonorous bodies, and these vibrations are termed sounds: sound is conveyed by the atmosphere, in straight lines, to an incredible extent, which lines have received the appellation of sonorous rays, and are increased in proportion to the elasticity of the body through which they pass; while the denser the body is, the more they become diminished in strength. The true seat of hearing is in that part of the organ which is formed by the *portio mollis* of the seventh pair of nerves; and its pulp is beautifully distributed upon the *ampullæ* of the membranous semicircular canals, also upon the *barbula*, and the *zona mollis* of the cochlea.*

The manner in which hearing takes place may be thus simply explained:—The rays emanating from a sonorous body are directed to and arrive at the ear, where they become concentrated, in consequence of its peculiarly elastic structure; and in this concentrated state they pass along the external auditory foramen to the *membrana tympani*, on which they excite a vibration; this vibration of the tympanum is communicated to the *malleus*, in immediate contact with it; the action of the *malleus* conveys them to the *incus*, and the latter again to the *os orbiculare*,

* William Hunter, M. D.

whence they next reach the stapes.* The basis of this last bone is extended within the vestibulum, in that part where, placed as a centre, it faces the common channel of the membranous semicircular canals, as well as the orifice of the scala vestibuli. In consequence of this situation, the vibrations on the stapes are extended to the water of the labyrinth, and the undulations directed from this part, as from a centre to a circumference, strike first the alveus communis, and are next extended throughout the liquor of the labyrinth surrounding the membranous semicircular canals, agitating by their undulations their whole surface; and this consequently affects the nervous expansion, spreading over all these parts.† One scala of the cochlea opens into the vestibulum, and the other begins from the fenestra ovalis; and being both filled with water of the labyrinth, and communicating with each other at the apex of the cochlea, the sonorous vibrations are in this manner communicated also to the scala of the cochlea. Besides this, between the scala of the cochlea in the middle point, as it were, is placed the zona mollis, where the nerve is also extended, and the sonorous undulations take place.‡

It is by these varied actions of the different parts on the auditory nerves, that the latter is enabled to convey the vibrations to the sensorium, by which the mind is informed of the existence of sound, and is enabled to calculate its import, and to judge of its difference or degree; for gravity, or acuteness of

* M. Bailie, M. D.

† Professor Robbi.

‡ Buffon.

sound, depends only on the number of vibrations given at the same time.

The situation of the ear, it may be observed, is more internal, and its powers are more concentrated, than those of the eye; its nervous expansion is more limited, and the bodies which act upon it are denser and more solid than those which influence the organ of vision; hence the sensations conveyed by it are limited in point of distance from its object, though they are more numerous and durable than those of the eye.

ON THE VOICE, AND USE OF THE EPIGLOTTIS.

The organ of voice, or larynx, has been compared to a clarinet, and similar instruments: it is composed of a mouth-piece, the aperture of which admits of expansion or dilatation, and of a tube which is capable of being lengthened or shortened; the tube is situated upon the superior part of the trachea, so that, as the air passes out during expiration, it may cause the edges of the aperture, at the entrance of the larynx from the mouth, to vibrate. If the upper part of the trachea be divided, on looking into the larynx from below, the tube, from being cylindrical, is seen to assume abruptly a triangular prismatic form; the two long sides of the triangle extend horizontally inwards and forwards, to meet at the front of the larynx. The base of the triangular opening is short, and is placed transversely.

The mouth, or orifice of the larynx, is called the rima glottidis; the two long edges that meet at its fore-part are termed the chordæ vocales. On looking

into the larynx from above, the epiglottis is seen: it consists of a thin flap of fibrous cartilage, held vertically, by its elastic connexions, against the root of the tongue, but capable of being thrown down to cover the opening of the glottis, the lips of the glottis, or the reflection of the mucous membrane, from the edges of the epiglottis to the posterior margin of the larynx, and the *ventriculus laryngis*, as the shallow fossa is called, placed immediately above and to the outside of the *chordæ vocales*, which permits these parts to vibrate freely.

When in a living dog an incision is made immediately below the cornu of the *os hyoides*, so that the cavity of the larynx is exposed, the following phenomena appear: at each expiration the *rima glottidis* is narrowed, and the *chordæ vocales* are brought nearer to each other, so that in part of their extent they come in contact. When the animal cries, the *chordæ vocales* appear to vibrate; when the tone uttered is grave, the *rima glottidis* is fully expanded, and the *chordæ vocales* appear to vibrate in their entire length; when the animal utters a shrill cry, the *rima glottidis* is observed to become much narrower, and the *chordæ vocales* being then in contact at their anterior part, their posterior portion only appears to vibrate.

The *rima glottidis* is the mouth-piece of the larynx, and corresponds in some measure with the reed of the clarinet, or with the lips of a person whilst playing the flute. In pursuing the same comparison, we observe a contrivance similar to the stops in these instruments, by which the tube may be shortened or

lengthened, in the alternate rising and falling of the larynx. When the larynx is raised, the vocal tube is shortened; when it is depressed, the tube is lengthened. Accordingly, when an acute note is uttered, the larynx is felt to rise, and to sink when the voice falls to a grave tone.

The use of the epiglottis, according to Magendie, is to perfect the larynx as a musical instrument. It is said that in the clarinet a note swelled beyond a certain degree of loudness is liable to break into a higher note. Now, Mr. Grenie discovered, that by placing a tongue of elastic substance, to break the current of air, this imperfection may be remedied. The epiglottis is just such a contrivance in the vocal organ, the use of which was unknown until it was thus accidentally discovered.

We have now to raise the curtain, and to examine the mechanism by which the changes are produced in the situation of the larynx, and in the size of the rima glottidis, which have been described.

The same muscles that are used to raise the pharynx in deglutition, are employed to elevate the larynx in modifying the tone of the voice. This action, for either purpose, is primarily instinctive; afterwards, we repeat by volition an effort which we recollect was attended with a result that pleased us. Other smaller muscles, which extend from point to point of the cartilages of the larynx, alter the dimensions of the rima glottidis. The principal piece in the structure of the larynx is the cricoid cartilage, a thick ring rising behind, to the height of an inch; it is received between the two flat plates of which the thyroid cartilage consists; and upon its raised posterior margin, two little pyramids

of fibrous cartilage, called the arytenoid cartilages, are loosely articulated, so as to move freely. The edge of the chordæ vocales appears formed of a peculiar elastic substance, extending from the front of each arytenoid cartilage to the thyroid; so that any movement given to the former immediately affects the dimensions of the rima glottidis. Muscles, termed crico-arytenoidei postici and laterales, extend from the back and outer part of the cricoid cartilage to the arytenoid of each side, and in their action draw the two apart from each other, and enlarge the rima glottidis.

Another broad but thin muscle, termed the thyro-arytenoideus, extends from the arytenoid cartilage to the thyroid. This muscle is parallel to the chorda vocalis of the same side, and enters into its composition. The three preceding muscles are supplied by the recurrent nerve, a branch of the nervus vagus: upon its division, animals lose their voice. It is easy to account for this phenomenon, by reference to the anatomical facts which have been mentioned:—When the muscles which the recurrent nerve supplies act together, the chordæ vocales are thrown into a state of tension. If the crico-arytenoidei are stimulated to contract more forcibly than the thyro-arytenoidei, the aperture of the rima glottidis is capacious, and fitted for the production of grave notes. If the thyro-arytenoidei, on the other hand, act the most forcibly, the chordæ vocales must be drawn near to each other, and, coming into contact at their fore-part, through the swelling of the shortening muscles which enter into their composition, are at liberty to vibrate in part only of their length.

Another set of small muscles is found at the upper part of the larynx: the arytenoideus transversus and the arytenoidei obliqui extend across from one arytenoid cartilage to another, and in their action draw these parts together, and entirely close the aperture of the glottis. These muscles, with the mucous membrane which invests them and clothes the adjoining surface of the larynx, are supplied by separate branches of the nervus vagus, termed the superior laryngeal nerves; and though it is probable that their action in some degree influences the voice, yet they are principally concerned in other functions of the larynx, which have been already alluded to, and may on the present occasion be fully explained.

The larynx is the guard of the respiratory apparatus during deglutition: when the food passes over its aperture, the muscles last described instinctively close it. When the nerve which supplies them is divided on both sides, deglutition can no longer take place perfectly, but each attempt at swallowing is attended with the entrance of some of the food into the trachea, which is immediately expelled by violent coughing, the sudden action of the expiratory muscles, which drives out the offending substance before the torrent of air that is expelled.*

Voice is attributed to such animals only as have lungs; lungless animals are either dumb, or, at most, sound, not voice, is attributable to them. The hissing to the rattle-snake is voice; his rattle is only sound. Some fishes have sound, none voice.†

* Mayo.

† Blumenbach.

ON SPEECH.

Articulate speech is peculiar to man, and it is found in him universally; no race has hitherto been discovered in which colloquial intercourse is not thus maintained. Although the physical power of speech may be said to depend upon the vocal organs, yet the art of speech, which can only be acquired perfectly by imitation, owes its existence to that sense whose beautiful and wonderful organ was described in the last chapter.*

Speech is the result of a series of actions connected with the muscles of the tongue and lips, which, although they are distinct from those concerned in the formation of the voice, are, like them, connected with the respiration; as articulate sounds necessarily depend upon the emission of air from the lungs. Besides the cartilages and muscles that compose the larynx, there are several ligaments, which serve to connect the various parts, and which, from their supposed use, have been termed vocal cords. It is a question that has been much agitated, and especially amongst the French physiologists of the last century, whether the musical tones of the voice depend upon the size of the aperture, or upon the degree of tension of these ligaments; whether the larynx is more analogous to a wind or a stringed instrument. Although it may not be very easy to give a decisive proof of either of these hypotheses, yet if we are to adopt one in exclusion of the other, it seems more probable that the ligaments serve to regulate the size and form of the aperture, than that they are themselves instruments of sound.

* Rudolphi.

A most curious circumstance connected with the voice, consists in the extreme delicacy with which we are able to modify its tones, and the power which we possess of imitating the tones of others. The same observation applies to speech; but as in this case the organs are more exposed to view, we can the more easily perceive how the process of imitation is conducted, than when an internal organ is concerned, where the operation is entirely concealed from our sight. The great diversity of articulate sounds, and the celerity with which we are able to accomplish the necessary muscular contractions, have been frequently commented upon by physiologists; and it may be asserted, that as the gift of speech is one of those powers which eminently distinguish the human species from all other animals, so there is none in which the mechanism, and the acquired perceptions with which it is associated, afford a more worthy subject of our admiration.

There are a variety of actions, partaking more or less of a mechanical nature, in which the lungs and chest are essentially concerned, depending upon some variation in their bulk, the extent or velocity of their action, or the manner in which they affect the contiguous parts. Some of these are to a certain degree instinctive, being directly subservient to some useful purpose in the animal economy; while they are more or less independent of the will, such as sneezing and coughing. There are others, on the contrary, which are entirely under the control of the will, depending upon the contraction of the diaphragm, or the muscles of the chest, which we call into action and regulate at pleasure, like other voluntary actions, such as sucking

and straining. Some of these actions may be regarded as modifications of the voice, being characterised by distinctive sounds, essentially connected with their final cause, as laughing and weeping.

OF THE SPEECH OF ANIMALS, BY G. SIBSCOTA.*

Although articulate speech is peculiar to man, it is often imitated by different animals, but not accompanied with that reason, or intellect, which regulates it in the human race. Thus the speech in parrots, crows, and other birds that are taught by art, is nothing else but a certain articulate voice, without any mental understanding, to which they are trained up by custom, not knowing what is signified by the words,—so that parrot which rehearsed the Apostles' Creed did not understand the things signified by those words. And therefore this sort of speech is not a representation of reason, and consequently not true speech. But it sometimes happens that they seem to appropriate the names of things to the things themselves, or retain the signification of them: that is the work of memory, by which they accommodate those words which they by their docility have gained, to particular things, as they have been accustomed to them, and according to their often repeated appellations. But their speech extends no farther to other things than custom hath directed them. And as the parrot which fell into the river called for help, and promised a reward; it must necessarily be, that she had by practice learned those

* Published in 1770.

words, being oftentimes before in the like danger. And since it is undeniable, that not only elephants, but some other creatures, as dogs and horses, (though these are not altogether so capable), do in some manner understand the speech of man to which they are accustomed, and know what is meant by such and such words as they are taught, (and as they, by the motion or gesture of their masters, know what they would have), though some more exactly than others,—is it a greater wonder for these brutes, if they have organs fit for speech, to be able by outward expressions, as they have learned by custom, to signify the single conceptions of their estimative faculty to others which they frame within themselves, according to the common speech they are accustomed to, than that they should by the usual gestures of the body, and other various ways (which is also the speech of mutes), be able to adumbrate their inward conceptions to others? Or what wonder is it for a parrot, pie, crow, or starling, to express what they inwardly conceive or desire by an articulate voice, or such as they have learned by custom? And those creatures that have been used to speak can count numbers, and yet they have no formal conception of those numbers.

It is sufficiently apparent, by what has been said, how infinitely the speech of inferior creatures doth differ from human speech. Whereas man doth not appropriate this or that word to this or that particular thing by custom only; but can use his tongue volubly, and can exercise it in the expressing of any thing whatsoever, upon all emergent occasions, in a far different manner from that of brutes. And as man's reason itself, or the internal speech, doth not aim at particular and material,

but universal, abstracted, and immaterial things, which brutes by their reason cannot do ; so the external speech, which is the nuncius of the internal, is assisted thereby, which indeed the speech of brutes cannot aspire unto. So that there is as vast a distance between the reason of brute creatures and human reason, and their speech, or the signification of things which is designed by speech, and the speech of man, as there is between the material and immaterial faculty. And therefore we may truly conclude, that no creature is endued with the faculty of real speech or true reason but man only ; yet the speech of brutes may be said faintly to resemble the true speech of man, as also their reason does human reason, by some kind of analogy.

ON THE NERVES AS THE ORGANS OF THE SENSES.

Many hypotheses have been brought forward by physiologists in order to explain the functions of the brain and nerves. That of Drs. Gall and Spurzheim is alluded to by M. Desmoulins, who inquires if there be any evidence that particular faculties have their seat in particular parts of the brain : he acknowledges the plausibility of the doctrine, but does not admit that the arguments adduced by these anatomists are conclusive, being derived only from the external form of the cranium ; he conceives that it is by the examination of the brain after the partial or total loss of certain faculties, that we are to obtain information on this subject. In the fifth book, which treats of the nerves, like the former parts of the work, we find many opinions which are novel and ingenious ; but as this portion of it more particularly consists in physiological details, we

may conceive that we are more immediately indebted for them to M. Magendie, and that they are more especially sanctioned by his authority. Nor do we perceive any point of considerable importance in which the opinions of M. Desmoulins essentially differ from those of his colleague. For instance, in the remarks on smell, it is stated that the branches of the fifth pair are the only, or at least the principal, nerves of this sense. In the chapter on vision, he asserts that no alteration of the eye takes place when it looks at near objects, and that the supposed adjustment is altogether unnecessary. It may here be remarked, that one of the principal arguments upon which it is founded is derived from the comparative anatomy of the cetacea,—they see equally well in air and in water; but their eyes possess a structure that does not admit of a change of figure. This argument admits the following reply: that the adjustment of their eye may depend upon an alteration of the crystalline, independent of any change in the external figure of the organ. The opinion of the author respecting vision at different distances is, that the size alone of the object varies, and that the image is equally distinct at all distances within the natural range of vision.*

The observation which M. Magendie made respecting the insensibility of the optic nerves to mechanical irritation, is extended by M. Desmoulins to the three pairs of nerves which are connected with the muscles of the eye; at the same time the filaments of the fifth pair that are sent to the eye are exquisitely sensitive.

* Bostock.

An analogous observation is made in the sixth chapter with respect to the acoustic nerve. The chapter on the properties of the fifth pair of nerves contains nearly the same opinions respecting them, which has been noticed before as being supported by M. Magendie,—that they form the immediate organ of all the senses except the sight ; and that they are accessory even to this sense, because vision is instantly destroyed by their division.

ON PERCEPTION.

An expansion of nerves being the medium by which impressions are made, it is proper to consider their ultimate effect on the phenomena of perception, by which communication is carried on between the sentient, thinking, and active principle within us, and the material objects by which we are surrounded. The subject has ever been, and perhaps ever will be, too difficult for the comprehension of minds of limited capacities. To enumerate the various and discordant opinions which have been brought before the world, from the times of Aristotle and Plato to the present day, would be tedious to the reader, and not suited to the design of the writer.

That the organs of sense are the media of our communication with the external world, and that the brain is an organization essential, in some manner as yet undiscovered, to our knowledge of what is received by the senses, are facts which are now generally received. This wonderful structure, placed on the confines of the material and spiritual world, has been so variously treated of by physiologists and metaphysicians, that it

would be in vain to attempt to give a general view of the numerous observations that have been made respecting it: but it does appear, from what has been written on the subject, that there is a considerable disproportion between various derangements and lesions of the brain and those of the mental powers. In cases in which insanity has been of the most complete character, so that the mental powers have been considerably impaired, it has been very difficult to discover any variation from a state of health in the appearance of the structure of the brain. Numerous cases have occurred in which a considerable disorganisation of that part has existed, and that probably for a great length of time; yet no defect has in consequence been observable in the intellect. A friend of the author's removed, in a *post-mortem* examination, a tumour, the size of a pigeon's egg, from the substance of the brain; the patient had been subject to headaches, and died in a convulsion. In this case the understanding was acute, and, being in the National School, he was considered a lad who had a facility of acquiring knowledge superior to his school-fellows in general. There are many cases recorded in which portions of the brain have been removed, the intellect still remaining unimpaired.

In the first instances, those of insanity, there may be some slight, though essential, change in the physical state of the brain; and in the second, notwithstanding its derangement and lesion, there may still remain some certain portion unchanged, which is the immediate organ of intellect: therefore we have not, from these facts, sufficient data to reason safely upon. But it does seem that the relation which the mind bears to the brain is totally different from that

which the vital functions bear to their respective organs ; and the following inference may be drawn, — that mind is not a property of brain, in the same way that contractility is a property of a muscle, or sensibility of a nerve. The nature of the connexion which exists between matter and mind is at present completely unknown to us ; and it does not appear that we are in possession of any method of investigation by which it is probable that any information can be acquired upon the subject.

DIFFERENCE BETWEEN IDEAS AND PERCEPTIONS.

That there is a difference between the idea and the original perception, must be evident to every one who has attended to the operations of his own mind ; yet it is not easy to determine, in a precise manner, in what this difference consists. Hume, who makes this the express object of inquiry, only observes, that the idea is less vivid and distinct than the primary perception — an observation that does not solve the problem.

We cannot trace the connexion between the perception and idea ; they follow in the order of what is called cause and effect — an order established by the all-wise Author of nature ; nor can we state with precision in what the difference consists between perceptions and ideas. Unfortunately, we have no language exactly adapted to express the operations of the mind ; most of the terms we use in reference to mind, are borrowed from the material world, — thus, we say that perceptions are the materials of which ideas are formed. Ideas are the perceptions fixed more or less firmly in the mind, by attention. The perceptive

powers may be strong; yet if the attention does not perform its duty, but few ideas, and those indistinct, will be treasured up in the mind.

It will hence appear, that perceptions and ideas do differ, though we are as unable to point out, in a precise manner, in what the difference truly consists, as we are to trace the link by which they are connected.

ON THE ORGANIZATION, GROWTH, AND MENTAL DEVELOPMENT OF MAN.

With the assistance of Mr. Bauer and his microscope, Sir Everard Home has shewn a child eight days old from the time of conception, about as broad and a little longer than a pin's head. He satisfied himself that the brain in this homunculus was discernible.

The organs begin to be exercised as soon as the child is born; and a faint glimmering of mind is dimly perceived during the first months of existence, but it is as weak and infantile as the body.

As the senses acquire their power, and the cerebral jelly becomes firmer, the mind gradually strengthens; it advances slowly with the body through the years of childhood, and becomes adult when the development of the frame is complete. In the perfect period of organization the mind is seen in the plenitude of its powers; but this state of full vigour is short in duration both for the intellect and corporeal fabric. The wear and tear of the latter is shewn in its mental phenomena; with the decline of organization the mind becomes decrepid with the body.* The number and

* Lawrence.

kind of the intellectual phenomena in different animals does very closely correspond to the degree of development of the brain. The mind of the Negro and Hottentot, of the Calmuck and the Carib, is inferior to that of the European, and their organization is also less perfect. The large cranium and high forehead of the orang-outang place him above his brother monkeys; but the development of the hemisphere of his brain and his mental powers are equally below those of the negro. The gradation of organization and of mind passes through the monkey, dog, elephant, horse, to other quadrupeds; thence to birds, reptiles, and fishes; and so on to the lowest link of the animal chain.*

In no other animal do the sutures of the cranium close, or the teeth first appear, so late as in man; no animal is so long before it can support the body on its legs, or is so long in arriving at the adult stature.

The long infancy of our species is compensated by a proportionate length of existence: no other of the mammalia of corresponding magnitude enjoys so extensive a life as man. As the duration of life is in proportion to the time occupied in attaining the full growth, there is every reason to suppose that monkeys fall very short in this respect: in this country, their period of existence is shortened by the climate not being suitable for them, therefore we cannot form a correct judgment respecting them from what we are able to observe here.

In instituting a comparison between man and the other creatures which inhabit the earth, it is necessary that we should represent him in a state of perfect

* Cuvier.

developement, and not morally or physically deformed, as are nearly all those cases of children found in a wild state.

The boy in whom M. Itard was so paternally interested was foolish, and always remained so. The negro boy who was thrown by shipwreck on the island of Barra, was evidently deformed; but notwithstanding this, he still retained the recollection of his former situation, of the life he had led, and the particular fate of a savage boy during twelve years: he was at length taken at Barra, and educated by two celebrated physicians. The boys who were found in Lithuania with a bear, never exhibited any mental developement when in human society.

ON THE ACUTENESS OF THE EXTERNAL SENSES IN SAVAGE TRIBES.

The dark-coloured races exhibit in general a great acuteness of the external senses, which is in some instances heightened by exercise to a degree almost incredible. In the unsettled life of wandering tribes, the chief occupations are hunting, war, and plunder: the members of the community are trained from their earliest infancy to these pursuits, and their progress in the necessary accomplishments determines not only the degree of their own personal enjoyment and security, but also their influence over others, and their rank in the association. The astonishing perfection of their sight, hearing, and smelling, must be referred to the constant exercise of the organs, as their capability of enduring violent or continued exertion, in performing

long journeys, is the simple result of habit.* Both are very interesting in a physiological view, and acquaint us with the extent of our powers, which are very imperfectly developed in the members of civilized societies.

Mr. Collins† has mentioned the quick-sightedness of the New Hollanders, and another traveller has borne testimony to the same effect: "The quickness of their eye and ear is equally singular; they can hear and distinguish objects which would totally escape an European. This circumstance renders them very acceptable guides to our sportsmen in the woods, as they never fail to point out the game before any European can discover it."‡

In describing a New Zealander who accompanied him to England, Mr. Savage says, "It was worthy of remark how much his sight and hearing were superior to that of other persons on board the ship: the sound of a distant gun was distinctly heard, or a strange sail readily discernible, by Moyhanger, when no other man on board could hear or perceive them."||

We learn from Mr. Barrow, that the Hottentots, "by the quickness of their eye, will discover deer and other sorts of game when very far distant; and they are equally expert in watching a bee to its nest. They no sooner hear the humming of the insect, than they squat themselves on the ground, and having caught it with the eye, follow it to an incredible distance."§ He

* Lawrence.

† Account of the Engl. Colony of New South Wales, pp. 553—584.

‡ Turnbull's Voyage round the World, second edition, p. 92.

|| Some Account of New Zealand.

§ Travels in Southern Africa, vol. i. p. 160.

relates the following anecdote of one whom he had left behind ill on a journey: "He had fallen asleep about the middle of the preceding day, and had not awakened till night. Though very dark, and unacquainted with a single step of our route, he had found us by following the track of the waggon. At this sort of business a Hottentot is uncommonly clever. There is not an animal among the numbers that range the wilds of Africa, if he be at all acquainted with it, the print of whose foot he cannot distinguish: the prints of any of his companions' feet he would single out from a thousand."

Dr. Somerville confirms this statement, and refers the superiority of the Hottentots in these points to constant exercise of the organs.*

In his frequent intercourse with the nomadic tribes of Asia, Pallas had the best opportunities of observing their capabilities: "The Calmucks," he says, "have a fine nose, a good ear, and an extremely acute eye. On their journeys and military expeditions they often smell out a fire or a camp, and thus procure quarters for the night, or obtain booty. Many of them can distinguish, by smelling at the hole of a fox or other animal, whether the creature be there or not. By lying flat, and putting their ears to the ground, they can catch, at a great distance, the noise of horses,

* Nonnulli feras venandi aut hostes effugiendi perpetuâ ferè consuetudine hâc facultate (visus) adeò pollebant, ut in campis arenosis vestigia observare possent ubi aliis nihil omninò appareret: hanc facultatem enim utpotè, tum ad victum tum ad salutem ipsam prorsus necessariam, assiduè exercent, et sic mirum in modum acuunt.—*Med. Chir. Trans.* vol. vii. pp. 155-6.

of a flock, or of a single strayed animal. But nothing is so surprising as the perfection of their eyes, and the extraordinary distance at which they often perceive, from inconsiderable heights, small objects, such as the rising dust caused by cattle or horsemen, more particularly as the undulation of the boundless steppes or plains, and the vapours which rise from and float upon them in warm weather, render things very obscure. In the expedition which the Torgot Vicechan Ubaschi led against the Cubanians, the Calmuck force would certainly have missed the enemy, if a common Calmuck had not perceived, at the estimated distance of thirty versts, the smoke and dust of the hostile army, and pointed it out to other equally experienced eyes, when the commander, Colonel Kischinskoi, could discern nothing with a good glass. They pursue lost or stolen cattle or game by the track for miles over deserts: Kirgises, or even Russians in the wild parts of the empire, are equally able to follow and discriminate tracks by the eye. This indeed is not difficult on soft ground, or over snow; but it requires great practice and skill to choose the right out of several intermingled traces, to follow it over loose sand or snow, not to lose it in marshes or deep grass, but rather to judge from the direction of the grass, or from the depth of the print in the snow or sand, how long it has been made.*

* Sammlunger Histor. Nachricht. th. i. pp. 100, 101.

AN ACCOUNT OF PETER THE WILD BOY.

Peter the wild boy, who lived many years in this country, is one of the most authentic cases, and his biography will be found interesting. In July 1724, Jurgen Meyer, a townsman of Hameln, met in his field with a naked, brownish, black-haired boy, apparently about twelve years old, who uttered no sound, was enticed, by shewing him two apples, into the town, and placed for safe custody in an hospital, by order of the burgomaster Severin. Peter,—for thus he was christened by the children on his first appearance in the town, and he went by the same name to his death,—behaved rather brutish at first, seeking to get out at doors and windows, resting now and then on his knees and elbows, and rolling himself from side to side till he fell asleep. He did not like bread ; but he eagerly peeled green sticks, and chewed the peel for the juice ; as he also did vegetables, grass, and bean-shells. He soon learned to conduct himself more properly, and was allowed to go about the town. When any thing was offered him to eat, he first smelt it and then put it in his mouth, or laid it aside shaking his head. In the same way, he would smell people's hands and then strike his breast if pleased, or otherwise shake his head. When he particularly liked any thing, as beans, peas, mulberries, fruit, and especially onions and nuts, he indicated his satisfaction by striking repeatedly on his breast. When shoes were first given to him, he could not walk in them, and appeared happy in getting rid of them, and running about again bare-footed.

Covering the head was equally unpleasant to him, and he greatly enjoyed throwing his hat or cap into the Weser, and seeing it swim down; but he soon became accustomed to clothing. His hearing and smell were acute.

In October 1725, he was sent for by George the First to Hanover, whence he was transmitted to London in the beginning of the following year, under the care of a king's messenger, and this was the foundation of his fame and fortune. Just at this time the controversy about the existence of innate ideas was at its height, and Peter seemed the very subject for determining the question. Count Zinzendorf wished that he should be intrusted to his charge, that he might watch the development of his innate ideas; but the king had already placed him at the disposal of the Princess of Wales, the afterwards celebrated Queen Caroline, who confided the particular care of him to Dr. Arbuthnot, for the purpose of investigating his innate ideas.*

Peter was as upright in his attitude, and as invariably biped, as any of ourselves; and the same remark holds good of all the other authentic examples; as of the girl described by Condamine,† a man found in the Pyrenees,‡ and the boy met with near Aveyron,|| and brought to Paris soon after the Revolution.

* Lawrence.

† *Histoire d'une jeune Fille Sauvage*, 12mo. Paris 1761.

‡ *Leroy, Exploitation de la Nature dans les Pyrénées*, 4to. 1776, p. 8.

|| *Historical Account of the young Savage of Aveyron*, 12mo.

CHAPTER III.

DEAFNESS AND DUMBNESS.

THIS most distressing affection is the *aphonia surdorum* of nosologists, speechlessness from deafness, either congenital or produced during infancy. There is nothing which relates to the intellectual acquirements of early life more certain than that the noblest of them all, the acquisition of vocal speech, depends entirely on the sense of hearing. Guided by the ear, the child is early taught that by an exertion of his will he can produce certain vocal sounds; he endeavours to imitate the words spoken by those around him: his first attempts are unsuccessful, because his memory is yet feeble, and his voluntary actions in this instance, just as in his first amusing struggles to gain that erect position by which man is distinguished, are irregular and uncertain; but repetition brings continual improvement, age develops the other faculties of the mind, and, without the least regard to those vibrations in his throat, or those motions of his tongue and lips, by which his purpose is accomplished, he goes on from indistinct prattling to the acquisition of perfect speech, regulated solely by the ear.

Those who have been born deaf, or who have been affected with incurable deafness before articulation has been attained or sufficiently impressed on the

memory, remain consequently without the power of speech; and if left to themselves, no attempt is ever made by them to attain it.

Persons in this condition, therefore, are dumb only because they are deaf; or, in other words, they are incapable of using language, the sounds of which they have never heard, and consequently cannot attempt to imitate. The organs of voice are not, in the affection here referred to, imperfect; the physical defect is altogether confined to the organs of hearing.*

Of the two most important channels of knowledge, the senses of sight and of hearing—a deprivation of the latter would seem, perhaps, upon a superficial view, to be a less fatal impediment to the acquisition of information than the former; but when it is considered that a want of the sense of hearing involves with it the loss of the principal medium of mental intercourse—language, it becomes evident that the bar to intellectual improvement is by such a deprivation doubly augmented. Hence, a general opinion has prevailed in all ages, that the deaf and dumb are cut off by nature from the acquisition of knowledge; and they have therefore generally been abandoned to a state of mental destitution, for which no remedy was believed to be discoverable. *Nec ratione ullâ docere suadereque surdis: quid facto esset opus?*

This state may be considered as the most afflictive circumstance to which the organs of sense are liable; and even when hearing has been attained by proper means, well and skilfully applied, it has surprised

* Philosophical Transactions, vol. v. p. 379.

many to find how slow the acquirement of speech is in those who are born deaf and dumb. But when it is considered, how slowly a foreign language, when spoken, is comprehended by one who, although fully competent to read and translate, has never heard it used in conversation, the surprise will vanish, as it will be readily perceived how slowly the ear, even in its most perfect state, attains the power of distinguishing and appreciating those sounds to which it is not familiar. It has occurred, when hearing has been produced in one born deaf, that the new sensation, instead of being agreeable, has caused great pain, and even agony when strongly excited.

The acquired perceptions of the ear are less numerous and less distinct than those of the eye. This is partly in consequence of the vibrations which constitute sound being less completely under our control, and partly from their physical effects being less understood than those of light. There seems, however, sufficient cause to believe, that blind persons judge of the distance, magnitude, and position of objects, entirely by experience and association; and it is often very remarkable to observe what precision they acquire in this respect, without any assistance from the sight, the sense which, under ordinary circumstances, we almost exclusively employ on such occasions. With respect to what may be termed audible ideas of distance, they are gained by comparing the strength of the impression with a previous knowledge of the space which exists between the ear and the sounding body. The audible ideas of magnitude are principally concerned in acquiring a knowledge of the size of apartments, which blind

persons are often able to estimate with considerable correctness.*

A few cursory remarks on the nervous system, and on the functions of the brain and nerves, will tend to throw some light upon the subject now before the reader.

It may be presumed, that those portions of the nervous system in man, which correspond anatomically with the entire nervous system of invertebral animals, are sufficient for sensation, volition, and the commonest instinct. Now the nervous system of articulated animals (and that of radiated animals on the one hand, and of mollusca on the other, is not essentially different) consists of a double chord, from definite points, upon the whole length of which nerves are derived to the parts adjacent. But the human nervous system is composed of similar parts, with the cerebrum and cerebellum superadded. Remove the cerebrum and cerebellum, and the nervous system in man is reduced to a double chord.

All questions respecting the action of the nervous system are involved in much obscurity, which, in some measure, attaches to the nature of the subject. In proportion to the deficiency of our knowledge upon any topic, so is generally the obscurity of our language; and the terms which we employ, when speaking of the nervous system and its actions, being originally metaphorical, and being used in different senses on different

* "The late blind Justice Fielding walked for the first time into my room when he once visited me, and after speaking a few words said, this room is about 22 feet long, 18 wide, and 12 high; all which he guessed by the ear with great accuracy."—DARWIN'S *Zoonomia*, vol. ii. p. 487.

occasions, increase the difficulty of obtaining accurate ideas upon the subject. The word sensibility, which is employed by physiologists to express the peculiar power of the nervous system, is applied in common language to a certain state of the mind or character; so that before we employ it in scientific discussions, we must begin by discarding our accustomed associations.

Physiological sensibility may be defined—the power which the nervous system possesses of receiving and imparting certain impressions, and producing corresponding changes in the sensorium: but it is essential to notice, that these two operations are not necessarily connected together, or that it is no necessary part of this sensibility for these impressions to be perceived by the mind, or to become perceptions.

Assuming it, therefore, as an established fact, that the brain and nerves are the primary seat of sensibility, we must inquire into the mode by which this faculty operates. The operation we shall find to be of two kinds; the first depending upon the action of external bodies on the nervous system, the second upon the re-action of the nervous system itself on some of the corporeal organs. The body is furnished with certain instruments, denominated organs of sense, consisting essentially of two parts,—a peculiar conformation of an organized substance, which is specifically adapted to receive and modify certain impressions, and a quantity of nervous matter suitably disposed for the reception of the impressions after they have been thus modified. The nervous matter that belongs to the organs of sense is connected by nerves to the brain, and these nerves possess the power of conveying the impressions along their course to this organ, where

they produce perceptions. In this operation there are three distinct stages,—the original impression on the sentient nervous extremities, the transmission of the sensation along the trunk of the nerve, and the reception of it by the brain. And it may be laid down as a point, proved by the most ample deduction of facts, that an external impression cannot be perceived by the mind without going through the successive steps of this process.

One of the most important of the external senses is the touch; it is extended over a great part of the surface of the body, but its most delicate seat is the points of the fingers. When a substance presses upon the finger, some peculiar change is induced upon the expansion of nervous matter which is connected with the cutis, a certain effect is immediately propagated along the nerves that lead from the hand to the brain, and a third change is then produced in the brain itself. That these three successive changes are all concerned in the operation, is proved by daily experience, in which we find that if either the organ itself be injured, the nerve be interrupted in its course, or the brain be in any way deranged, the proper effect does not follow from the application of the impression.

The example of the eye, another of the organs of sense, may be adduced, as affording a still clearer conception of the subject, the impressions of sight being of a more distinct and specific kind than those derived from the touch. The eye is an optical instrument, consisting of a lens, which is adapted for receiving the rays of light, and bringing them into a proper state for forming an impression on the retina, an expansion of nervous matter that is situated at its

posterior part. The action of the lens upon the rays of light is entirely mechanical, and differs in no respect from the effect that is produced upon them by a transparent substance of the same shape and density. The nervous expansion at the back of the eye is connected with the optic nerve, and this communicates directly with the under part of the brain. Now, it is necessary for vision that the nerve should be in as perfect a state as the eye itself; and we always find, that although both the eye and the nerve be perfect, yet, if the brain be diseased, the correct perception of sight is not excited.

We cannot indeed perform direct experiments upon those organs of the external senses that are situated in the immediate vicinity of the brain, as the eye and the ear, in consequence of the short course of their nerve, and the impossibility of coming into contact with them without deranging parts immediately essential to life; but there are many pathological facts which prove the necessity for the entire state both of the organ of sense and the communicating nerve. Blindness and loss of hearing are as certainly produced by an affection of the optic and auditory nerves, or by any circumstance which prevents them from performing their accustomed actions, as by a disease of the eye and ear itself; and without any physical derangement of the part, we have frequent examples, where mere pressure upon the nerves produces the same effect, and where, upon the removal of the pressure, the faculties of the organ are again restored.

The second mode in which the nervous system operates is, by its re-action on some of the organs of the body; an operation which, with respect to the succes-

sion of events, is the reverse of the one which has been described above. Of the actions of this description, one of the most important to our existence, and the most frequently exercised, is the faculty of voluntary motion. Here the affection originates in the brain, in which some change takes place; this is transmitted down the nerve into the muscle, where an effect is produced on the fibre which causes it to contract; and in this, as in the former case, all the three stages are equally essential. Now in this instance, in consequence of the space which intervenes between the parts where the action commences and terminates, we have the most ample means of observing the necessity of the integrity of the nerve as the medium of communication. If the nerve be divided in its course, we may exert the volition and produce the necessary change in the brain, but no motion will ensue in the muscle; at the same time our own feelings will not indicate to us that any thing has occurred out of the ordinary course of events, and we are only aware of the defect by finding ourselves unable to produce the desired contraction. We have it in our power to prove that, in this case, the defect does not depend upon the morbid condition of the muscle; because, if we irritate the nerve just below the point where it is divided, we find that the muscle will contract, in the same manner as if a similar kind of irritation had been applied to the nerve in its entire state. We may also extend the same kind of trial to the brain; for, by irritating the upper part of the nerve above its division, we shall have a sensation produced in the brain similar to what would have followed the application of the same stimulus to the remote extremity of the nerve.

We perceive that the two modes in which the power of sensibility operates, so far as the order of the phenomena is concerned, are exactly the reverse of each other; but that the same parts are called into action, and are equally connected together. We may then conclude that sensibility is the appropriate and exclusive faculty of the nervous system, and that it has two distinct modes of action,—the one originating from external impressions, which are propagated from the extremities to the centre; the other depending upon a change in the brain itself, which proceeds in the contrary direction, from the centre of the nervous system to its extreme parts.

Having ascertained that the nervous system is the organ of sensibility, either as proceeding from external impressions carried along the nerves to the brain, or transmitted by them in the contrary direction, from the brain to the voluntary muscles, our next subject of inquiry must be, in what manner is this operation effected? The question may be thus stated in direct terms. When an impression made upon an organ of sense is transmitted by a nerve to the brain, or when the exercise of volition is communicated to the nerve so as to produce the corresponding effect upon the muscle, what change does the nerve experience, or in what way is it acted upon, so as to admit of this transmission?

Three hypotheses have been invented to account for this power of the nerves: the one which is the oldest, and has been the most generally received, is that the brain and nerves are provided with a certain fluid called the animal spirits, which serve as the

medium of communication between the different parts of the nervous system; the second supposes that this transmission is effected by means of the vibrations or oscillations of the particles of the nervous matter itself; while the third ascribes the action of the nerves to the operation of electricity.* For our knowledge of the chemical composition of nervous matter we are indebted, in the first instance,† to Thouret‡ and Fourcroy,|| who gave us some important information respecting it; and what they left imperfect has been more lately supplied by Vauquelin.§

HISTORICAL ACCOUNT OF THE ART OF TEACHING THE DEAF AND DUMB TO SPEAK.

This very important art was first contrived by Dr. Wallis, whose versatile talents and industry displayed themselves in so many ways, and gave birth to so many admirable inventions. He has himself given us an account of the method which he practised.

* Bostock.

† It will be amusing, and may not be altogether uninteresting, to the student, to peruse Lemery's account of the chemical analysis of the brain, written about the commencement of the last century. *Course of Chemistry*, pp. 506—10. Lemery was an intelligent and industrious experimentalist, to whom the science lies under considerable obligations.

‡ *Journ. de Physiques*, tom. xxxviii. p. 334. Thouret particularly pointed out the circumstance of the little comparative tendency of cerebral matter to undergo decomposition, p. 329.

|| *Ann. Chim.* tom. xvi. p. 282.

§ *Ann. Chim.* tom. lxxxi. p. 37.

The person on whom he began the trial was Mr. Daniel Whalley, who had once been able to speak, but having lost his hearing when only five years of age, he had gradually, in consequence, left off speaking, and forgotten all language. The task of teaching the deaf person to speak consists of two parts, quite independent of each other, and rendered on that account more difficult. The first consists in teaching the scholar the position of the tongue and other organs of speech in pronouncing the different sounds; the second in making him acquainted with the meaning of words and with the use of language. The commencement of both of these parts is most difficult. The position of the organs is explained as precisely as possible by signs; and when a particular sound is once attained, the scholar, by frequent repetition, is prevented from forgetting it. In explaining the meaning of words, Dr. Wallis arranged the most material words in classes, and pointed out their meaning, either by shewing the objects of which they were the names, or by some other equivalent means. In about two months, Mr. Whalley was able to pronounce most words, and to understand an English book or common subjects. He was, on the 21st of May, 1662, present at a meeting of the Royal Society, and in their presence, and to their great satisfaction, pronounced distinctly enough such words as by the company were proposed to him, and though not altogether with the usual tone and accent, yet so as to be easily understood. He did the same thing before King Charles II., Prince Rupert, and several of the nobility. In the space of one year, which was the whole time of his stay with Dr. Wallis, he had

read over a great part of the English Bible, and had attained so much skill, as to be able to express himself intelligibly on ordinary affairs, to understand letters written to him, and to write answers to them, though not elegantly, yet so as to be understood; and in the presence of foreigners he pronounced the most difficult words of their language that could be proposed to him.* History of the Royal Society, by Dr. Thompson.

The merit and character of Dr. Wallis are fully admitted; but it is a question if *he* was the “*contriver*” of the art of teaching the deaf and dumb to speak. Mr. Whalley was under the tuition of Dr. Wallis one year (1661 probably), and in 1662 he was exhibited to the Royal Society. But an ingenious English physician, a man of deep and laborious research, had published before 1653, a treatise which he called “*Philocophus, or the Deafe and Dumbe Man’s Friend.*” And had composed before the above date “*The Academy for the Deafe and Dumbe, being the manner of the operation to bring those who are so born to heare the sound of words, with the eyes, and thence to learne to speake with the tongue.*” Beside the above, this writer had also a “*Tractatus de removendis Loquelæ Impedimentis;*” and a “*Tractatus de removendis Auditoris Impedimentis.*” With the “*Philocophus,*” published many years before Dr. Wallis instructed Mr. Whalley, or laid before the public any account of his method, and with the other treatises ready for the press, and advertised in 1653, it cannot be allowed that Dr. Wallis was the original contriver of the important art

* Phil. Trans. 1670, vol. v. p. 1087; and 1698, vol. xx. p. 353.

of teaching the deaf and dumb to speak,—an account of which he first published in 1670.

In 1680, a work was published at Oxford by George Dalgarno, entitled, “*The Deaf and Dumb Man’s Tutor;*” in which is pointed out the importance of teaching dumb children at an early age to signify letters and words by their fingers. He says: “Here it may not be objected, that all the conveniency will not balance the pains that must be taken in learning the art. This objection puts me in mind of another, and that a very considerable conveniency; and therefore I answer, the pains that is taken about learning a hand-language, if it were learned in due time, that is in childhood, would be so far from hindering, that it would contribute to the child’s progress in learning to read, if he were taught both to know his letters and to spell upon his fingers.

“This would please the child’s fancy, and imprint the letters the sooner upon his memory, having his book always open before his eyes; so that I look upon this as the greatest conveniency of cheirology, that it would be of so great use, and learned with so little pains.

“And this consideration put me upon thinking of a more advisable way of training up young ones than any yet practised, that is, to begin children to know their letters upon a hand-book, instead of a horn-book; or at least to have a hand-book upon the back of the horn-book; for I make no doubt but before they came to know the names and figures of the letters, they would know their places upon the hand, and be able to point to them with the other or the same hand, as readily as to pronounce them with the tongue.

“ And who will not acknowledge that it were a thing desirable, and deservedly to be esteemed as a piece of liberal education, to be able to speak with the hand as with the tongue? And therefore, who would not think it worth the while to train up young children from their *a b c*, in glossology and cheirology, *pari passu*? Specially, seeing the one is no hinderance, but a considerable help to the other; for I may truly say with the poet’s words,

————— Alterius nam
Altera poscit opem res, et conjurat amicè.”

Dr. Watson* observes, that “ In no instance of original deafness that has come under his notice, has there been any visible imperfection in the external ear. When a child is born deaf, therefore, or totally loses its hearing, there remains nothing for those to whom nature or providence has confided the care of it, but patient acquiescence in the defect; or, which happily has been found practicable, to substitute the perceptions through other senses, to supply the loss as far as respects the acquisition of speech and language. Persons born deaf are, in fact, neither depressed below, nor raised above, the general scale of human nature, as regards their dispositions and powers, either of body or mind. They are human beings, individually differing from their kind, only by an accidental defect; this defect is not such as to disturb the course of nature in the first stage of the growth of the mental faculties, though,

* The teacher at the Deaf and Dumb Asylum, in his work on the Instruction of the Deaf and Dumb.

while it operates as a bar to the acquisition of language, it retards, and almost precludes their expansion after this stage. From the moment that a child is born into our world, commence his sensations of the impressions of external objects, which are to form the ground-work of that wonderful fabric,—a human mind. These, by degrees, become objects of thought; they may then be termed perceptions. The traces and images of these being associated and retained in the memory, constitute ideas. This process goes on for a while, something analogous to the growth and expansion of the corporeal frame, without any perceptible act of the will in the control of it. It is not till nature has matured her work to a certain degree, that she permits us to interfere with effect in assisting her to carry it on. When this period arrives, the child is observed to have, and occasionally to direct, a power of exercising his attention to the consideration of one object or subject, in preference to another. In doing this he will meet difficulties, which will produce calls for assistance.

“The inquisitive curiosity of children is the natural indication of these difficulties; and in proportion as their attention is fixed by the answers or solutions we offer to them, so may we fairly consider them fit subjects of education. Hence, some children are better subjects of education at four years of age than others are at seven; some better at seven than others are at nine, &c. It may be said, that children who can hear and speak, may thus indicate their aptitude to receive instruction; but how can a parent distinguish these indications in a child that is deaf? This question is more likely to proceed from those who have had no

opportunity of observing the manner of those more than commonly interesting little unfortunates, than from those who have.

“It will be found, agreeably to the account we have attempted to give of the comparative importance of the senses of seeing and hearing, as furnishing matter for mental operations, that the process we have been describing has been but little retarded by deafness. Nay, I will venture to affirm, that in many cases which have fallen under my own observation, it appears rather to have been forwarded by it. I have seen more settled attention to the appearances of things, and more apparent satisfaction at every endeavour of those about them to gratify curiosity, in children who were deaf at an early age, than ever I saw in children who could hear and speak. It is not till a considerable length of experience has convinced him of the imperfection of the vehicle he possesses for the communication of his thoughts, that a deaf and dumb child begins to mistrust it, and ceases gradually to weary himself with inquiries that produce nothing but disappointment. Let the parents, therefore, of such children sedulously watch the indications they give of a capacity to learn; and, from considerations already stated, they will, I am sure, see it to be their duty, if the means are in their power, to improve the opportunity that is in their hands. It is true, that though a deaf child may give proofs of its capacity to be instructed as early as three or four years of age, it is, nevertheless, too young to be placed at school.”*

Mr. Arrowsmith observes, that “Much has been

* Instruction of the Deaf and Dumb.

written on the subject of educating the deaf and dumb, by gentlemen who have themselves taught and instructed them with great success, and who have been the means, through a bounteous public, of establishing asylums for the exclusive purpose of educating indigent persons of this description. It is to be feared, however, that those establishments have operated like scarecrows with teachers in general, who have been induced, in consequence of the establishment of such asylums, to think there must be so much difficulty in educating these unfortunate mutes, that none are competent to undertake the charge but such as have attended an asylum for instructions, and have thereby acquired a thorough knowledge of all the mysteries of this seemingly occult science. These newly initiated artists, instead of taking off the mask which was worn by their predecessors, have put on another, still more hideous, and thereby dazzled the ignorant.

“ The education of the deaf and dumb has for ages been conceived a matter of great difficulty, and even by some an impossibility. Very few persons, consequently, have given themselves the trouble of investigating the subject; yet all who have attempted the education of them have succeeded beyond their own most sanguine expectations. Too much praise cannot be bestowed on the establishment of the benevolent institutions for educating the indigent deaf and dumb. These institutions were established when there was no apparent possibility of meliorating their condition by any other preceptors; consequently, every credit is due to a generous public for their philanthropy. I must beg leave to differ from the preceptors in one

particular. Too much time and too much labour, as I conceive, have been bestowed upon teaching the deaf and dumb utterance, when the benefit of it to them is by no means adequate to the trouble of learning it, particularly in the manner in which they are now attempted to be taught. If it were of that utility which some have been pleased to ascribe to it, I would cordially subscribe to the propriety of every exertion being used to acquire speech; for if man without utterance were void of reason, as some have pretended, speech would be indispensable. I will suppose, for a moment, that I was born deaf and dumb, had attended school, and learned every thing *without* utterance; and you, being alike situate, had learned every thing *with* utterance. I should be glad to know, under such circumstances, how it can be made to appear that I am less rational than you, and what can prevent me from exercising my reasoning faculties as well as any other person who can hear? The only difference, I conceive, is, that I may be a little longer about it, but perhaps I may on that account be more correct; for it cannot be denied, that a written question or answer is more to be depended upon than a verbal one. Does not reason tell us, there is no more connexion between ideas and sound, which affects our ears, than between those ideas and written characters, which affect our eyes? Speech is nothing more than a translation of writing. Those who can hear and speak make use of it as a more convenient mode of communication; while the deaf and dumb, for want of hearing and speaking, substitute the written language and signs.

“ It has been observed, by an author who is a great

encourager of utterance, that this artificial speech is a medium which is found very useful for the indigent deaf and dumb; because children of this description are placed out in manufactories, and are thus enabled to communicate more easily with their masters. It is evident that the person who made this observation had never been a manufacturer; if he had, he would have given the preference to servants who could not hear and speak. They make the best and most trusty servants, having nothing but their business to attend to; and they are not diverted from it by conversation, like the others, while they are no less useful and rational. I cannot help dwelling upon this subject, because I know the indigent deaf and dumb have lost much useful time in learning utterance, which, without being of absolute use to them, causes great pain and torture to themselves in learning, and makes them very disagreeable companions afterwards. If parents in affluent circumstances think proper to have their children taught utterance, in the name of fortune let them, as they can afford to pay for their education, and may be pleased to hear them speak; but do not let a public charity be occupied in any thing but what is useful and absolutely necessary.

“It is a great pleasure to see so many gratuitous schools established for educating the poor, who can hear and speak; and I hope to see the indigent deaf and dumb admitted into those schools, confident as I am, that they can be taught, with great ease, to read, write, and understand so much as to render them useful, agreeable, and happy members of society. I have often thought, when I have met a

man unable to read or write, but who could hear and speak, that he was infinitely a more pitiable object than the instructed deaf and dumb. I know, if two men thus situated, of equal abilities, were to apply to me for employment in any trade, I should not hesitate a moment in fixing on the latter as a servant, in preference to the former.

“There are asylums established for the exclusive education of the indigent deaf and dumb, in most countries; and I shall be very happy to see the education of them introduced into all the charity schools where children are educated who can hear and speak. The masters and mistresses would find little difficulty in beginning to teach them the letters and the meaning of words; but in case their pupils should not be quite equal to the children taught at the first asylums, it must be admitted, that a little education is better than none. But I am certain, from experience, that a child born deaf will have a greater advantage from learning in a school where children are educated who can hear and speak, than at a school where none but deaf and dumb are taught; and the children who can hear and speak will be alike benefited by being taught along with them. If the deaf and dumb were going to spend all their days in company with each other, then it would be as well for them to be brought up and educated together; but as they will have to depend chiefly upon people who can hear and speak, the sooner and oftener they join their society, the better it must be for them; and the children who can hear and speak will, from their infancy, become acquainted with the dumb language, and be able, when they grow up, to

correspond with any person they may happen to meet with labouring under the like infirmity. If I had a child of my own born deaf and dumb, and could not afford to send him to any school, I would not let him go to an asylum, nor to a school where none but the deaf and dumb are taught, if he could be educated there for nothing.

“ The asylums for the education of the deaf and dumb are so well filled, that thousands must remain without any education, unless the parents or other teachers will undertake to instruct them.

“ I have, for many years past, had it in contemplation to publish all I knew of the method of educating the deaf and dumb ; but I could not make up my mind on the subject until lately, when Providence caused to be put into my hands a most valuable book, entitled ‘ The Method of Educating the Deaf and Dumb, confirmed by long experience ; by the Abbé de l’Epée.’ The moment I read this book, I was confirmed in the opinion which I had ever entertained, that there is no necessity for the education of the deaf and dumb to be confined to the teachers at the asylums ; but that parents, or any schoolmaster or mistress in the world, might as usefully instruct them.

“ It is somewhat extraordinary, that although there have been so many professors in the art of teaching the deaf and dumb, who have promised to publish to the world at large the knowledge of their advances and improvement in the art, no such publication has appeared ; for what reason it may be difficult to conceive, unless they were afraid of exposing the simplicity and artlessness of their tuition, and thereby

losing that popularity and general estimation which the public, for want of knowing better, has been pleased to bestow upon them. I will admit that it could not be expected, that gentlemen, whose labours had been crowned with such brilliant success, would have made known to the public the mysteries of their profession, by which they were making a fortune, without some handsome remuneration; nor can the public wonder that their mode of instruction has been kept so profound a secret. Indeed, this is the best reason I can assign, why children who can hear and speak are not allowed to be taught with the deaf and dumb. If they had, it is natural to suppose the magic secret would have long ago been known, because the method adopted at the asylums is perfectly explicable. There is no more useful knowledge to be obtained at a deaf and dumb asylum, than can be taught by any schoolmaster or mistress whatever.

“ Nothing can possibly contribute so much to the information of the deaf and dumb as pictures; the vocabulary and plates published by Dr. Watson in 1809, would have been the most useful part of his publication, had the pictures been properly arranged and referred to; but they are jumbled together in such a manner as rather to confuse the ideas than edify the understanding.

“ I have often asked those who have been taught utterance, whether they found it pleasant to speak, and whether it was not painful to them to learn? And I have always been answered, that they suffered so much in learning, and afterwards found it so unpleasant to speak, that they wished they had been made to depend

entirely upon reading, writing, and the manual alphabet, as a medium of communication. It is painful to every body to hear them attempt utterance; and learning it spoils their features so much, that I have seen very handsome children so disfigured by it, that in a few years time I hardly knew them. I have before observed, that I lately met with a work published by the Abbé de l'Epée, on the subject of educating the deaf and dumb.

“ For want of another and better system than that adopted at the asylums, thousands of our fellow-creatures must continue little better than the brute creation. It is very extraordinary that this book of the Abbé de l'Epée, which was published in 1801, should have entirely disappeared, and that there is not a single copy now to be met with. I am inclined to think that the work was suppressed; for, if publicity had been given to it, the deaf and dumb would have been educated in common with other children long before now. It is evident, from what appears in the Edinburgh Encyclopædia lately published, respecting the deaf and dumb and their education, that every pains have been taken to depreciate the method adopted by the Abbé de l'Epée, for the purpose of extolling the teachers at the asylums of the present day. The latter, I have no doubt, have been the principal cause of endeavouring to make the public believe that the system of education, in every respect, adopted and practised by the Abbé, was useless, and even an imposition upon the public. By these means they have endeavoured to establish their own magical and occult

science, in teaching that which is of no use—utterance tending only to astonish the weak, and to acquire an unmerited applause. I will defy them, or any person, to instruct a deaf and dumb child without signs; and I challenge them to produce better signs than what the Abbé made use of. I do most positively deny that the Abbé ever taught his pupils words without explaining the meaning of them; and every unbiassed person, after perusing his method of educating the deaf and dumb, will be convinced of this fact. Could any thing so chimerical have entered the mind of any one, as to attempt to teach a deaf and dumb child to write a word without explaining the meaning of it? No person, it may be presumed, would be so foolish as to do this, much less a man of such abilities as the good Abbé de l'Epée.

“The authors of the Edinburgh Encyclopædia, after having totally misrepresented the Abbé's method of education, say, ‘we have done with the Abbé de l'Epée.’ The teachers at the asylums may also say they have done with him; and they would, no doubt, be glad to find every body else of the same opinion. But I must beg leave to differ from these gentlemen, and wish I could find language sufficient to express the sense of gratitude I feel for so benevolent and good a man. The French nation has acknowledged him to be the greatest character she ever produced, by the following eulogy bestowed upon him, which diffused his fame to all nations:—
‘Science would decide for D'Alembert, and nature says Buffon; wit and taste present Voltaire; and

sentiment pleads for Rousseau ; but genius and humanity cry out for De l'Epée, and him I call the best and greatest of all.'”*

A very interesting and curious work on this subject was written in the German language, many years since, by Andrew Elias Buchner, professor of medicine and natural philosophy in the University of Halle, entitled, “ *An easy and very practicable Method to enable Deaf Persons to Hear.*” A translation of this essay is in the British Museum ; and as it contains many very excellent practical remarks, the substance of it will now be laid before the reader.

If the origin of the nerve, says the learned professor, namely that part of it which lies nearest the sensorium, is injured, it is not in the power of art to restore the sense of hearing ; yet persons of this class may, by attention to the different motions of the mouth in speaking, be brought to understand the thoughts of those about them.

The various means that have been contrived with a view to relieve this affliction, may be divided into two classes. To the first may be referred that plan by which the deaf may, by means of other senses than that of hearing, be enabled to have those perceptions which others obtain by the ear.

The second class comprises those methods by which the auditory nerve itself is put into motion, and thus the very sensation is produced in the mind which we call hearing. This method, again, is twofold ; one in

* The Art of Instructing the Deaf and Dumb, by J. P. Arrowsmith.

which the vibratory motion of sound is propagated to the auditory nerve by means of the ear, by the intervention of some other bodies of ingenious construction; the other method conveys sound in a similar manner to the auditory nerve, and thus produces the sensation of hearing, not only by means of the ordinary channels and organs, but also by means of the adjoining firm parts of the head.

Most attempts to afford relief by the first class of methods have only occasionally and incidentally proved of any benefit to the hearing. The deaf may indeed be able to understand and distinguish with great quickness all the motions of a speaker, and thus to comprehend clearly all that is spoken; and by observing the motions of the mouth in the act of speaking, it has been thought speaking might be imitated; upon this notion many learned men have employed their thoughts, amongst whom are Peter Pontius, Paul Bonetus, Dr. Wallis, Holder, Sibscota, Franciscus, Mercurius, Van Helmont; but, above all others, John Conrad Amman has most of all distinguished himself. Peter Pontius, a Spaniard, made the first attempt in this way, towards the close of the sixteenth century; and he taught deaf persons both to write and to speak. After him came Bonetus, a master-gunner of the king of Arragon; he published a work in 4to, in 1620, on the art of enabling dumb persons to speak. Then Dr. John Wallis applied himself to improve this art, and described it in his *Tractatus Grammatico-physicus de Loquelâ*, and in his letter to the Honourable Mr. Boyle, *De Surdis Mutisque informandis*: about the same time Dr. T. Holder published, in 1669, a book called

Elements of Speech, &c. with the art of teaching the deaf and dumb to Speak ; in 1670, George Sibscota on the same subject ; lastly, Van Helmont attempted to explain more distinctly the natural formation of the letters of the alphabet, for the benefit of the deaf and dumb ; but he has confined himself to the Hebrew language, and given his rules in his *Alphabetum Naturale Hebraicum*. But above all others, John Conrad Amman, M. D., of Amsterdam, succeeded in teaching his own deaf and dumb daughter, and several others, to speak ; he published a tract in 1692, in which he laid open the whole of his method ; he gave a new and more enlarged edition of it in 1700 ; several editions of it were afterwards published.

On the principles of Amman, Kerger established his method, which he published in the appendix to *Ephe-merid. Acad. Nat. Curiosor. Cent. i. et ii.*, pp. 233 et seq. The whole of this method rests on that well-known physiological principle, namely, that we communicate with each other by means of articulate sounds ; and by daily practice we learn to form with every conception certain articulate sounds which are generally twenty-four, and in some languages not so many, called letters of the alphabet, which, when combined and pronounced at once, like single articulate sounds, are called syllables ; and when farther combined, they are called words. But all these articulate sounds, in order to their production, require at the same time a certain visible alteration in the organs of speech. In fact, the accurate attention to, and careful imitation of, all the particular motions requisite for the articulation of sounds, constitute the whole of Amman's

method. This method is subject to several imperfections, which render it inferior to other more modern methods. In the first place, let us take a case which sometimes occurs,—a person born deaf, dumb, and blind; it is not possible by Amman's method to impart conceptions to him, which usually arise from the sense of hearing. But it may be alleged, he can feel; certainly he may learn to speak in that way. But for one in this condition to place his hands on the mouth and throat of the speaker, would appear awkward and clumsy, not to mention that in forming sounds several motions are performed with the tongue, the teeth, the cheeks, &c., mostly observable by the eye, but not properly to be felt without interrupting the speaker.

The second imperfection in this method consists principally in confining the conceptions imparted thereby barely to language. All those ravishing sensations, which in other respects the sense of hearing is susceptible of, are here quite lost; as are also the thrilling motions of the organs of speech instantaneously lost in each other when raised with that rapidity in the expressions of the deeper passions, so as to strike and surprise the hearers.

Thirdly and lastly, take a person of little or no natural abilities, and attempt to teach him in this manner; I am fully persuaded the pains taken with him would be quite lost.

I shall now consider the second class of methods, of which there are, as stated above, two sorts: the first is, by various contrivances to increase the intensity of the repercussions of the air in the channels and cavities of the ear: in this case it is requisite that the auditory

channel be open; these are of no service in perfect deafness. Some of these means are as follow: the hand applied to the margin of the ear, so as to increase the area of the external part of the organ, at the same time opening the mouth: thus, more vibrations will be directed into the auditory channel exteriorly, and the air being reflected from the palate, may pass through the Eustachian tube to the cavity of the drum, and thereby render the vibrations more intense, provided that this last-mentioned channel have no obstruction. Artificial means are employed for the same purpose, as trumpets, &c. Father Sebastian Treuchel, in 1718, invented a kind of small drum, similar in shape to a tambourine, with gold-beater's skin instead of parchment; one of these was fixed over each ear.

The next sort of means of this class is now to be considered; yet previously it is important to bear in mind these three general facts:—First, sound is propagated by elastic bodies; secondly, sound is interrupted by soft interposing inelastic parts; thirdly, the bones of the skull in which the auditory nerve is lodged, form with the upper maxillary bone one continued hard and elastic body, uninterrupted in their connexion by any softer parts, and hence well adapted for the propagation of sound. By striking any sounding body, when part of it is placed in contact with the teeth, the sound is much more intense. In the stillness of night, if the back part of the head be placed upon the ground, the sound of persons riding may be distinctly heard at the distance of a German mile. In Haller's edition of Boerhaave's *Prælectiones*, it is

stated of a deaf musician, that he used to lay hold of the upper parts of his lute with his teeth when he played, and thus was enabled to perform in a correct manner. Many similar cases are recorded.

It has been observed, that deaf persons have been enabled to hear, if in speaking one should direct the sound over against the head. The method of producing this sense by means of some elastic body held to the teeth, claims by much the preference. The following case is from the Breslaw collection of essays:—A man at Copenhagen had by distemper lost his hearing, so that he could not hear the firing of cannon; at last he accidentally fell on a method by which he could perfectly well understand any speaker, and write down all that he said; and this he did by means of a stick of wood, of a moderate length, one end of which he held to, or took in his teeth, resting the other end against the place where the speaker stood; and thus at church he could understand the preacher and write down the sermon, upon seating himself just under the pulpit, with his face towards it, while one end of the stick was between his teeth, and the other end resting against the foot of the pulpit. John Paul Baumer, a young physician of Franconia, undertook to improve this method. His whole plan consists in taking a stick made of an elastic body, as glass, steel, copper, bell-metal, silver, &c., flat, and broad at both ends, to prevent its touching the lips; and being thus made fit for the due reception of sound, the deaf person takes one end of this stick between his teeth, and the speaker the other; with this precaution, however, that neither of them shall touch the stick

with the tongue or lips. In this manner the deaf person hears every word that is uttered. In order the more fully to establish the utility of this method, the author gives an instance in his second remark (section 6) of a young woman aged twenty-four, who learned to hear in this manner, though with an old rusty piece of a sword-blade, about two feet long; for upon pronouncing only a few words, she, with a smile, and pointing to her head, intimated that she perceived every word that was said, and directly tried to imitate them.

But, there are many defects in this method, namely, that the stick must not be touched either with the lips or the tongue, in which case all the lingual and labial letters, as, b, d, f, l, m, &c., must be uttered indistinctly; to obviate which, the author, indeed, has proposed another method, by using an acoustic tube and a speaking-trumpet. If the tube be employed, the deaf person must take it in his teeth, and the speaker must pronounce at the wide end of it, for which purpose a common funnel will answer as well; but if a speaking-trumpet, the deaf person must open his mouth very wide, while the speaker who pronounces through it holds its upper broad part close to the teeth of the deaf person, yet without touching them. To conclude,—all the methods mentioned hitherto under this second class, are rendered far more commodious, more perfect, and of far more general utility, by considering a peculiar contrivance of an ingenious deaf person, who gave the greatest attention to every incident that offered to his observation. And this method I shall now propose at full length.

A respectable merchant of Wesel, in the duchy of Cleves, a venerable, hoary-headed man, of seventy-eight, had, as early as his twentieth year, a great difficulty of hearing, which, as far as he could recollect, was occasioned by a violent fall, or by a profuse bleeding at the nose. The most promising means against this disorder proved ineffectual, it rather growing upon him from year to year, till at last he became quite deaf, unable to understand a single word, without bawling loud in his ears. After a long and accurate examination of the external organs of hearing by Dutch and German physicians, the case was deemed incurable. However, he procured a variety of acoustic tubes from Amsterdam, in order to afford some relief to those who wanted to speak with him; but they were laid aside, as never procuring any distinct degree of hearing. Afterwards marrying, and having two of his eldest children, a son and a daughter, taught to play on the spinnet, he often came up to it, and eagerly wished to hear the music. As the music-master once happened to say that it was very possible for him to hear, if, according to an old and well-known experiment, he held a stick or tobacco-pipe with the one end on the bridge of the sound-board, and with the other to the upper teeth, — this he instantly tried, and was greatly pleased that he could both plainly distinguish each note, and, as he thought, much stronger than formerly at his best hearing. But all this was ineffectual to make him understand persons speaking, till an accidental trial procured him also this happiness. In the year 1749, he had the good fortune to light by mere accident on

a peculiar method, by which any person at the distance of twenty or even thirty paces might, without greatly straining his voice, speak to be understood. This happened as follows:—One day when this deaf person had all his family about him, and was pleasing himself with his daughter's playing, by means of his tobacco-pipe, his brother, who happened to be there present, alleged, that as he could plainly distinguish the sounds or notes of the spinnet, he might also in the same manner understand the articulate sounds of speaking. For this purpose his brother took a speaking-trumpet, and holding the narrow part or mouth-piece to the upper teeth of the deaf person, he uttered a few words at the upper or wider part thereof. This trial, however, proved unsuccessful, the deaf man not being sensible of the least articulate sound; but he himself directly fell upon a device which proved more successful. The brother was to hold the rim of the wide end of the speaking-trumpet to his upper teeth, and he himself to do the like with the lower end or mouth-piece; upon which his brother had scarcely uttered a couple of words, but he directly repeated them with the greatest joy, and also assured him that he understood them more distinctly than if he had bawled them in the loudest manner in his ear. The deaf man, in order to be convinced whether the success was not owing to the structure of the speaking-trumpet, or whether the same thing might not succeed with other bodies, directly tried with his tobacco-pipe and a small wooden stick in the same manner; and to his great joy found it not only possible, but also that he could even hear if the voice, however low, were audible to

other persons. The curiosity of this man and his friends did not rest here; they wanted to know at what distance one might converse with him. For this purpose they took thin sticks or slips of wood of different lengths, one in particular six feet long, an inch broad, and of the thickness of the back of a knife.

The farther trials and observations which were made in the use of this method have been confirmed by the following experiments:—In the first place, upon bawling in the loudest manner into the mouth of the deaf person, through a large tin funnel, without touching the teeth, or even without the funnel, not a single word is understood. Secondly, if the slip of wood be held too fast with the fingers, or laid hold on with shut lips, the voice proves very indistinct; but, thirdly, if held between the teeth, the sensation is extremely weak. Fourthly, if the slips be held to the under teeth, there is not the least sense of hearing; whereas, fifthly, in using the slip, the voice is perceptible and distinct, upon bringing the tongue to the palate, or to the teeth. Sixthly, the voice is less perceptible on joining the teeth together, than on their standing asunder. Seventhly, though the mouth be full of water, the hearing is not in the least diminished. Eighthly, when a brass or iron wire is held to the teeth, the deaf man hears nothing at all; but when held between the teeth, a little. Ninthly, the deaf person may hear very well on holding a beer-glass to the upper teeth by its lower rim; or if, with the mouth shut, he presses it somewhat hard just under the nose, and another person directs his voice up the glass,

close to it. This does not answer with a wine-glass. Tenthly and lastly, the speaker must have good sound teeth, without any loose ones, at least in the upper jaw, as then the voice is very indistinct.

As the explanation of all the methods hitherto treated, and the observations occasionally offering thereon, are founded on three propositions advanced above,—all that is necessary here is, to make a closer application of them to the present case, and from the consequences thence drawn, to give a sufficient proof of the commodiousness and utility of the last method proposed to procure hearing to the deaf.

I shall now briefly mention all these hard parts of the head, with their several connexions with each other, from all which their capacity to propagate sound will be more easily and certainly determined. First, I offer to consideration the teeth, which are parts extremely hard and firm, and by an articulation called gomphosis, are wedged or fixed, and immovable in their sockets, in both the jaw-bones, so as not to drop out even in a skeleton. In the second place follows the under jaw-bones, both whose apophyses condyloideæ are obliquely inserted in the fovea glenoides of the temporal bone ; and moreover, the oblique eminence of the same bone, by means of the cartilago interarticularis. Thirdly, the upper maxillary bones come to be considered, whose hinder and inner part is immediately connected with the apophyses pterygoides of the os sphenoides ; but the fore-part firmly connected with the palatine to the ossa palati, and with the zygomatic processes to the zygomaticum. Then, fourthly, follows the just-mentioned os jugale, or

zygomaticum, which, by a peculiar process, is closely connected backwards with the temporal bone. Fifthly, the palatine bones are connected with the os cuneiforme by the pterygoidal processes. Sixthly, the os cuneiforme lies in the middle between the said bones, and forms, as it were, the common copula, or tie, of these and of the temporal bones, seeing it is connected forwards with the palatine bones by the pterygoid processes, and by the temporal processes, called by some the greater wing of the os cuneiforme, with the os squamosum and petrosum of the temporal bones. Hence, seventhly, it appears that the temporal bone is immediately connected with the os jugale and cuneiforme, and mediately with the palatine bones and both the maxillary bones, and with the teeth; yet so that the connexion with the inferior maxillary is interrupted by an interposing cartilage. Eighthly, the connexion of the temporal with the other bones of the cranium, as the ossa frontis, parietalia, and occipitis, is either mediate, by means of the os cuneiforme, or immediately, by means of the sutures, which last, in more advanced years, entirely disappear. Ninthly and lastly, to this head we refer the tuba Eustachii, a canal partly bony, partly cartilaginous, and partly membranous, and closely connected with the temporal bone.

From this connexion of bones we may plainly see that sound is propagated by such of them as are continuous and closely connected together, and are, as much as may be, either bare or naked, or only covered with thinly expanded soft parts. Of this kind are principally the upper teeth, then the upper maxillary

bone; also all the bones of the cranium, when stripped of their hair and other softer parts.

Neither the under maxillary bone nor the tuba Eustachii can properly propagate sound. Of the last we are moreover to observe, that being membranous from the pterygoid processes to its opening into the mouth, and partly also lax, and on that account exhibiting a somewhat collapsed passage, the vibrating air can neither be conveyed in sufficient quantity to the cavity of the drum, nor produce in it the due vibratory motion. As sound may be propagated by all elastic bodies in close connexion or contact with each other, so in this manner may all thin slips of wood, Spanish reeds, sword-blades, tobacco-pipes, &c. be of service when pressed to the above-mentioned hard and elastic parts of the head, which stand connected with the temporal bones.

Now, as among all the elastic bodies just mentioned, the fibres of wood are remarkably tough and flexible, and on account of their loose and open texture give no great resistance to vibratory motions, but rather afford them greater scope,—so thin slips of wood, or slender Spanish reeds, are best adapted for the purpose of propagating sound to the elastic parts of the head and the organs of hearing.

As the sensation which is perceived in the act of hearing, produced by the methods of the second order of the second class, seems to be formed at most in the middle of the brain backwards, at the medulla oblongata,—we may hence, according to anatomical grounds, judge that the vibrations produced by sound put the auditory nerve in sensation, from the os petro-

sum quite to their origin. And hence arises this practical proposition, that the easy method we have been hitherto upon to procure hearing to the deaf, is adapted to all persons afflicted with deafness, be the other auditory organs injured how they may, provided the auditory nerves are not obstructed, or quite destroyed at their origin. For this last is the only case in which the present method is not applicable, and on such melancholy objects all labour and pains are lost.

After these observations on artificially communicating sounds, I shall follow up the subject by an extract from Sir Hans Sloane's manuscripts, which are likewise deposited in the British Museum, and entitled, *The Conjecture for the Engine of Hearing*.

“Supposing the mystery of hearing to be nothing else but a due perception of y^e undulating motion of y^e aire, w^{ch} shakeing y^e drum of y^e eare and thereby communicating itself to y^e inside of it, and being from thence, by y^e convenient structure of y^e eare, conveyed to y^e brain, striketh it immediately, and so informeth it how things move wthout; it being also known y^t those animals y^t are fearful, and thence quick of hearing, as connies, hares, staggs, which have proportionably greater and longer eares yⁿ others w^{ch} upon occasion they dress and prick up;—it seems not improbable y^t y^e sense of hearing might be improved by an engine so figured, y^t being long, capacious, hollow, and like a cochlea winding wthin, suitably to y^e motion of sounds, would be fit both to receive a great deal of y^e mouved air, and keep it together, and conveigh it perfectly to y^e tympani of y^e cares. The matter fit for such an engine

some doe propose ivy-wood or hew-tree, as porous and giving a report by slight percussions."

Besides this paper of Sir Hans Sloane, there was one also published some years ago, by Archibald Cleland, surgeon to General Wade's regiment of horse, which will shew that the subject excited then more attention than at present: it contains some ingenious remarks on the construction of instruments proposed to remedy some kinds of deafness proceeding from obstructions in the external and internal auditory passages. He observes,

"In order to discover with more exactness whether the disorder lies in the outward ear, I make use of a convex glass, three inches in diameter, fixed in a handle, into which is lodged some wax candle, which comes out at a hole near the glass, and reaches to the centre; which, when lighted, will dart the collected rays of light into the bottom of the ear, or to the bottom of any cavity that can be brought into a straight line: therefore, when it is discovered by the help of this glass and lighted candle, that the ear is full of hard wax, which will not bear to be taken out by the forceps, the method is to have a small boiler, wherein are put some proper herbs; and by different tubes of various sizes, the steam is conveyed to the bottom of the ear. In a short time the wax will dissolve, and the person find great ease. In some of these tubes are placed two valves, to regulate the heat to the person's inclination; if this has not the desired effect, and the person still remains deaf, the following instruments are made use of to open the Eustachian tube: if upon trial it should be found to be obstructed,

the passage is to be lubricated by throwing a little warm water into it, by a syringe, joined to a flexible silver tube, which is introduced through the nose into the oval openings of the duct at the posterior opening of the *nares* or nasal fossi, towards the arch of the palate. The pipes of the syringe are made small, of silver, to admit of bending them as occasion offers, and for the most part resemble small catheters; they are mounted with a sheep's ureter, the other end of which is fixed to an ivory pipe, which is fitted to a syringe, whereby warm water may be injected; or they will admit to blow into the Eustachian tube, and so force the air into the barrel of the ear, and dilate the tube sufficiently for the discharge of the excrementitious matter that may be lodged there. The probes, which are of the same shape with the pipes, have small notches near the points, which take in some of the hardened and glutinous matter that is contained in those tubes, which is distinguished by the fetid smell when the probes are withdrawn.

“ There is another kind of deafness, which proceeds from a violent clap of thunder, noise of a cannon, or the like: in this case it is probable that the position of the *membrana tympani* is altered, being forced inwards upon the small bones, and so becomes concave outwards: in this case, no vibration of sounds will be communicated to the drum until the membrane has recovered its natural position. The means proposed to remedy this disorder are: first, (if the person heard very well before, and it be not too long after the accident has happened) to oblige the patient to stop his mouth and nose, and force the air through the Eustachian tube into

the barrel of the ear by several strong impulses, which will probably push the membrane back to its natural state. But if by any accident the excrement is hardened in the tubes, the orifice of it which opens into the barrel of the ear should be stopped up, so as that no air can be forced that way. The second method proposed is, to introduce into the meatus auditorius externus an ivory tube, as near to the drum as can be done, and so exactly fitted that no air can go in or out betwixt the skin of the external meatus and the tube. When it is fixed, I take the further small end in my mouth, and by degrees draw out what air is there contained; and I believe it will act like a sucker upon the membrane, and draw it back to its natural state, and then the person will hear as before. If this should fail, I should be apt to believe the violent shock the membrane has suffered may have dislocated some of the small bones, in which case there is scarcely any remedy."*

From these observations it clearly appears, that should medical aid fail in relieving the deaf and dumb, still sound may be communicated to them, and that many may be made to hear by the mechanical contrivances which have been pointed out in this essay, and therefore they should not be thrown on the deaf and dumb asylums, but as a last resource.

I cannot conclude these extracts without mentioning a valuable paper of Mr. Swan's on this subject, published by the Medico-Chirurgical Society, in which he presumed that people born deaf and dumb, and who

* From the Philosophical Transactions.

had no defect in the auditory nerves, might be made to hear through the medium of the facial nerves, and thus have their unfortunate situation amended. To substantiate this opinion, he has adduced a case in which the external passage to the ear is imperforate, and sounds are heard through the nerves of the face. The person can also speak intelligibly.

Mr. Swan thinks that the reason why those who are born deaf are not more frequently able to acquire a degree of perfection in hearing, is because their whole attention is taken up with signs; and no methods are generally used to increase the power of the provision usually made by nature for supplying the defects occasioned by imperfections of the tympanum.

CHAPTER IV.

ON THE CAUSES OF DEAFNESS AND DUMBNESS.

PREVIOUSLY to entering more particularly upon the causes of deafness and dumbness, it will not be irrelevant to make a few remarks upon the causes of disease in general.

Daily observation demonstrates that the human structure, even in its most perfect formation, is liable to lesions of organisation and derangement of function, producing that state of the system in which its usual actions or perceptions are either interrupted or attended with pain. This state is called disease.

Every animal carries within itself the germ of its own destruction; or, in other words, it is formed for a limited existence. Many diseases, therefore, arise spontaneously, or without any assignable external cause,—but many more are produced by causes over which we have some control; and perhaps the chief source of the physical ills to which we are liable is the deviation we make from the simplicity of nature. The injurious influence that domestication has upon the health of the lower animals is very strikingly apparent; and in proportion as their subjugation is more complete, and their manner of life differs more widely from that which is natural to them, so are their diseases more numerous and severe.

The diseases of our more valuable domestic animals are sufficiently numerous and important to employ a particular class of men; and the horse alone has professional assistance appropriated to him. Men of education and talent have devoted themselves to the investigation of the diseases of this noble and useful creature.

The poor little canary-birds, confined in their wiry prisons, are very liable to disease, more especially inflammation of the bowels, asthma, epilepsy, and soreness of the bill.

No animal deviates so far from the simplicity of nature in its habits as man; none is placed under the influence of so many circumstances calculated to act injuriously upon the frame. His morbid affections are hence abundant and diversified, as may be seen by referring to the different nosological arrangements; these long catalogues of diseases afford strong evidence that man has not carefully followed that way of life which has been marked out for him by nature.

The crowded state of the inhabitants of large cities; the injurious effects of an atmosphere loaded with impurities; sedentary occupations; various unwholesome avocations; intemperance in food; stimulating drinks; high-seasoned and indigestible viands, and these taken hastily in the short intervals allowed by the hurry and turmoil of business; the constant inordinate activity of the great cerebral circulation, kept up by the double impulse of luxurious habits and high mental exertions; the violent passions by which we are agitated and enervated; the various disappointments and vexations to which all are liable, re-acting upon and disturbing

the whole frame; the delicacy and sensibility to external influences, caused by heated rooms, too warm clothing, and other indulgences,—are all contrary to the voice of nature; and they produce those morbid conditions of the system which a more simple and uniform mode of living would prevent.

Our associates of the animal kingdom do not escape the influence of such causes. The mountain shepherd and his dog are equally hardy, and form an instructive contrast with a delicate lady and her lap-dog,—the extreme point of degeneracy and imbecility of which each race is susceptible.

In the early ages of society, man enjoyed long life; his manner of living was simple; his food, habitation, and pursuits, were all calculated to fortify the body; and no anxious cares disturbed his mind.

Humboldt observes, that individuals whose bodies are strengthened by healthy habits in respect to food, clothing, exercise, air, &c. are enabled to resist the causes of disease in other men. He describes the Indians of New Spain as a set of peaceful cultivators, accustomed to uniform nourishment, almost entirely of a vegetable nature, that of their maize and cereal gramina.* They are hardly subject to any deformity; he never saw a hunch-backed Indian; and it is extremely rare to see any who squint, or who are lame in the arm or leg. In countries where the inhabitants suffer from the goitre, this affection of the thyroid gland is never observed among the Indians, and seldom in the

* Political Essay on the Kingdom of New Spain, vol. i. p. 152.

Mestizoes.* He repeats the same testimony very strongly concerning various tribes in South America, as the Chaymas, Caribs, Musycas, and Peruvian Indians.

Having made these preliminary remarks upon the general causes of disease, those will now be considered which produce deafness, and consequently dumbness. The causes which have been mentioned are those that are called remote, and tend to bring the system in general into a state of debility and disease. The causes now to be enumerated are those known by the term proximate, which when present make the disease, and when removed the disease ceases. These are so numerous, and many of them so obscure, that it is difficult, and perhaps impossible, to give an exact and complete account of them.

In the first place, the acoustic nerve itself may be absent *ab origine*: this has been proved to be the case in some instances, but it is not a very frequent occurrence. It is evident, that deafness must be the consequence of the want of so essential a part of the auditory apparatus. This nerve may be under such pressure in the interior of the skull, either at its origin or in its course, as to prevent the nervous influence, and so intercept all communication between the organ and the brain. The diagnosis in these cases is so much the more difficult, as the source of the malady is profound and concealed.

* The offspring of a European and an American.—*Personal Narrative*, vol. iii. p. 233.

Although the auricular portion of the external ear is a very useful part, and tends to perfect the organ, yet it is not of such great importance as to produce total deafness by any disease to which it is liable; provided all the other parts are in a proper state, absolute deafness would not be the consequence of the absence of this portion: affections of the meatus externus are more serious in their results, and frequently prevent hearing; and if they occur before birth, or in the early months after birth, and are not cured, dumbness will be inevitable. The most frequent causes of deafness and dumbness in young children are, obstructions of the Eustachian tube,* viscid mucus impacted in the meatus, herpetic eruptions, which so often afflict children at birth or at the time of teething; also Fever, Measles, Small-pox, Syphilis, &c.: besides these sources, there are various affections of the membrane of the tympanum. This membrane in new-born infants, says M. Leschevin, is covered, on the side next the external passage, with a very thick, spongy membrane, which falls off after suppuration,—if it remain fastened to that part of the tympanum, it is certain that it will occasion deafness: might not this be the case with the mute of Chartre, whose history is given by the Académie Royale de Paris, 1703, who heard at the age of twenty-four, after a suppuration in both ears.† M. Portal raises doubts as to the existence of this membrane;—it is not possible, he says,

* Children born with this obstruction are deaf and dumb.

† This case was given at length in the author's Treatise on the Physiology and Diseases of the Ear, published in 1817.

to be assured of this fact in infancy. The suppuration, it is said, is almost imperceptible; besides, when it takes place, the pus must be so mixed with the cerumen of the ears, that it would be difficult to distinguish it. In order to remove all doubts upon this subject, the infant should be constantly under the eye of a surgeon, who might examine the nature of the cerumen, which, during the suppuration, is altered from its natural colour, and has an unpleasant odour. But, adds the author, all these observations are difficult to make—it may be said impossible, because so many circumstances oppose it. It is necessary to wait a short time, when the child will shew whether it hears or not.

Mons. Saissy observes, the membrane of the tympanum may be covered, on the side of the auditory passage, with a spongy pellicle, in consequence of some inflammation, connected with a polypus which implants itself on its external part. It may be relaxed, and project into the tympanic cavity; sometimes it is too tight, inflamed, ossified, cartilaginous, wanting in part, or entirely absent.

It is not long since, says Rusenthal, that I had an opportunity of examining the body of a deaf and dumb subject, who had become so in consequence of the Small-pox. I found this membrane relaxed, and thicker than usual; the auditory nerve appeared also a little harder:—on the whole, the parts of the internal ear were well formed.

There are various affections of the membrane of the tympanum, involving diseases of its cavity, its bones and muscles, likewise affections of the labyrinth, mas-

toid cells, Tumours, Polypi, morbid Septa of the passage, &c.

One cause which I shall mention from a French author, whose opinions I consider singular, is, *le commerce sexuel pendant la grossesse*. In fact, the causes of deafness are without number, and every day fresh ones are discovered.

If, on closing the mouth and nose, and making a strong expiration, the patient do not feel the air pass into the Eustachian tubes, or strike the membrane of the tympanum, we may conclude that they are closed: these signs are common to the imperforation from birth, as well as to that arising from diseases of the throat and nasal cavity, and the complete obstruction of these tubes. We may also be assured of their being closed, by probing them by means of the nostrils; if the opening of the tube be not found, it is a proof that the obstacle is placed lower down: often the obstruction which intercepts the air is found farther down, and the instrument meets there an invincible resistance; if to this is joined elasticity, and a slight pain in the part touched, there is no doubt that a membranous portion is the obstacle that prevents the air penetrating into the tympanic cavity. In these cases hearing may be restored, if the obstacle to the perception of sound is only in the opening of the tube, or extended in it, provided the immediate organ of hearing is not too much diseased,—for then the faculty of hearing is irrecoverably lost.

From the formation of the ear, it is obvious that, in order to the proper exercise of the sense of hearing, all parts of the organ must duly perform their func-

tions; in the reception, the concentration, and the percussion or action of sound on the auditory nerve; when there is an imperfection in any one part, hearing must be either defective, or entirely suspended, according as the part of the organ is more or less of primary importance to the influence of sound. In cases of deaf and dumb, if the error lie in the external ear, it would be obvious on inspection; if in the intermediate ear, it would be nearly the same: it is only therefore in the internal ear, and in its connexion with the Eustachian tube, that the imperfection is liable to be overlooked. We find that in many children and grown persons, deafness has taken place from previous affections of the throat influencing the state of the Eustachian tube, and that this deafness has continued till some means of restoring the throat and ear have been employed.

It may be safely affirmed, that in a considerable proportion of the deaf and dumb, this tube is either impervious from original malformation, or has been rendered so by viscid secretions plugging up the orifice. This tube forms a slender pipe, merely sufficient for the passage of air leading from the cavity of the tympanum, exactly the same in use as the hole in a drum; the membrane of the tympanum being the drum-head, and liable, like it, to tension and relaxation. Though every other part of the ear be perfect, as generally appears in deaf and dumb persons on dissection, yet if this perforation of the Eustachian tube be wanting, the organ either cannot act, or but imperfectly, and that only by strong excitement from loud sounds, as the report of a gun, &c. It has been

already noticed, that deafness has followed an affection of the throat both in syphilis and simple inflammatory cases, producing cohesion of the sides of the Eustachian tube during the febrile process; and did not this happen when speech is perfect, dumbness would be the natural result. This might be inferred from what we know of the important use of the passage, but it is fully confirmed by experience,—a fact not less important than obvious.

Perhaps the most unpleasant cases of deafness and dumbness are those resulting from monstrosities and malconformation. Of this I have seen a singular instance in a child without any external ears.

The following interesting case of original deafness was communicated some years ago by the late Dr. Haighton, of Guy's Hospital, to the Medical Society of London, and afterwards published. This case, from the known character of the author, and the important and satisfactory reasoning contained therein, deserves our attention.

The doctor commences by observing, that the vital parts and the organs of sense are more perfectly formed, and exist in a higher degree of perfection, at the time of birth, than the other parts of the body. The necessity of this is very obvious; for if the former were not at this period formed in some degree of perfection, they would be unfit for performing those offices which are absolutely necessary for the preservation of life. The different organs of sense are also very perfectly constructed, that they may be the more able to receive those various impressions which

every surrounding object is ready to make on the newborn infant, and which, being conveyed to the mind, produce what is called perception. As soon as the mind becomes furnished with a variety of perceptions, it begins to employ itself in comparing them with each other, by which it discovers their agreement or disagreement: this is called judgment. But before the mind can exert itself in acts of judgment, it must be well stored with a variety of perceptions: to this end it is expedient that the different organs of sense convey faithfully to it such impressions as may be made on them; but when, either from disease, accident, or original malconformation, they are unable to discharge that office, the mind is deprived of a part of its materials, its operations become proportionally circumscribed, and its attainments impeded. Original blindness has always been considered as a misfortune, because it keeps us in total ignorance of every thing relative to colour, confines our knowledge of the situation of places, and unfits us for most of the common employments of life. But original deafness places a person in a still more pitiable situation,—he is unavoidably dumb; for in order to speak, it is necessary to learn a language, and to learn a language it is necessary to hear. But to form a just idea of his calamity, we need only reflect on the very great loss he sustains from being deprived of the lights of education, and of the knowledge of many important truths inseparably connected with his happiness. It would be a god-like act to relieve a fellow-creature from such a state of wretchedness; it would be, in effect, elevating his mind from a low, grovelling state, to the condition

of a rational being. But this is an arduous work !— I wish the circumstances of the present case had been such as admitted even of palliation ; this paper would then not only have had the merit of explaining one of the causes of deafness, but afterwards of suggesting the most probable means of affording relief. But even this has been denied. I must therefore content myself with laying before you, in as clear a manner as I am able, the appearances which presented themselves on dissection, and subjoining such remarks as the circumstances furnished me with.

Mr. B. died when he was about thirty years of age. Having been deaf from his birth, he was consequently dumb. He possessed but little originality of genius, and his intellectual powers were very limited ; but he was not destitute of talents for imitation. He frequently employed himself in drawing patterns for needle-work, and generally executed them with great exactness. He has shewn me several of his productions. I have occasionally conversed with him in his own way upon ordinary occurrences ; and though he often made inquiries, they were always trifling, and such as indicated a very confined understanding. His disposition was naturally irascible, but his conduct was neither vicious nor immoral. While he was lamenting his situation, during the illness of which he died, his friends attempted to console him on religious grounds ; they endeavoured to impress his mind with the necessity of patience, and an entire resignation to the will of the Deity, whom they represented as the author of his sufferings : but so little light had his mind received

concerning natural or revealed religion, and the relation subsisting between the Creator and creature, that he put himself into a violent fit of anger, which was with difficulty appeased. After death, Mr. Walshman,* who had attended him during his illness, very obligingly gave Mr. Cline and myself an opportunity of examining the parts concerned.

Appearances on dissection.—The brain, which was carefully examined, exhibited nothing peculiar, nor did any thing worthy of notice occur, until, in the order of examination, we arrived at the seventh pair of nerves, which, from its function, is called auditory. This nerve consists of two portions, one of which is called portio dura, from its firmness, but its connexion with the sense of hearing is somewhat remote: the other is called portio mollis, and is very properly considered the true auditory nerve. This last portion was remarkably small; it did not appear to be half its usual size; but the portio dura seemed in every respect natural. Having taken out the temporal bones, in order to examine the parts more at leisure, we found nothing preternatural in the meatus auditorius, membrana tympani, the cavity of the tympanum, or the two apertures leading from it, viz. the Eustachian tube, and the communication with the mastoid cells. The figure of the four bones of the tympanum was natural, and their relative situation very proper. The first of them, called malleus, was attached, as usual, by its manubrium to the membrana tympani;

* Now Dr. Walshman, the eminent physician of Kennington.

and the last, called stapes, had its basis resting on the entrance of the vestibulum, called fenestra ovalis. Every appearance hitherto was natural. The sole cause of deafness was found in the labyrinth. This part of the organ, consisting of the vestibulum, cochlea, and semicircular canals, was perfectly formed; but instead of containing water, was filled with a solid, caseous substance. This was the only preternatural appearance, and I believe will be very sufficient to explain the case, when we consider the economy of this organ. With this view, permit me to subjoin a few remarks.

Remarks.—The organ of hearing, instead of being divided into external and internal, may, perhaps, with more propriety, be distinguished into parts preparatory to the impression of sound, and parts more immediately subservient. Under the first class may be ranked every part except the labyrinth, as the meatus auditorius, membrana tympani, the cavity of the tympanum, with its apertures and contents. Under the last class may be considered the labyrinth and its contents. In the present case, the first of these classes appeared very perfect; the meatus auditorius conveyed the tremulous motions of the air to the membrana tympani, which again, by the communication of the malleus, incus, os orbiculare, and the stapes, conveyed those movements to the labyrinth. The Eustachian tube, being pervious throughout its length, performed its office, viz. that of preserving the balance between the air on the outside of the membrana tympani, and that in the cavity of the tympanum, by which means that membrane is allowed

to vibrate in a more perfect manner. It is not altogether certain, that an obstructed Eustachian tube will produce total deafness, though it may diminish that sense in a very high degree, in proportion as the freedom of vibration of the membrana tympani is impeded. But if it could be clearly proved, that a total deafness arose from this cause, and if it were also possible to ascertain this in a living subject, there is a probability of obtaining relief from an operation. The most natural idea in such a case would be to restore the natural opening by the introduction of instruments up the nose. But the distant situation of the orifice of this tube from the entrance of the nostril, together with its being out of sight, create a difficulty; and it is probable that our attempts in this way might be in vain. There remains, however, another expedient. It is well known, that the mastoid process of the temporal bone is internally composed of large cells, which have an opening of communication with the cavity of the tympanum, in a manner similar to that of the Eustachian tube: in such a case, a perforation might be made into that process, and the communication between the external and internal air be again restored. But in the present case even this was a lost hope! The evil here was deeper seated,—the labyrinth was the part which alone was concerned in the complaint. Not that it failed in the performance of its office from any imperfection in its form, but merely from the nature of its contents.

Before the time of Cotunnus, this part of the ear was supposed to contain air. It was that fluid which was thought to be put into motion by sonorous bodies,

and which, by pressing against the auditory nerve lining that cavity, produced the sense of hearing. The investigations of this anatomist have placed that matter in a clear light, and have shewn that, instead of air, it contains water. In the year 1761, he published a treatise at Naples, under the following title, *De Aquæductibus Auris humanæ internæ*, in which he proved that there is no air contained in the labyrinth, and that its natural content is water; but he does not seem to have had the clearest idea of the source of this fluid. He imagined that the two canals which pass from the labyrinth to the inside of the cranium, called aquæductus vestibuli and aquæductus cochleæ, conveyed this fluid from the inside of the cranium into the labyrinth. But Dr. Meckel, the present professor of anatomy at Halle, has shewn, with more probability, that these canals serve as outlets, and that their true office is to prevent a surcharge. The labyrinth, besides being lined by an expansion of the auditory nerve, is likewise furnished with a very vascular membrane, probably for the purpose of secreting this water. But, whatever opinions may be formed on this point, it is demonstrable, that water is the proper fluid of this part, and that by its means the vibrations of sonorous bodies are conveyed with greater force to the auditory nerve than can possibly be done by the lighter fluid, air. For although both air and water are, from their fluidity, capable of having a very perfect intestinal motion excited in them, yet the force with which these fluids strike against the nerve will be in proportion to their respective densities. But in the present case there was no fluid of any kind, its place was supplied

by a solid substance, which, being incapable of receiving so perfect a vibratory motion, was unable to produce its proper effect on the immediate organ.

In recording the appearances on dissection, the diminished size of the auditory nerve was noticed. Is this to be considered as a cause of deafness, or as an effect? I should imagine the latter. For if it were the cause, we should naturally expect the effect to be in proportion, and, instead of a total deafness, there should have been only a partial one. It is most probable that its connexion, in this case, is only an effect; for it is a law in the animal economy, that parts increase in bulk from moderate use, and become diminished from the want of it. This is very evident in the muscles, where, from a diseased joint, which prevents motion, the whole limb is observed to shrink. I have known the same thing take place in the optic nerve, where there had been an accidental blindness. I should therefore consider this as the effect, and not the cause.*

* Transactions of the Medical Society of London, vol. iii.

CHAPTER V.

ON THE TREATMENT OF THE DEAF AND DUMB.

It will not be improper, on entering upon the treatment of the various diseases which produce deafness and dumbness, to offer a few observations on the physiology of the organ of hearing.

The parts essential to perfect hearing are :— First, an external ear; for, whenever this part is completely removed, deafness is the consequence. Secondly, the membrane of the tympanum, which may be partially injured, but never can be completely removed without producing deafness. Thirdly, the stapes; for all the small bones of the ear may be removed without causing deafness, but the stapes is the only one that prevents the escape of sound from the internal ear. Fourthly, the aperture of the Eustachian tube, as preserving the access of air through the throat to the tympanum, and its renewal and change in the organ; and that this is a necessary and essential part, is evident from the structure of the ear in the tortoise and frog, which have no external ear, but an enlarged Eustachian tube, placed at the back part of the roof of the mouth. Fifthly, the presence of a fluid in the internal ear, which is necessary to heighten the acuteness of impression, and to render it effectual.

It remains next to observe in what manner the

impression on these parts is made, or the tremor from sonorous bodies communicated to the nerves in the internal ear. In man, quadrupeds, and birds, besides the impression communicated to the nerves of the ear by the whole bones of the head, a distinct impression may be conveyed to them in three different ways:—1st, By the structure of the parts regulated by their muscles, which connect the membrane of the drum with that of the oval foramen. 2d, By the action of the air contained in the cavity of the tympanum, which air must communicate its tremor in two ways—by motion from the membrane of the tympanum, and also by tremor of the external air, communicated to the membrane of the Eustachian tube: and, 3d, By the medium of a watery liquor in the cavities of the vestibule, semicircular canals, and cochlea, which transmits the tremor from the membrane of the oval and round foramina to the portio mollis, or nerve of the internal ear.

Such is the complex and minute structure of this important organ, that when we attend to the intricacy of its parts, to the delicacy of its texture, and to the numerous windings and sinuosities it every where displays, we are struck with wonder and admiration at the nicety of its mechanism, and cannot be surprised that the least change should produce on it a deviation from the healthy state. Nay, when we farther contemplate the varied organization of the ear in the different tribes of animals, we shall in all of them find it admirably fitted for their respective habits and characters; and by a slight comparison of the various tribes, we shall understand the reason for the difference of structure in each.

The treatment of the diseases of the ear is very far from having attained that degree of perfection of which it is susceptible: the chief obstacles are, first, the apparatus of the ear is so complicated, the different parts that compose it so concealed, that the diseases are hidden from our sight,—thence the uncertainty of the diagnostic; secondly, the prejudice which supposes that the deafness at birth depends always on malconformation of the organ, and that, being incurable, all attempts at relief are considered useless,—yet means may be used without inconvenience, and often with success.

It is always to be considered that, in treating of the subject of deafness and dumbness, the deafness is to be regarded alone as the cause of dumbness; and it is, therefore, necessary here to take some review of the different diseases which occasion deafness, and which tend to produce that forlorn state which occupies the attention in this Essay.

OTITIS, OR INFLAMMATION OF THE EAR.

Whatsoever part is attacked by inflammation, an increase of bulk is the consequence; and in those structures which are of a solid and unyielding nature, the disease assumes a more severe form. Thus in Otitis, or Ear-ache as it is commonly termed, the pain is excruciating and the fever high, in consequence of the peculiar nature of the parts, which are cartilaginous and therefore unyielding. As this painful affection rarely produces commiseration, it is liable to be neglected at the commencement; nevertheless, it some-

times does assume a serious character, and induces a cerebral affection which resists the curative powers of medicine.

In such cases, dissection has shewn collections of pus in the cavity of the tympanum, marks of inflammation on the dura mater, which is found detached from the inner surface of the cranium, as well as various other morbid appearances, evidently the result of disease first originating in otitis.

It has been observed by M. Lallemand in his anatomical and pathological researches, that acute otitis occurs more frequently before than after puberty; he considers it attacks equally all temperaments, and both sexes. Some cutaneous affections which spread to the mucous membrane of the meatus externus will produce external otitis; this is more particularly the case in some species of fever and small-pox. The inflammation in these instances extends very readily to the interior of the ear, the sad consequences of which not unfrequently are caries of the bone, incurable deafness, and sometimes disease of the brain which terminates in death.

The sudden application of cold when conducted in a current, especially after the system has been rendered more susceptible, by fatigue from exercise, or other depressing causes, as the incautious use of calomel and such lowering medicines, will produce this affection. In the latter stage of fevers we frequently observe internal otitis to take place: this is not to be considered a critical event in respect to the fever; but as the brain is an organ which is frequently in a state of high vascular action, amounting in some cases to inflammation, the ear becomes affected more frequently than

any other organ, on account of its contiguity to the brain.

External otitis is an affection much less important and severe than the internal kind: the suddenness of the discharge which takes place soon after the commencement of the pain, distinguishes it from the latter. The surface of the meatus externus is observed to be red, tumid, and covered with a puriform secretion on the second or third day, whilst in internal otitis it is dry for several days; the discharge at length comes on and is abundant, and it proceeds through the Eustachian tube. Symptoms similar to those which usually attend inflammation of the brain or arachnoid membrane, not unfrequently attend internal otitis; sometimes this affection is complicated with those diseases, by which the diagnosis is rendered very difficult. The pain in otitis is not in all cases limited to the ear; it is found in some to extend to the whole head, varying in degree and in nature: in some instances it is much more severe than in others, and is sometimes darting, at others dull and compressive.

The plan of treatment in this disease is similar to that employed for the cure of inflammations of other parts. In slight cases, the constant application of a sedative evaporating lotion, spare regimen, and saline aperients, are the most suitable remedies; in the more aggravated forms of the affection, it is advisable to abstract blood from the vicinity of the part affected by means of leeches; and where the pain is very excruciating, it will be proper to administer an anodyne at bed-time. By these means a termination by resolu-

tion may be sometimes effected ; this will be known by a gradual cessation of pain : but should we fail to produce this desirable object, suppuration must be encouraged, by laying aside the means just now mentioned and using fomentations and warm poultices. The progress of inflammation is so rapid in some constitutions, that it is not in our power to avert the termination in suppuration.

I have observed, and I find my experience accords with the remark of a writer of eminence, that when suppuration takes place, the pus is most usually found to point at a part between the auricle and mastoid process of the temporal bone, or it discharges into the meatus auris. In the first mode of exit, the abscess which is formed heals readily ; but in the other case, the aperture into the meatus is so constructed that the pus collects and produces painful excitement : if pus be allowed to remain in contact with bone, caries and exfoliation will probably be the consequence. It is, therefore, highly important to obviate such an occurrence, by making a free opening into the sinus : I have sometimes preferred introducing the point of a lancet into the abscess behind the ear. Thus the discharge is very much facilitated by the dependent situation of the aperture thus formed.

This disease is most liable to occur in young children during the period of dentition ; from which circumstance we can readily account for the acute form that it assumes : here opium is frequently required, to assuage the intense pain by which the little sufferers are tortured. It occurs more frequently in children of

a scrofulous constitution than in others; therefore it is obvious how important it is to endeavour to terminate inflammation by resolution.

Where otitis occurs in early infancy, and is attended with total deafness, the natural consequence will be dumbness:—remove the cause, and the effect will naturally cease.

The two following cases are related by M. Lallemand: the first will shew the necessity of early treatment; the second, the impropriety of hastily suppressing the discharge.

CASE.

Elizabeth Erot, twenty-three years of age, had had a discharge from the left ear, from the age of seven, (at which period she suffered from the small-pox), accompanied by pains in the head, which increased rather than diminished with her age. In the month of November (being then in a late stage of pregnancy) she experienced such severe pains in the crown of her head, as to make her cry out, and which pains were diminished by pressure. At this period the discharge from the ear had diminished. The bowels being constipated, lavements were prescribed, and fomentations to the ear. The pains increased, with spasmodic twitchings of the arms. Her accouchement now took place, but produced no relief; and this interesting female sunk under her afflictions.

On removing the calvarium, the dura and pia mater were found inflamed, and in the left hemisphere of the brain there was an encysted abscess. The petrous portion of the temporal bone was carious and black. This

case is recorded by Bonetus. Our author remarks, that the lymphatic temperament is peculiarly prone to chronic affections of the ear, and that the small-pox is a very frequent exciting cause of deafness and purulent otorrhœa. It may be observed, that as the discharge diminished, so in proportion was the headach augmented.

CASE.

A youth about fifteen years of age, subject to vertigo from his infancy, learnt with difficulty, but retained what he learnt with wonderful tenacity, and appeared endowed with a sound understanding. At the age of two years he became deaf of the left ear, in which a suppuration and discharge were established. In 1809, he being then in his fifteenth year, there appeared a small fungous excrescence at the bottom of the meatus externus, — to which the unguentum nitratum was applied, with the effect of stopping the discharge in fifteen days. At this period an acute pain commenced in the head and ear. The ointment was discontinued, the discharge returned, and the pains ceased. Some time afterwards the ointment was re-applied, and the discharge again interrupted. On the eighth day after the cessation of the discharge, the boy became affected with such acute pain in the head, that he was forced to cry aloud, and said he should certainly go mad. In the course of a few days he suddenly became insensible, with dilatation of the pupils, slowness of the pulse, and other symptoms of cerebral compression. He died in a state of coma.

Dissection.—Vessels of the dura mater gorged with blood, as also those of the pia mater and arachnoid membrane, which was quite dry on its surface. Two ounces of serum were in the ventricles. In the *left* hemisphere of the brain, a cyst was found three inches in diameter, consistent and vascular, containing thick purulent matter. The inferior extremity of the cyst rested on the petrous portion of the temporal bone; and a small opening of communication between the ear and the cyst existed, the bone being carious. The cerebral substance surrounding the cyst was yellow, and much softer than natural.*

HERPES.

This disease is liable to affect the external ear, and is of more frequent occurrence than otitis: it is characterised by a vesicular eruption with an inflamed base. From the exposed situation of the part, the vesicles are apt to be broken,—a copious fœtid discharge takes place, and an ulceration succeeds, which frequently proves troublesome and difficult to heal; when it continues for a considerable time, the cutis of the auricle and meatus becomes thickened, considerably diminishing the capacity of the passage, which is obstructed by the inspissated discharge; hence obstruction to sound takes place, and temporary deafness is the natural consequence, as the sound cannot have access to the membrana tympani. As herpes is a constitutional affection, constitutional

* For further observations of M. Lallemand on this interesting subject, vide *Medico-Chirurgical Review*.

treatment is essential in the cure; yet the part upon which the disease has more prominently shewn itself must not be neglected: in fact, local remedies are here very important, as our object is to cure deafness in order to prevent dumbness. The thickened exudation from the herpes which is lodged in the meatus should be carefully removed by syringing with soap and water; and that this simple operation may be performed in a proper and effective manner, it is of great importance that a suitable syringe should be employed; a moderate-sized one, whose power is not too great, is best adapted to the purpose: the operation is one requiring skill, and it should not be confided to a person ignorant of the subject. When the impurities have been removed from the ear, an alterative injection is to be substituted for the soap and water; alterative medicines should also be administered in small doses until the disease be subdued.

The time requisite to complete a cure may be from two or three weeks to several months, according as the constitutional or local symptoms may be more or less severe. It is important that the plan of treatment should be assiduously pursued, or we cannot reasonably expect a favourable result.

MORBID SEPTUM OF THE PASSAGE.

In new-born infants we occasionally find mal-formations: when they are of considerable extent, and the child is materially altered in its general aspect, it is termed a monstrosity. When a less degree of deviation from the proper structure takes place, it is not usual

to apply this term to them. One of these slighter deviations from proper formation is the existence of septa, which occur in the different passages, and which are not unfrequently found in the external ear: an obstruction of this kind in the meatus must necessarily prevent any action of sound on the membrana tympani from without, in which case deafness must be inevitable. This kind of obstruction may be the result of disease, and it is evidently sometimes produced in consequence of the ulcerative process; but it more frequently is occasioned by a diseased tympanum, when there has been considerable suppuration, and much pus has been discharged into the passage.

The progress of the disease is usually in the following manner:—A puriform discharge from the ear occurs first, then the deafness which the patient has experienced from the original disease is suddenly very considerably increased. He has also, during the former state of deafness, perceived the air occasionally to pass through the meatus on blowing the nose; but when the puriform discharge has ceased, the patient will not be able to drive the air from the mouth through the passage, if a septum be there; whenever he makes the attempt, he will feel a particular fulness of the tympanum.

The septum may be readily seen, if the patient be placed so that a strong light fall into the meatus externus, and the ear be properly examined. The treatment, in these cases, is to pierce and lacerate the septum, by which the hearing will be restored to the same degree it was enjoyed whilst the tympanum only was the seat of the affection; the hearing is thus re-

stored instantaneously, so that the ticking of a watch, which could not previously have been perceived, although close to the ear, has been heard at a considerable distance. It is very important, after the operation, to pay great attention, in order to prevent the reproduction of the partition by the closing of the sides of the aperture.

POLYPI OF THE EAR.

Polypi are liable to occur on mucous surfaces: the uterus is sometimes found to be filled with these morbid formations, but the mucous membrane lining the cavernous structure of the nose is the part on which they are most commonly seated. The meatus of the external ear is liable to be affected by these tumours; they are usually here occasioned by a diseased tympanum—they very seldom proceed from any other cause. They, in some respects, resemble syphilitic warts, to which they have been compared,—they are both the result of irritation.

Polypi may be removed from the ear in the same manner as they are from other parts: when they are small, they may readily be extracted by a pair of forceps; the part to which they were attached should then be touched with a piece of argenti nitras. The caustic should be introduced with great care, so that the tympanum be not injured, which would be the case if it were carried too far. Success generally attends this plan of treatment.

In those cases in which the polypus is appended to a small root or neck, the best method of removing it is by

a ligature: this is equally effectual as the forceps or knife, and it is much less alarming to the patient.

INSPISSATED CERUMEN.

There is no cause of deafness depending upon the state of the external passage which is of so frequent occurrence as collections of cerumen or wax: a due quantity of this secretion is requisite to preserve it in a healthy state, and to guard it from external injury,—hence, when this important secretion is defective in quantity, deafness will be the consequence. The cerumen sometimes becomes thickened and indurated, so as to produce very great deafness.

In different individuals this secretion varies very much; it is in some abundant, in others scanty. Physiologists have not yet been able to explain how it is excreted: it is generally believed that the fresh secretion propels the older, and that the occasional dependent position of the ear favours this process.

A case of catarrh of the ear, produced by a change in the secreted cerumen, which became acrid, and produced inflammation and a discharge of matter, is mentioned by M. Alard.

M. Itard also states, that sloughing of the skin of the meatus will sometimes take place, in consequence of the pressure and irritation that are occasioned by indurated cerumen.

I have frequently been surprised to find how minute a portion of hardened wax will destroy hearing; and I am convinced, that it is in consequence of the peculiar change in the quality of the wax, and not by its

quantity, that deafness is produced. When cerumen in this state is upon the membrane of the tympanum, the vibrations of that membrane are impeded;—sometimes the passage is wholly obstructed by this substance.

The following symptoms are those by which the nature of this kind of deafness may be known:—It is always attended by noises in the ear, consisting either of a confused sound, or a heavy sensation like the noise of a hammer; these sensations occur most whilst eating. When such symptoms are present, if the ear be examined, the cause of the deafness will easily be ascertained.

The means to be employed for relief in such cases, is to moisten and dissolve the secretion, and afterwards to have the passage well syringed, which is to be repeated until the whole is removed; when hearing will be instantaneously restored, if the organ itself is in a sound and perfect state. An unpleasant sensation is produced in the ear in consequence of the strong excitement occasioned by forcing the fluid into the passage,—this does not continue long, and no unpleasant effect remains. From a supposition that the cause was situated deep in the structure of the organ, this disease, though simple in its nature, has been overlooked, and often mistaken; hence we see the importance of accurately examining the ear in all cases of deafness, that we may ascertain from what cause it arises.

CONGENITAL INSPISSATION OF CERUMEN.

This is not an unfrequent cause of deafness, although it has not met with much attention from the profession.

In infants at birth, the secreting surfaces of all the passages are covered by a viscid layer of their proper secretions: this fact is very obvious as regards the fauces, in which the accoucheur frequently finds such an obstruction to respiration, from the tenacious mucus which hangs about the epiglottis, that he is under the necessity of removing it to prevent fatal consequences. The bowels also are loaded with tenacious matter, and in the ears the cerumen is in a much more solid state than in after-life; and this appears to be wisely designed: the parts of the concha and passage being narrow, this state of the secretion is well adapted to prevent the injurious action of the waters of the amnion upon the tympanum.

In all cases of apparent deafness and dumbness in children, it is of very great importance that the ears should be carefully examined, as the malady will frequently be found to proceed from this cause.

CASE.

Mrs. L. came to consult me respecting her only son, a child of three years of age, who, as she apprehended, was born deaf and dumb, from his not noticing sounds nor making any effort to speak: on examination, I observed a quantity of hardened cerumen at the bottom of the passage, which having dissolved and removed, and repeatedly syringed, I had the satisfaction to find that he was able to hear, which had never previously been the case. I made the first trial by means of a trumpet. He now enjoys both hearing and speech.

DISEASES OF THE TYMPANUM.

PURIFORM DISCHARGE.

In this disease, the discharge which flows from the ear is thin and ichorous: it is so corrosive in its nature as to act upon a silver probe, imparting to it a yellow stain; in consequence of the ulceration which exists in the interior, blood is occasionally mixed with the discharge. The sense of hearing becomes necessarily impaired, and is in many cases entirely lost.

The nature of this affection may in general be ascertained by observing that, on blowing the nose, part of the air passes by the meatus externus, which proves that there is an imperfection in the membrana tympani. Although this is a symptom seldom absent, yet it is not always found; for when the inflammation which produced suppuration has obstructed the Eustachian tube, all communication will be prevented between the mouth and the meatus externus, although the membrana tympani should at the same time be pervious.

Whenever we find air pass out at the meatus externus, attended by a discharge of a puriform character, the nature of the complaint is no longer doubtful; when these symptoms do not concur, we must have recourse to an examination of the organ.

In examining the ear, the head of the patient should be placed so that a strong light may fall upon the organ, and that the rays may pass direct to the bottom of the meatus externus: by this method the

diseased part will be readily perceived, and we shall be enabled to ascertain the nature and degree of the lesion. In those cases in which it is not possible to see the part, the progress and extent of the injury may be determined by passing a probe down to the membrana tympani; the peculiar sensation communicated to the fingers of the practitioner will inform him of the state of the organ. This operation, it must be confessed, demands an extreme delicacy of touch — the *tactus eruditus* — which can only be obtained by much practice and experience.

Of the various causes by which this disease of the tympanum is produced, those of the throat are the most frequent. This part of the organ is very liable to suffer, in consequence of the gangrene or sloughing of the throat which takes place in scarlatina maligna: in consequence of this dreadful disease, the bones of the internal ear are sometimes thrown off; and although the patient recovers from the fever, yet he never can regain the sense of hearing.

This disease, also, frequently succeeds the ear-ache, or inflammation of the passage extending to the tympanum; and should the inflammation not be subdued by resolution, then the tympanum and mastoid cells will become filled with pus or matter.

After the patient has suffered the most intense pain, the pus is discharged by ulceration, in large quantity. During its progress, the discharge of matter produces, for a time, a relief of symptoms; but, as the disease proceeds, fresh matter is formed, and continues to flow from the passage.

The treatment to be observed here is obvious: to arrest inflammation in the first stage; and if this be done early and with energy, all the symptoms will subside. The deafness, which is always great during the inflammation, will gradually lessen; and the deposited lymph will soon be absorbed. But if inflammation has continued for some time, even though the resolution be accomplished, the patient does not always recover his perfect hearing; and the question is,—how far a proper secondary treatment may remedy this imperfect state, which the previous inflammation has left? The defect here chiefly arises from a deposition of lymph, and perhaps, also, from some thickening of the parts.

We know that, in other parts of the body, a large quantity of lymph will be absorbed if proper means be used for giving activity to the vessels. As the deafness after inflammation of the tympanum arises from this cause, the object is to prevent the lymph from becoming organised, and any thickening of the membrane from becoming permanent. The object, therefore, should be, even if suppuration is formed, to make an early opening, in order to evacuate the matter, and thus prevent the membrane from acquiring that state which renders it unfit for receiving the impression of sound in a proper manner. An opening being once made, and the matter discharged, every precaution must be next taken to prevent its forming again.

In a vast number of cases of this disease, the attack is slow and insidious, so that at first we are not aware of its commencement:—slight fits of pain are

felt, and relieved by a trifling discharge ; these fits occur at intervals, and it is not until after a long time that the puriform discharge is fully confirmed.

This disease has divided the opinions of practitioners ; by some it is considered as only trivial ; by others as certainly dangerous ; and, indeed, any one who regards its consequences on the organ of hearing must be of the latter opinion. Its progress is rarely stopped if left to itself, until the organisation of the tympanum is destroyed, as well as its contents, or the small bones ; when total deafness ensues.

Hence the most judicious treatment is required to arrest its progress ; and this treatment is, at the same time, attended with no danger : those, therefore, who think that no interference should take place, I conceive, are highly to be blamed.

This disease may properly be divided into three stages. The first consists of a simple puriform discharge. The second is when it is complicated with fungus and polypus. And the third is when a caries of the tympanum attends the discharge.

In the first stage, the inflammation and thickening of parts will evidently obstruct the passage of sound between the external and internal ear.

In the second stage, the mechanical obstruction of a fungus, or polypus, must still more oppose the entrance of sound, and increase the degree of deafness.

On the suppression of the discharge, in the first or second stage, there is often a remarkable increase of deafness.

Where the discharge has continued, it forms in part a medium for the transmission of sound ; and, there-

fore, though offensive in the last stage, the hearing will be still more diminished if it be partially suppressed: thus patients in this state, after syringing their ears, hear better for a time, in consequence of the fluid acting as a temporary medium for the transmission of sound.

Though in very old cases cures may be performed, yet it is to recent ones chiefly that the aurist is to look for success; but, owing to popular prejudice, the malady is too often slighted or temporized with; and hence it is generally in confirmed cases only that he is consulted; for, in the early period of the disease when relief may be obtained, it is commonly neglected, until, tired out with the fruitless expectation of nature curing herself, the patient has at last recourse to advice.

No complaint, perhaps, requires greater attention in tracing it through its different stages, and in varying the treatment according to these stages. No one remedy is to be confided in; the circumstances of each individual case should be studied before any particular method is adopted.

The first stage of the disease will frequently yield to an injection of the *zinci sulphas* or sulphate of zinc, used night and morning, which will often effect a cure in the space of three weeks or a month. It is apt, however, to leave a morbid sensibility of the ear, which occasions pain on the entrance of loud sounds. A solution of the *plumbi superacetas* or sugar of lead, is equally useful as an injection.

In some cases, the continuance of these injections has been necessary for a considerable time; which it

may be proper to state, in order, first, that the patient may not look for a speedy cure; and secondly, that he may be induced to persevere a reasonable length of time.

CASE.

Master R., aged three years, the son of an officer in the Royal Artillery, was deaf and dumb at the age of four years: this young gentleman was a remarkably fine boy of his age, very quick and lively; his father had consulted many of the profession, who gave him no hopes of relief, and he was about to consign him to the care of a well-known teacher of the deaf and dumb; but having been informed that it would be some years before his son would be able to speak, he was reluctant to adopt that measure, and, through strong recommendation, was induced to bring him to me. On inquiry, I found that no means of cure had been attempted; that the child, when an infant, had been subject to eruptions, attended with a profuse discharge of pus from the nose and both ears, which latter symptom had not subsided. From this information I at once entertained hopes of a cure, as I found, on inspection, there was no structural deficiency, nor had the puriform discharge under which he laboured attained the last stage of the disease; and I considered that if the discharge was suppressed, the powers of the organ would be restored. I accordingly commenced the cure with a course of slight alterative treatment, which I followed up by local applications in the form of injections, and to this practice I joined tonic medicines.

In the course of a year and a half, during the

greater part of which time he was in the country with his aunt, who has the merit of carrying my plans into effect, he completely recovered, and can now both hear and speak, neither of which he could have done had the disease been neglected, and the patient solely consigned to the usual mode of education.

In the second stage of the disease, the object is to extract the fungus, or polypus, with a pair of small forceps; and if these excrescences do not come entirely away, to endeavour to pinch the roots until the whole be removed. The roots may then be touched with the *argenti nitratum*, as before mentioned.

On the removal of the fungus, or polypus, the injection of zinc is to be used; and, in a great number of cases, the hearing will be restored, and the discharge suppressed.

When the fungus, or polypus, is removed, the morbid condition is then reduced to the same state as I mentioned in the first stage.

CASE.

Charlotte Morgan, aged four years, was brought to me from the country: this child was the most distressing object I ever saw; she was subject to violent fits; when she recovered from them they appeared to leave her silly. When born, I understand, she had blotches all over her body; and the discharge from her nose and ears, externally, was profuse and disagreeable: in the left ear she had a polypus, and in the right ear the temporal bone was evidently carious. It appeared that the mother had never had any advice for this poor

child since it was a twelvemonth old; and being assured that her daughter would outgrow the disease, she had, like many other thoughtless parents, rested perfectly easy. I commenced by having all the parts well cleansed, and putting her on an alterative plan of treatment. I succeeded in removing the polypus by means of a ligature, which mode is far preferable to the knife. The alterative plan was continued at intervals for three months, injections were used to the ears, and likewise gargles to the throat. The child is now quite well, and can hear and speak.

I consider the safest modes are frequently the best: it is not in a display of shewy operations in acoustic surgery that I wish to excel, but by preventing the necessity of them. At the same time, I may remark, when a cure cannot be effected without an operation, no one is more ready than myself to undertake it; but still I urge the necessity of using all our endeavours, in the first instance, to procure relief without it. I well remember witnessing, many years ago,* a very severe operation, which was adroitly performed. An old

* At his Majesty's Royal Hospital at Haslar, where, after obtaining his qualifications as a surgeon from the Royal College of Surgeons, the author was employed as a medical officer nearly six years; this hospital contained at one time during the late war 2000 patients. Haslar is one of the largest hospitals in Europe; none are better regulated, or have had more surgical operations performed in them, and with greater success. Among the numerous celebrated practitioners who have served there, may be mentioned Dr. Lynd, Dr. Hope, Dr. Maginnis, Dr. Babington of the city, Dr. Clarke, Dr. Jones, Sir R. Hunter, Mr. Vance, Mr. Price, and Mr. O'Reilly, his Majesty's resident medical attendant at Windsor, whose talents, skill, and experience, deserve the confidence reposed in him.

surgeon, who had operated extensively in several engagements, observed,—although I might admire the skilfulness of the operator, he should admire him much more if he had cured the patient without the operation:—and, for the cause of suffering humanity, I am happy to find it is not so much the fashion to operate as formerly.

In all cases of this disease where a cure is completed, the healing process seems to be effected by the extension of the cutis, or skin, of the meatus, into the tympanum, and its becoming continuous with the membranous lining.

This fact is confirmed by dissection in several cases of the disease where such a continuation clearly appeared.

After a cure, as a free passage of the air takes place, it occasions a drying of the thinner or watery parts of the discharge; the remainder, accordingly, becomes inspissated, and is the cause of occasional increase of deafness: but though this be the case, if a practitioner, when consulted, ascertains that there has been a previous discharge, he should be extremely cautious of employing any forcible means to remove it, lest he endanger the reproduction of the former disease.

Deafness, and consequent dumbness, in very young children, frequently proceeds from matter lodged in the drum of the ear, of which the following are striking examples related by M. Deleau.

CASE.

Victoire Gilbert, a deaf and dumb child, aged seven, was brought to me on the 15th Nov. 1820. She was so deaf that she could only hear loud thunder, or the

report of a cannon when near to it. A sound, directed into the meatus, caused acute pain as soon as it touched the membrane of the tympanum.

I operated on the 17th Nov., in spite of the resistance which the child made to the operation. In a few days, by means of injections, the cavity of the tympanum was disgorged of all the matter which it contained, and the child evinced all the signs of perfect hearing. If a carriage passed, she ran to the window; tunes played on the piano-forte gave her great delight; and she seemed to look about for sounds as if they were palpable or visible.

On the 19th Dec., the child quitted St. Mihiel, to reside with her uncle at Toul. At this period she began to pronounce some words, though in an under voice, her character seemed to develope itself, and the expression of her countenance became more open and intelligent. By degrees she wholly recovered, and heard and spoke distinctly.

CASE.

Jeanne Jacquinot, aged twelve, of a good constitution, was attacked with a disease, when four years of age, which left her completely deaf. She lost her speech by little and little, so that at the time she was brought to M. Deleau she could only pronounce the word *papa*.

He examined this girl on the 11th Nov. 1820. Her nose and throat were well formed; there were no appearances of inflammation in the meatus, which was large and straight, and it was easy to see the tympanum, which was apparently thickened, and of a whitish colour.

The operation was performed on the left side, and part of the substance of the tympanum destroyed. The right tympanum was simply perforated.

Immediately after the operation, the child heard distinctly every sound made either in the room or in the street. The ears were injected on the sixth day, when the water thrown in by the meatus passed out of the nose through the Eustachian tubes.

A third case of M. Deleau's is that of a boy, deaf and dumb from birth, cured when nine years of age; and is related by that eminent physiologist M. Magendie, which has excited much interest both here and on the continent.

CASE.

Claude Honoré Trezel, at this time ten years of age, born at Paris, of poor parents, was of that class of the deaf and dumb which cannot hear the loudest noises nor the most violent explosions. His countenance had little expression; he dragged his feet in walking, and his gait was tottering. He did not know how to wipe his nose, and he made his principal wants known by a certain number of signs.

The operation by which his hearing was restored is not new. It consisted in the injection of air, or of different liquids, into the cavity of the tympanum. The first few days after the developement of hearing, was a season of continual delight to the child. Every kind of noise caused him an inexpressible pleasure, and he sought for them with great eagerness. He was, however, some time before he perceived that speech was a means of communication; this he still attached,

not to the sounds that issued from the mouth, but to the movements of the lips. Accordingly, for some days, he thought that an infant of seven months old spoke, because he saw the movements of the lips. He was soon taught his error, and that the importance belonged to the sounds.

It happened, unfortunately, that he heard a magpie pronounce some words,—then, generalising this fact, he thought that all animals could articulate, and actually endeavoured to make a dog speak. He employed considerable violence to make him say, ‘*papa,—du pain,*’ the only words which he himself could pronounce. The cries of the poor animal alarmed him, and he desisted from his attempt.

The earlier period after the developement of hearing wrought a considerable change in the physical state of Trezel. His walk became firmer, the mournful air of his appearance gay and smiling; he learned to wipe his nose, and ceased from dragging his feet.

A month elapsed, and Honoré remained almost in the same state. Absorbed by his new sensations and observations, he could only catch the different syllables that formed the words; and he was almost three months before he could distinguish compound words, and that of the short and simple phrases. He required much time also to enable him to distinguish the direction of sounds. A person being confined in a room where there was an infant, and addressing him, it was with considerable difficulty that he could discover the person who spoke, and even then it was rather from his eyes and reason than from the sound, that he dis-

covered it. The organ of voice is composed of a number of different pieces; among which are muscles, bones, cartilages, and membranes. It would have been admirable, if, without any previous exercises, all these pieces could have acted in concord, so as to have produced the vocal sounds, and appreciable articulations; but this is not the case. The first sounds which Trezel pronounced without difficulty were, *a, o, u*,—the other vowels followed later; and the first words which he formed were, '*papa, tabac, du feu.*' When he wished to pronounce more complicated words, he made great contortions of the lips, tongue, and all the parts concerned in articulation. By degrees he was able to pronounce the more difficult compound words. When advanced thus far, he believed himself on an equality with other children of his own age; and, satisfied with himself, and proud of his new situation, he despised the companions of his misfortune, and refused to see them. Notwithstanding, however, this vanity, Trezel made very little progress in pronunciation. A vast number of syllables escaped him, or he articulated them in an extremely defective manner. Perhaps he would never have liberated himself from this difficulty, had he not ceased to depend entirely upon his ears, and assisted himself by his sight. They wrote several words, and he pronounced them much more articulately, catching with considerable clearness the assemblage of the vowels and consonants, and their reciprocal influence. Another very remarkable fact may also be stated, viz. that the association of the sight, and the movements of the larynx, was always prompt and easy;

while that of hearing, and the organ of voice, was always difficultly and slowly exercised. For instance, as soon as Honoré perceived the written syllables, he pronounced them, if at the same time they were repeated to him; but if the writing was removed, the syllables were in vain articulated in the most distinct manner; he could not follow them.

His pronunciation is very defective, and the *r* rolls disagreeably upon his tongue, and the differences in accent appear unknown to him. He exhibits also a phenomenon which has engaged the attention of the commissioners. When they spoke a word distinctly to him, he repeated it immediately. But if his instructor wished to address his understanding, signs and expressions of countenance were employed.

It would have been thought, that after having acquired a new mode of expressing his wants and ideas, he would have neglected that which had hitherto served him, and which is inferior to speech; but hitherto the contrary has happened. The natural language of Honoré, *i. e.* by signs, instead of going gradually into disuse, and being replaced by speech, has gained rapidly a striking perfection, much superior to what he possessed before he had acquired the sense of hearing.

In recapitulation, Honoré Trezel, who, a year ago, was so completely deaf as not to be able to hear the loudest noises, understands all kinds of sounds, knows when they come from a distance, distinguishes their character, avoids carriages and horses, and proceeds to open the door when any one knocks. He is pleased with music, and can appreciate and repeat all the

articulations of the French language. He obeys the spoken commands of his instructor, but does not yet sufficiently understand other people; and he learns, analyses, and repeats a number of phrases at length." —*Journal de Physiologie par Magendie*. Juillet 1825.

From the preceding cases, it will be seen that this subject is not neglected by our professional brethren in France; and by the success of the treatment of these affections, it will be found most advisable, wherever a case of deaf and dumb is presented, that the state of the ear should be particularly examined; and there is little doubt, if hearing can be obtained, which I have found it can in many cases, that speech will naturally follow.

"I have seen instances, and collected facts, enough to induce me," says Mr. Thelwell,* "to warn all parents not hastily to consign their children to colleges of the deaf and dumb. *Temporary* deafness and other circumstances, during the first four or five years of infancy, sometimes produce habits, which a confusion of mind and indolent despair on the part of those who have the superintendence of such children afterwards confirm, when the cause, in reality, has ceased; and if, instead of applying proper provocatives to the senses, for the purpose of superinducing enunciative action, the poor child is then consigned to those silent receptacles where instruction is carried on without any attention to the organs of hearing, the catastrophe is obviously inevitable. What could have been more injudicious than placing the poor savage of Aveyron in

* Vide London Medical and Physical Journal.

the college of the deaf and dumb? Yet, at this very instant, a fine child, physiognomically speaking, of great promise and expectation, in the city of Carlisle, rushes upon my mind with all the boding apprehension of a similar immolation."

OBSTRUCTION OF THE EUSTACHIAN TUBE.

The next affection of the tympanum I have to consider is, the influence produced on it by the obstruction of the Eustachian tube.

By this obstruction a very great degree of deafness is produced, and air can no longer be admitted into the cavity of the tympanum, while the included portion of air is either absorbed or it remains.

If it remain, it becomes condensed, and counterbalances the pulses of air excited by sounding bodies; if it be absorbed, the membrane of the tympanum is carried by the pressure of the atmosphere as far as its limits allow it, and in this case cannot vibrate as it ought, to any considerable degree. That this last opinion is the most just, is confirmed by dissection, which has shewn the tympanum in a number of cases filled entirely with mucus, and consequently, that the air had been absorbed.

The causes of the obstruction of the Eustachian tube, as before stated, are syphilitic ulcers, or sloughing from the cynanche maligna, or putrid sore-throat.

It is on the healing of the ulcers that deafness ensues; for then the obstruction becomes complete, and the opening into the throat is, as it were, sealed

up: besides these causes, a polypus in the tube, or depending from the pharynx, has occasionally produced the same obstruction: and an enlargement of the tonsils, where it continues permanent, as in some cases, has been attended with the same effect.

This species of deafness is attended with no peculiar or diagnostic symptom to mark it, except the actual loss of hearing. There are neither distressing noises in the ear, nor any of those other sensations which indicate a diseased state of the auditory nerve, or certain morbid causes acting upon it.

The true criterion to distinguish this is, that some conspicuous disease of the throat always precedes it; and, therefore, the previous history from the patient is of great consequence in ascertaining its nature. In these cases, on examining the parts by dissection, I have found that the obstruction lies in the cartilaginous extremity of the tube. There are instances, however, where the obstruction depends on an increasing or superabundant ossification, filling up the substance of the bone. In such cases the disease is slow in its progress, different from the former; and at the same time shews no obvious cause.

Though this species of deafness is highly formidable, yet the cure of it has been in many instances accomplished by means of an operation first performed in this country by Sir Astley Cooper: to this he was naturally led by the important observation, that the sense of hearing, though imperfect, is not destroyed in cases of suppuration of the tympanum, or its partial injury from other causes: hence, as complete deafness is produced by obstruction of the tube, from no

entrance being given to the air, he very rationally supposed that, by making a small puncture in the membrane, in order to allow the air to get access, the functions of the ear would then be duly performed.

The experiment confirmed the justice of the idea ; and hearing has been obtained in a number of instances in this way, not only by Sir Astley Cooper, but by myself and others.

M. Deleau very justly observes, that the tympanum is useful, but not absolutely necessary, to hearing. Fishes and reptiles want it altogether ; and there are numerous instances of individuals who have lost it in part, without the sense of hearing being at all impaired by the deficiency ; but, on the contrary, the faculty has in consequence become more developed. For the first few days after such an operation, the hearing is a little affected by the change of structure, though it soon recovers its former acuteness. The accident indeed is somewhat similar to the loss of one or two of the front teeth, in which case the speech becomes at first altered and difficult, but in a short time the person recovers his wonted pronunciation.

It has been supposed that the operation was originally performed in this country ; but we find in the *Annals of Medicine of Altenburg*, for the month of November 1816, an epistle quoted which had been written to the celebrated Haller, and in which it is stated that M. Eli, a Parisian surgeon, had been in the habit of curing deafness, by perforating the tympanum in cases where there was no paralysis of the seventh pair of nerves.

M. Saissy observes,* that surgery presents two means of cure under these circumstances; the puncture of the membrane of the tympanum, and the perforation of the membranous portion that stops the Eustachian canal. As to the perforation of the mastoid process, he thinks it ought to be rejected, as uncertain and dangerous. There are three circumstances which make the puncture of the membrane of the tympanum absolutely necessary; first, when the partition that obstructs the tube is even with the edges of the mouth of this tube; secondly, when the tube is obliterated in all its extent; and, lastly, when the membrane of the tympanum is ossified, and the rest of the organ is perfect.

He further observes: the second operation consists in restoring the tube to its natural state; to accomplish which, a silver stiletto is necessary, armed at one extremity with a steel point in the form of the trocar, the other sharpened like the rest of the instrument, so as to enter the canula, which serves to probe the tube; it should be introduced by the beak of this canula, and drawn out by the other extremity of it, so that the trocar may be concealed: the canula, thus armed, must be carried into the nasal fossa, the same as for injecting the tube; when it has attained the obstacle, (which will be known by the resistance, and the depth in which the probe is engaged,) the stiletto must be gently pushed forward until the obstacle be vanquished, which will be announced by there being no longer any resistance; afterwards the stiletto must be withdrawn, so that its trocar part may re-enter the canula, which serves as a case,—

* Essai sur les Maladies de l'Oreille interne. Paris 1827.

this last must be disengaged by a movement inverse to that with which it was introduced: the aperture thus made, will soon close if left to itself; to prevent this, a tent is to be carried beyond the point where the obstacle existed, left there twenty-four hours, and repeated until it is presumed the sides are healed; to effect this, a piece of catgut is substituted for the stiletto introduced to the extremity of the canula, which it must not pass,—the other end must be marked with ink the length that is to be introduced so as to go beyond the obstruction: the probe, thus armed, is again introduced into the tube; the obstacle attained, the catgut must be gently pushed in as far as the mark and left there, while the canula is withdrawn; in doing which, much care must be taken to leave the catgut undisturbed; when the instrument is disengaged from the nostril, the catgut is cut close to the nose, which is to be lightly stopped with cotton. This operation is easier to execute than to describe, and the method has the advantage of restoring the hearing without injury to the organ; it is practicable when the membranous obstruction is not more than a line in depth, but not so if the aperture of the tube is closed even with the edges of it, because then the instrument cannot be fixed, nor the place that ought to be penetrated positively ascertained. This method is equally impracticable when the tube is entirely obliterated; this may be presumed to be the case, if, after introducing the stiletto four or five lines into the tube, the same resistance is met with.

Catarrh of the Eustachian tube is absolutely the same as that which affects the tympanum and mastoid cells; it is rare, when these parts are affected with

catarrhal fluxions, that the tube and its aperture are not so likewise; the treatment must therefore be the same.*

The Eustachian tube may also be filled with blood, mucus, or a matter similar to chalk. Amongst the obstructions of the tube and its aperture, he places the tumefaction of the membrane which lines these parts, provided the sides of the parts do not adhere; for then it is no longer an obstruction, but a true obliteration, which it is essential not to confound.

Guyot, of Versailles, (whose case and instrument I mentioned in a former work,) was attacked with a complete deafness, caused by the mucus which obstructed the tube. Herholdt, surgeon of Copenhagen, was convinced, from anatomical researches on animals born dead, that the Eustachian tube, whilst the foetus is contained in the uterus, is filled with the liquid of the amnios and mucus, in such a manner that it establishes an equilibrium between the exterior fluids and those within, without which, the membrane of the tympanum would suffer a compression from the water in which the foetus swims.

The observations of Herholdt are important, in

* M. Magendie has given us an interesting account of a boy, who, after having been completely deaf until the age of nine, by means of an operation acquired the perfect use of the ears. Among the most remarkable circumstances of the case, we may notice the difficulty which he had in obtaining a knowledge of the position of sounding bodies, and still more of imitating articulate sounds: it was only after many unsuccessful trials that he could accomplish this object; and even after an interval of some months, his powers in this respect were very limited.

throwing light on a cause of congenital deafness much more frequent than is imagined; but he was not the first who made this discovery, as, more than thirty years since, M. Saissy heard the celebrated Desault, in his anatomical lessons, say, that the fœtus before birth had the cavities of the mouth, œsophagus, stomach, and intestines, the larynx, Eustachian tube, the external auditory passage, &c. &c. filled with the water of the amnios. An English surgeon found the Eustachian tube obstructed with congealed mucus in the corpse of a man who had become deaf from a cold. Secondly, a matter resembling chalk sometimes obstructs the Eustachian tube, as it fills the case of the drum and mastoid cells. Thirdly, violent blows, which cause hæmorrhage, may produce an effusion of blood in the interior of the ear, coagulate, and obstruct the Eustachian tube, &c. &c: it was the opinion of Morgagni; and Stenon gives an example which leaves no doubt of this being the cause of deafness. Fourthly, the tumefaction of the membrane which lines the aperture of the tube and the interior of the canal, occasioned by frequent and obstinate colds, occasions a temporary deafness, but which often becomes permanent in young children: this is more common than is generally believed, and persons of more advanced age may be attacked in the same way, which produces a hardness of hearing more or less considerable.

Diemerbroeck proposes the following means to find out an obstruction or obliteration of the tube. "When, after closing the ears, a violin bow is taken between the teeth, and the strings of that instrument are touched with

it, without the sound being heard," "it is a sign," says he, "that the tubes are obstructed." This was also the opinion of Haller: "Another road," says this illustrious physiologist, "by which the air charged with sonorous oscillations may penetrate to the organ of hearing, is the Eustachian tube: in cold-blooded animals it is the principal road for sound." Lentin proposes the following plan to ascertain whether the tube is stopped:—To lay the head on a table with the affected side uppermost, which he fills with tepid water, and stays some moments to see if the tympanum is pierced or not: in the first case, the liquid will pass through the hole to the throat,—the patient is to close the mouth and nose, and press the inspired air; if the tympanum is perforated, air-bubbles will arise on the surface of the water; but if it is perfect, the air introduced into the tube will cause the membrane to project towards the external passage, when as much water will come out of the ear as the convexity of this membrane has displaced; this circumstance supposes the tube to be free in its whole extent: if obstructed, the water will not flow over, nor will there be any air-bubbles. Lentin's reasoning does not appear to me so conclusive as he seems to believe; for, supposing the membrane to be entire and the tube free, and the water is thus forced out of the ear, how can we be assured whether it is from the impulsion of air against the membrane, or an involuntary movement of the head occasioned by the forced expiration?

The signs which we have before described are common to the obstruction of this tube, whatever may be the matter that fills it; but besides these signs,

the history of the case will announce the nature of that matter: for example, if the person becomes deaf after frequent colds and obstinate catarrhs, there will be reason to conclude that there is a mass of mucus in the cavity of the tube and its aperture. If the deafness come gradually, after syphilis, or any other disease, without affection of the throat or back nostrils, and it remain after the disease is cured—one may presume that a chalky matter causes the obstruction: this may be changed into certainty, if, by means of a canula, a stiletto is introduced into the tube; the resistance felt at the end of this stiletto, and the absence of all pain, will make known the nature of the obstructing matter; and if, in injecting the canal, the liquid do not penetrate into the cavity of the tympanum, and at the same time some chalky particles are detached, which issue from the mouth and nose,—all these united circumstances leave no doubt as to the immediate cause of the deafness.

If, after a cold, catarrh of the throat or nasal fossa, deafness continue, and a difficulty be found in probing the tube, we may be assured that the mucous membrane which lines the aperture of this tube is tumefied: all these obstructions will yield to the treatment we are about to describe. Considering the obstruction only, supposing the disease which caused it no longer to exist, many means have been imagined for clearing this tube; such as, injections carried into it; probing it by the mouth; introducing into it, by means of a strong expiration, a deterative liquid, with which the mouth and nose are

filled ; the perforation of the mastoid process has also been proposed and practised.

He does not scrupulously follow the chronological order in which the various methods have been suggested and practised. That of injecting the tube by the mouth, is dated from the beginning of the last century, and originated with Guyot, post-master at Versailles : " He had," says Sabatier, " some knowledge of anatomy, which he acquired from motives of curiosity, and his own case induced him to study the structure of the ear with much attention : after having conceived the hope of curing himself by injections into the tube, he had an instrument made according to his own views, and by the use of it he recovered the faculty of hearing." He presented this instrument of his invention to the Académie Royale of Paris.*

There are many difficulties attending this method,—added to them is the nausea and vomiting occasioned by the introduction of the probe into that part of the mouth ; yet, notwithstanding this, the inventor is no less entitled to our gratitude : the praise of the Académie des Sciences, as well as the most distinguished men of our profession, have been given him for his invention, and are justly his due. Sauvage speaks of the method in a manner that shews he did not know the instrument, or the method of using it. The celebrated Sabatier thinks fresh researches are necessary to ascer-

* This instrument I described in an early edition of my Treatise on the Ear : I had one made, with the addition of an elastic gum tube instead of a metal one, which I have had no difficulty in introducing.

tain whether injections can really be carried into the Eustachian tube, or whether they are only of use in washing the entrance of it. The translator of Heister says on this subject: "The difficulty of finding the orifice, in order to adapt the syphon of the syringe, has given rise to this conjecture; and even when found, it is probable the liquid does not penetrate, because of the obstacle which the air enclosed in the internal ear presents."

The air contained in the tube, the cavity of the tympanum, and mastoid cells, does not present the least obstacle to the injected liquid; its specific weight, and the force, however small, with which it is carried in, are sufficient to displace the air, which will force itself out between the sides of the Eustachian tube and the canula. He is daily in the habit of using these injections with tepid water, either mineral or simple, or any other liquid he may judge suitable, and always with very little effort, and has never found the air the least impediment.

In a collection of surgical theses published by Haller, is one defended at Paris in 1748, in which another method is mentioned of injecting the tympanum, which consists of filling the nose and mouth of the patient with a great quantity of steam of hydromel, or any other detersive liquid, which is to be forced into the tubes by a strong expiration, the nose and mouth being closed: the insufficiency of this plan is too evident to need any remark.

Lentin, in a work published in 1793, mentions a method of cleansing the orifice of the Eustachian tube by means of a probe, bent in a manner suitable to

the purpose, and furnished at one extremity with a sponge, which was to be introduced behind the palate without touching it (a thing impossible), till it reached the orifice of the tube, and passed several times from above to below over its orifice, to clear away whatever obstructed it.

M. Lentin substituted a small piece of veal for the sponge, and obtained, according to his own account, complete success, avoiding the pain and inflammation caused by the sponge. This method has all the inconveniences of Guyot's, without its advantages, as that would at least cleanse the orifice and its environs; while this, according to Lentin's own acknowledgment, if the sponge be used, will irritate the parts; and the veal glides over them without removing the mucus.

A method which has neither the inconvenience nor danger of the perforation of the mastoid process, the puncture of the membrane of the tympanum, nor the difficulties and uncertainty which the plans of Guyot, Lentin, &c. present, merits, without doubt, the preference over them all; and this means consists in injecting the Eustachian tube through the nostrils. This idea is not new; but the instrument which renders this operation more certain and more easy is a new invention, and on that account merits the attention of the profession.

Before describing the operation, and the instrument with which he performs it, I shall give a short historical account of those which have been before invented. Douglas, an English surgeon, says Sabatier, was the first who shewed in his anatomical lessons the manner of

injecting the Eustachian tube by the nostrils: Cleland, also of London, proposed in 1731 a syringe for this purpose. Sauvage says that the surgeons of Montpellier made use of this instrument: it is impossible to form an idea of it from his descriptions. Wathen also, another English surgeon, performed the same operation. The illustrious professor Sabatier invented a syphon for the same purpose: this instrument was four inches long and a line in diameter; the last six lines were bent so as to form an angle of a hundred degrees; at the other extremity a syringe was to be attached, &c. From this description it is evident that Sabatier's instrument is straight, except being bent at one extremity, and that he had but one for probing both tubes.

He cannot conceive how such an instrument could probe the Eustachian tube of a dead subject, and for a living one he believes it to be impossible: thus Sabatier himself remarks, what is not difficult in an anatomical preparation, may be absolutely impossible on a living subject.

Leschevin proposes injecting this tube by the nose: "There is," says he, "only one means of carrying remedies into the cavity of the tympanum, which is by injecting the Eustachian tube; the large opening at the bottom of the nostrils permits, without much difficulty, the introduction of the probe. He has repeated this operation several times on dead bodies of different ages, and, after a little practice, did not find the least difficulty in it." Leschevin gives no description of the instrument he used, merely saying the tube was bent; but in what manner, he does not mention. It appears also it was only on dead subjects that he made his attempts.

A modern author has another idea on this operation : " It has been proposed," says he, " in cases of obstruction of the Eustachian tube, to open it with the extremity of an obtusely bent stiletto, or even to inject it with a crooked syringe ; but though those who have a perfect knowledge of the structure of the parts may easily effect this on dead bodies, there is little reason to hope that any great advantage could be drawn from it in general practice ; for the irritation of the parts, even in a healthy state, from the introduction of the instrument, would be so considerable, that success must be very doubtful, and the difficulty must be much augmented when the extremity of the tube is diseased."

The same writer is not the only one prejudiced against this mode of probing the Eustachian tube ; men of the greatest merit have partaken of this opinion, and perhaps still do. M. Portal says : " It has been thought possible to inject the Eustachian tube in probing it by the mouth : Wathen was the first who wrote on this operation (1734).* Some French surgeons have endeavoured to perfect the plan ; several have considered they have succeeded ; but the facts have not answered to what they have advanced ; and M. Saissy regards their attempts as quite useless : it is not possible to inject this tube either by the mouth or nose."

Trucy, of Marseilles, in speaking of the advantage of the perforation of the membrane of the tympanum in cases of deafness caused by the obstruction of

* The operation for injecting the Eustachian tube is described in the Philosophical Transactions in 1747, by Professor Martin, of Cambridge.

this tube, after having mentioned, in a few words, the different means of introducing liquids into this duct, and thence into the interior of the ear, thus expresses himself: "Injecting into the Eustachian tube is quite an illusion, and no success can reasonably be expected from the plan."

The advantages of M. Saissy's method cannot be reasonably disputed, as by it liquids may be carried into the Eustachian tube, the cavity of the tympanum, and mastoid cells, and the deep and obstinate ulcers with which these parts are affected may thus be cured; secondly, these parts can be freed from the mucus which may lodge there after colds and catarrhs; thirdly, it gives issue to blood that may accumulate after blows on the head; fourthly, it serves to remove chalky matter which sometimes accumulates in these cavities, and by means of the canula, a stiletto in form of a trocar, may be carried into the tube, to break a membranous partition or scar formed from ulcers in the throat; and lastly, by this means, if there is an insensibility in the acoustic nerve, an injection may thus be carried into the interior of the ear.

The partisans of the perforation of the mastoid process make the following objection to this method, and, by an inconceivable oversight, completely refute themselves: "This means," say they, "is not sufficient to destroy the cause of deafness, provided the injections made in this manner remove the obstructions in the cavity of the tympanum; indeed, the matter comes out with the injected liquid, but it is not rejected with the same force as if it had been done in the side of the mastoid process."

M. Saissy then states those cases in which this is not practicable, and those in which it is useless; such as, a defect in the conformation of the nostrils, a polypus in these cavities, a considerable obstruction of the pituitary membrane which lines the orifice of the tube and its environs: such are the causes that may be obstacles to the introduction of the canula into the tube. If the deafness depends on the hardening or ossification of the membrane of the tympanum, or the lesion of some part of the labyrinth, this operation would have no beneficial results.

Valsalva has observed, that if the Eustachian tube is stopped, deafness is the consequence: he gives two examples; one in a gentleman who lost his hearing by a polypus in the nose, which extended to the uvula; the other in a peasant, who had an ulcer on the left side of the uvula: when a tent steeped in detersive liquid was put into it, the patient did not hear with the left ear, and when the tent was withdrawn, he heard again. Tulpius speaks of a deafness and noise in the ear caused by a tumour of the palate near the Eustachian tube. Excrescences of the nature of polypus in the nose and throat, extend in a posterior direction, and frequently produce deafness.

The *Mémoires de l'Académie des Sciences* of Paris, in 1705, mentions a very singular fact:—A young man, twenty years of age, became suddenly deaf, from having his throat squeezed by a man with whom he was fighting; all remedies were found ineffectual.

It is presumed, that the excessive tumefaction of the tonsils, the arches of the palate, and the mucous membrane of the orifice of the tube, occasioned by the

violent compression of the throat, caused this deafness. I am inclined to doubt the permanent effect of this compression on the organ of hearing; as it is not credible that the parts thus obstructed would not recover in a few days, without the faculty of hearing being injured, at least in some degree. There is, however, one circumstance which might lead us to believe in a permanent deafness from such an accident, as when an ulcer, or an effusion of blood is the consequence; and although the memoir says all remedies were useless, it does not state what these remedies were. In a similar case, he would bleed in the arm, apply leeches to the neck, use resolute gargles, cataplasms of the same nature round the neck, strict diet, and diluting drinks: if, notwithstanding these remedies, the obstruction was not dissipated, (which it is difficult to believe), he would not hesitate in making some incisions at the bottom of the throat, especially in the tonsils and the arches of the palate; he would apply a large blister between the shoulders, and another on the anterior part of the neck. These means, he thinks, would be sufficient to dissipate any obstructions, however considerable.*

If, after the entire resolution of the guttural tumefaction, the deafness continued the same, it would be reasonable to conclude there was an effusion of blood, or some other matter, in the tube and in the cavity of the tympanum; in which case, injections of tepid water into the Eustachian tube would be sufficient to restore the organ to its functions.

After these observations from the French authors, it will perhaps be satisfactory to insert here, in order to

* Saissy, Essai, &c.

give every possible information on this highly important subject, the ingenious remarks on the affections of the Eustachian tube by a late celebrated President of the Medical Society of London, Dr. James Sims; also those of Mr. Wathen and Dr. Hamel.

OBSERVATIONS ON DEAFNESS FROM AFFECTIONS OF
THE EUSTACHIAN TUBE, BY JAMES SIMS, M.D.

The tube which passes from the internal cavity of the ear beyond the membrana tympani to the back part of the fauces, is called the aqueduct by some, but is more commonly known by the name of the Eustachian tube, from its having been first accurately described by that excellent anatomist. Some writers, as Le Clerc and Haller, have supposed Alcmaeon and Aristotle acquainted with this tube, from their asserting that goats breathe through the ear. This assertion, however, is given both by Pliny and Varro to Archelaus. But it appears to me that a knowledge of this tube, and even its uses, may with much more reason be attributed to Hippocrates; what they have averred concerning goats being false: whereas, in his book *de Locis in Homine*, he says, that in suppurations of the ear, a sponge dipped in a drying medicine is to be put into the external ear; and at the same time a purgative, by which he means stimulating medicine, is to be put into the nose, so that the matter which before flowed into the ear may be carried into the nose.

Many uses have been ascribed to this tube, yet I am apprehensive one of the principal ones has not as yet been pointed out. From several circumstances, I

am of opinion that it conveys the sound of our own voice to the organ of hearing, in the same manner as the meatus auditorius externus conveys to it all other sounds whatever; on which account it is the principal regulator of our own voice.

Had I not formed this opinion from a variety of facts, I should have been led to give it up on the authority of the celebrated Dr. Monro of Edinburgh, who, in his tenth chapter of the *Physiology of Fishes*, asserts, from what he thinks a conclusive experiment, that no distinct impression is transmitted through the Eustachian tube. As this is intended merely as a practical paper, I would not have mentioned my opinion here, if it had not served to illustrate some of the remarks which follow: and as I am venturing to dissent from one great physiologist, I hope I may be allowed to point out what I think an error in another no less celebrated one, I mean Haller, who, (in sect. v. cap. iii. lib. xv. of his *Elementa Physiologiæ*,) says, that in inspiration a torrent of air enters the Eustachian tube, and presses the membrane of the tympanum strongly outward. That this happens in expiration, especially if the mouth or nose be closed, or the expiration be sudden and violent, as in sneezing, may be easily demonstrated; but that it should happen in inspiration, is contrary to the laws of mechanics.

Be these matters, however, as they may, no one, I believe, at this time doubts, that deafness ensues when the Eustachian tube is obstructed, as well as when the meatus auditorius externus is stopped up. These two species of deafness being, perhaps, the only curable ones, are therefore most worthy of our attention. The

manner of treating each being entirely different from the other, it becomes also of great importance to find out marks by which we may distinguish them.

To point out the symptoms by which we may know the Eustachian tube to be the seat of the disease, and how to remedy it when seated there, shall be the subject of this paper.

Previous to any general deductions, I think it best to give an historical account of what I have observed, from my first paying particular attention to the subject until the present time.

In the summer of 1773, I was desired to visit a young gentleman in Fenchurch-street, who, from having taken cold, had been seized with deafness about three weeks before. The disorder was at first attended with feverishness, and some degree of inflammation about the tonsils, for which he had been bled. The other symptoms of the case, such as an eruption upon his face of a leprous appearance, which afterwards yielded to the Æthiopic pill, are not necessary to be related here; let it suffice to say, that on the morning before my first visit he had been perfectly restored to hearing by a violent fit of sneezing, his ears giving a loud crack at the same time. That a stoppage of the Eustachian tube might occasion a deafness, I did not doubt, from having frequently observed, both in myself and others, the hearing injured for a short time during colds, together with a noise in the ears, which usually went off on their giving a smart crack; but that this might be so permanent as in the following case, and yet still be remediable, I must own did not fall within my conception: I shall therefore relate it circumstan-

tially, as given to me by the gentleman himself, the application of it seeming very important in medicine : — Mr. Robert Stephens, a student of medicine, of a strong make, and about twenty-one years of age, on his return, in the month of April 1770, from Edinburgh to Ireland, embarked at Greenock in a small vessel ; and as there were a great number of passengers, he suffered many inconveniences during the voyage, which proved very tedious. When at sea, they were becalmed in such a situation as rendered it equally inconvenient to turn back or proceed ; making choice, however, of the latter, they endeavoured to hasten their arrival at Belfast, by towing the vessel with the long-boat. This employed them, by turns, for three days and as many nights, during which time Mr. Stephens was often violently heated, and afterwards much exposed to cold. Being an unexperienced sailor, he neglected applying to spirits, their nostrum in such circumstances, of which imprudence he began to find the effects before his departure from the vessel, being seized with a very severe fit of the rheumatism, which lasted many months. Eight or ten days after his arrival in Ireland, he was seized with an inflammation of the tonsils that almost threatened strangulation ; nothing could be swallowed but thin diluting liquors, even thick water-gruel not finding a passage downwards without the most exquisite pain, and the least motion of the glottis in swallowing the saliva being attended with such torture, that the remotest member of the body felt its effect. For three days it had the appearance of suppurating, but on the fourth it subsided so much that he had recourse to his usual manner

of life. Immediately after its abating he perceived his hearing begin to decrease, with a prodigious noise in his ears, which continued for three weeks, until it brought him to such a situation that he could not hear common conversation; or even when spoken to in a louder voice, he lost the half of what was said, from the impression of the first sound remaining so long upon his ear as to render the following ones indistinct. Under these disagreeable circumstances he continued a whole year, during which he tried blisters, syringing, and every thing that could be thought of, both by himself and some very eminent physicians whom he consulted, without receiving the least advantage. His patience was at length quite exhausted, and he resolved to resign himself to his fate, and lay aside the use of all applications, thinking that they clogged his ears, and rendered sounds more confused. In this state of inactivity and despondence he continued two months, without perceiving the least alteration, until at last fortune, who often bestows upon us those good gifts that reason and forecast have in vain sought for, cast a person in his way whose daughter had suffered under the like calamity for a space of time he does not at present recollect, and whose hearing had been luckily restored in a very simple and unexpected manner. Her nose happening to be stopt by a cold that hindered the intercourse of air through that organ, to rid herself of this inconvenience, and make a passage for it by that way, she closed her mouth, and applying her fingers to her nose, made a violent effort to emit her breath, when, instead of procuring a passage through her nose, she found one into her ears, which occasioned each to

crack like a pistol. The experiment was attended with so little trouble, that he made the trial in the same manner; but, after many attempts, it proved unsuccessful. Loath, however, to remain in that melancholy state, which is so remarkably the lot of deafness, he at last made some little alteration in his method, and, to his inexpressible joy, it had the desired effect: instead of filling his mouth with air, he kept his lips closely pressed to his gums and teeth; this made the air exert itself in full force about the entrance into the larynx, and the first trial with these alterations succeeded with one ear. In twenty-four hours, during which time his many anxious efforts to recover so valuable a blessing may be more easily conceived than expressed, the like success attended him with the other ear. For the space of three days afterwards, he was obliged to avoid all company, on account of the disagreeable impression each sound made upon his ears. He could hear distinctly a whisper from a distant part of a room, frequent trials of that kind having been made to prove the reality of the cure: he has ever since enjoyed as usual that inestimable faculty.

From the circumstances of this case, the situation of the disorder in the Eustachian tube was evident, and the extraordinary and unexpected cure roused my attention in the highest degree. I must own, that the almost magical manner in which it was performed caught my fancy so much, that I obliged all my deaf patients to make efforts similar to those described in this case, the natural consequence of which was, that I failed in vast numbers of instances where the disease was not situated in the Eustachian tube. One good,

however, resulted from these indiscriminate trials, which was, that I became able, in a considerable degree, to point out the characteristic differences between it and other kinds of deafness. Among the instances wherein I failed, or was only partially successful, two, being attended with remarkable occurrences, shall be mentioned here.

A single lady, who had been formerly deaf for some weeks and been suddenly relieved from it, was, after a cold, seized a second time with deafness, which continued increasing upon her for some months. I saw her after the malady had continued three months, when I recommended to her the method already described, without effect. She afterwards applied to an aurist in this town, who pronounced the case to be nervous, and applied a perpetual blister behind the ear; after this had been kept on for some weeks, she was, as before, instantaneously relieved by a sudden noise in her ears.

Both from the suddenness of the relief and other symptoms, I am led to believe that the seat of complaint was in the Eustachian tube. I am likewise convinced that she never used the method prescribed with sufficient force, as I could not persuade her to try it before my face, she seeming displeased with its simplicity, and immediately applying to an aurist, who treated it with becoming importance.

The second case was of a beautiful young lady, sister to an ingenious surgeon of this town, who had been deaf to a considerable degree for above two years. From a thorough conviction of the seat of the disorder, I strongly recommended the foregoing method,

and got her brother to second my persuasions. The consequence was, that she appeared at first perfectly cured; but I find that the complaint has since repeatedly returned: she is, however, always considerably relieved by the same method as the first.

I shall come now to some general remarks upon the disease, drawn from all the cases I have seen of it. The most frequent cause I have found to be the catching of cold, as it is called in this country, which answers to the coryza of Hippocrates, and the distillatio or gravedo of Celsus. This probably acts by inflaming and swelling the soft mucous glandular membrane that lines the part of the tube next the fauces. The secretion of these glands becoming viscid, may likewise block up the tube, and so occasion deafness, as we see in and after many fevers. It is likewise known, that a polypus, a swelling of the palate, or repeated inflammations of the tonsils, produces the same consequence. Aphtha, or an erosion of the muscles of the tube, likewise produces it; any inflammation that occasions cohesion between its sides will likewise have a similar effect.

From what I have seen, women appear more liable to deafness than men, and also, I believe, to this particular species; but upon this I am not able to determine at present.

There seems to be a considerable consent between the two ears, perhaps as great as between the eyes: thus, upon one ear being stopped with the finger, the hearing of the other is rendered very dull and confused. Sanious or purulent discharges frequently appear from both, and one ear is seldom long affected

without the other suffering in the end; these facts are obvious in the external ears, and are, I believe, equally true as to the Eustachian tubes.

The marks by which deafness is known to proceed from an obstruction of the Eustachian tube, are,—1st, Its being preceded by some of the causes already mentioned.—2d, On making an effort to expire, and at the same time retaining the breath by stopping the mouth and nose, no pressure is found upon the tympana of both ears; whereas, if the tube be not obstructed, and the effort be very considerable, the pressure is so great as to be attended with pain, and to endanger the rupturing of the membrana tympani. And here it is to be remarked, that a pressure upon the tympanum of one ear is not sufficient, on account of the sympathy mentioned in the last paragraph, unless that pressure be observed in each of the ears at different times,—a thing not likely to happen.—3dly, The sound of the deaf person's voice appears different from what it did before, and also from the sound of any other person's. This, however, is only remarkable where both tubes are stopped; as, where one only is affected, the person's own voice is heard equally as well as formerly.—4thly, There seems always to be a noise heard by the person, as if in his own ears. This sometimes resembles the sound of a tea-kettle just before it boils; at others, it is a roaring like water, or like a high wind blowing through trees, or even like thunder. This noise is heard when one ear only is affected, though, perhaps, not in the same degree. An easy experiment may be thought to militate against this opinion, which is, the stopping one or

eye and when both

both ears with our fingers, when immediately a sound is heard in the head, of the kind just mentioned; but it is to be considered, that in this case a quantity of air is included between the finger and membrana tympani,—a circumstance which can never happen in diseases of the external meatus, but is precisely what happens in obstructions of the Eustachian tube.—5thly, Persons deaf from this cause hear better in a carriage, or in any considerable noise. I am sensible that this has been attributed by some to the tension given thereby to the muscles of the small bones of the ear; whether this, however, be not hypothetical, must be submitted to physiologists.—6thly, When one tube is obstructed, the hearing is much more impaired in proportion than when the external meatus of only one ear is stopped. This is not to be understood of the sound of the patient's own voice, which is perceived equally as before. And I am led to conclude, that in all cases of deafness, where one or both tubes remain open, and when the internal parts of the ear are not disordered, the person hears his own voice as well as formerly, and therefore we find him always speaking in a lower voice than other people.

After all I have said, however, of the distinguishing marks of these different species of deafness, there are cases where it is very difficult to decide. And in many it appears evident, that both the tube and the external meatus are affected, which is no more than what we perceive in diseases of most other parts of the body; the parts in contiguity and connected with them becoming frequently affected.

According to the different causes from which the

obstruction of the tube arises, the consequent deafness is curable or otherwise. Where it is owing to any glutinous matter stopping the passage, or a simple swelling of the membrane which lines it, or a tumour in the neighbourhood, it is plainly within the reach of the medical art. To these causes I shall therefore principally refer in what is to follow. When it is slightly impacted with this matter, the first and most simple way in which it is freed from it is by the action of swallowing. This seems to produce its effect by putting the anterior cartilaginous and membranaceous part of the tube in motion. That this part of the tube is movable, or at least contractible, all authors agree; and any person who will carefully attend to his own feelings, will perceive a peculiar sensation in his ear in performing deglutition. I have often found that a slight obstruction in my ear has been removed by this effort, and therefore, whenever I perceive the hearing stopped, with a little singing in my head, I, as it were mechanically, perform it. Others, I doubt not, have experienced the same, though without taking notice of it, or knowing whence the benefit arises. Gaping, yawning, and gargling, have all been known to cure it, and probably act in a similar manner to the last. Whatsoever forces a current of air into the tube often removes deafness; and this will have its effect, whether the disorder proceeds from viscid matter, as in the last case, or from a swelling and puffiness of the mucous membrane.

In the action of bawling or speaking very loud, the air is forced out of the thorax with impetuosity; and though part of it finds a vent through the mouth and

nose, yet some will pass into any cavity that admits of dilatation, which is the case with the tympanum, the membrane of which may be protruded considerably outward. Coughing has a similar and more powerful effect, and sneezing a still greater: these have been, therefore, often known to give relief.

The action of vomiting falls likewise under this head, although at first the propriety of placing it here may not be evident. It is, however, a compound action, for we not only evacuate the stomach, but at the same time force the air out of the lungs with great violence, to prevent, I suppose, any of the matters then passing over the top of the larynx from dropping into the aspera arteria.

Another species of effort has been said to cure this complaint, and may, I think, be ranked here, although the connexion be less apparent than in the former case, that is, retention of breath. After retaining the breath for any considerable time, we are obliged almost convulsively to expel it, the effect of which latter action has, I apprehend, been confounded with the former, by those who have recorded its usefulness in the disease.

I have already mentioned, that a swelling of the membrane which lines the inside of the tube will cause deafness. This besides may produce the former cause by thickening the mucus secreted there, as we mostly see in inflammations of glandular parts. Whatsoever, therefore, astringes this membrane, or even the parts in contiguity with it, may be of service. It is in this way that gargles may have cured the disease.

Unloading the vessels of this membrane is also evidently a natural and efficacious mode of cure. This may be accomplished by cupping, blisters, or issues, in the neighbourhood, or by producing general depletion by purgatives, all of which modes have been sometimes successful. Under this head may be also arranged the advantage often received from wearing a flannel cap, or other warm covering of the head, at night. These latter remedies may also be combined with those in the former paragraph, inasmuch as the lessening any swelling of the solids will make the obstructing matter more easily removed. Syringing the external ear may sometimes have been of service, from the effect of applications never being confined to the part alone which they touch, but being propagated to the contiguous ones, especially those parts that are connected with them.

The last mode of cure which I shall mention is by injections into the tube, either by the mouth or nose. The injecting by the mouth seems rather impracticable; by the nose, it has, beyond a doubt, sometimes succeeded; and whoever would wish to know more of this method, may consult Mr. Wathen's very ingenious paper on the subject, in the forty-ninth volume of the *Phil. Trans.*

Having thus run over the various means that have sometimes been successful in the cure of this disease, it remains only to point out the degree of dependence that can be placed in them.

The simplest, and apparently the most certain and powerful, is the mode of injection, in which the rest of the frame is in no way strained or put out of order.

But this is liable to objections. The liquid used may fall into the trachea and raise a troublesome cough ; or what is of much more consequence, and appears to me insuperable, is, that the most skilful person is never certain that he has introduced the point of the syringe into the orifice of the tube ; and even although it be, unless it can be pressed on so far as to be firmly wedged into the narrow part of it, the fluid will all return by its side into the nose or mouth, exerting little or no force on the obstruction. I am more confirmed in this opinion from conversing with Mr. Wathen on the subject, who I find is not so sanguine in his hopes of cure from it as he was originally.

All the other modes of cure mentioned evidently fall short in power and efficacy of the one mentioned in Mr. Stephens's case ; I shall therefore content myself with laying down such further directions as I have since found useful in the prosecution of it.

Perseverance in repeating the efforts is very requisite in this way ; in the same manner as we see in reducing hernia, or in child-bearing, a number of efforts succeed, any one of which singly appears of no service whatever. Considerable force is likewise requisite ; indeed, I always order the force to be increased until the air is found to rush against the membrana tympani, and to give pain. In cases where only one ear is originally affected, I think it best to stop the other one with wax externally, or some other soft adhesive substance, whilst using the efforts to expel the breath, lest their violence might rupture the membrane of the tympanum of that ear in which the tube is free, or at least give it considerable and unnecessary pain.

Where the deafness has been of long standing, if the efforts made in this way do not succeed at first, I think it best to have recourse to blisters, or some of the methods mentioned in a preceding paragraph for emptying the vessels of the tube; after which, the efforts are renewed at times with superior efficacy.

Deafness from other causes I do not mean to investigate here, and hope to be excused the conciseness with which I have treated the subject, as it is not my wish to write to those who will not take the trouble of reflecting. My chief intention is to procure a fair trial to a method I have in several instances found successful; and I shall think myself happy, if, by means of what I have written, any persons recover the inestimable gift of hearing.

These valuable remarks of Dr. Sims's I shall follow up by a paper of the late Mr. Wathen's, entitled,

A METHOD PROPOSED TO RESTORE THE HEARING,
WHEN INJURED FROM AN OBSTRUCTION OF THE
TUBA EUSTACHIANA.*

Whatever obstructs that passage leading from the ear into the nose, called tuba Eustachiana, so as to hinder the ingress of air through it into the cavity of the tympanum, is, I believe, universally esteemed destructive to the sense of hearing. Hippocrates observed, that in a quinsy of the fauces the patient became deaf, by its compressing and closing up this tube.† Many

* Read before the Royal Society, May 29, 1755.

† Coac. ii. n. 35.

practical writers assert the same to have happened from adjacent ulcers, &c.* and I have known a swelled tonsil occasion deafness. This canal opens into the lateral and anterior part of the cavity of the tympanum; is so shaped that it first decreases as it descends towards the posterior part of the nose, becoming very narrow; then, suddenly diverging, is much enlarged, opening into the posterior part of the nose by an elliptic orifice, a little prominent, turning inwards and forward, placed laterally and just above the velum pendulum palati. This canal, then, is composed of two distinct cones, the extremities of which unite together, but their bases diverge differently; it is likewise lined with a porous membrane, full of criptæ and mucous cells, continued from, and like to, the membrane of the nares.†

When, therefore, we consider the structure of the Eustachian tube, and its free communication with the atmosphere, we may reasonably suppose it subject to inflammation of its membrane, and concretion of its mucus, from cold, &c. like the external meatus; and although its mucus is of a very different nature, it is, nevertheless, liable to inspissate by heat, when its

* Haller in Boerhaav. de Auditu, p. 380, 416. Tulpius, i. n. 35, à tumore palati. Valsalva, cap. v. p. 90, à polypo et ulcere, viz.:—A certain yeoman had an ulcer above the uvula, on the left side, which communicated with, and corroded part of the orifice of the left tuba Eustachiana, which, when he stopped with a tent dipped in medicine, he immediately lost his hearing in that ear, but recovered it as soon as the tent was taken out.

† Haller in Boerhav. de Auditu, p. 378; Not. E. Physiologia. Haller de Auditu, sec. 485. Valsalva, cap. ii. p. 32; idem. fig. 14.

thinner parts are exhaled.* And, from the form of this passage, we may easily conceive, that an obstruction pretty far advanced is not to be removed without difficulty, and that in proportion as it is more or less injured. Why then may not this be suspected as sometimes the cause of deafness? Perhaps it is not unfrequently so: *e. g.* When a patient is somewhat deaf from cold, and the outward ear has been examined and found clear of hardened wax, &c., it is, nevertheless, not uncommon to find himself suddenly relieved by a great noise in his ear. This is probably owing to the breaking away of the congealed mucus, and the instantaneous rushing of the air into the tympanum; so that when this disorder is but slight and recent, nature seems frequently to relieve herself; but when more confirmed, her efforts are ineffectual for its removal. These considerations inclined me strongly to think the hearing might suffer from that cause, and I was much confirmed herein by the following very remarkable case:—

Richard Evans, aged thirty-five, was exceedingly deaf in both his ears, and no visible disorder in the external meatus. It arose from cold, and had subsisted several years, during which time no art or means whatsoever could procure him the least relief. In August last he died of the small-pox, at the hospital in Cold-bath Fields. I took the opportunity of examining the

* Morgagni and others tell us that they constantly find the cavity of the tympanum in infants much clogged with mucus; and Mr. Douglas has often observed the same in adults, and is of opinion that it is concomitant with an obstructed tube in general, and that the injection is equally as effectual as if the tube only was obstructed.

Eustachian tube of each ear, and found them both stuffed quite full of congealed mucus, which was observed by two gentlemen of the profession present. This was the only visible cause of his deafness, the other parts appearing in their natural state.

As all these concurring circumstances strengthened me in my opinion, they likewise incited me to make trial of an operation that was some time ago proposed to the Academy of Sciences by M. Guyot: but the author having never practised it, he wanted the recommendation of facts to prove and enforce it; it was therefore rejected by them as impracticable.* Besides, M. Guyot proposed doing it by the mouth, which is quite impossible, as evidently appears to any one who will give himself the trouble to examine into it. Convinced of this, M. Petit (who has lately published a new edition of Palphin's Anatomy,) proposed, and that learned and skilful anatomist, Mr. John Douglas, first demonstrated, the possibility of passing the probe, &c. through the nose into the Eustachian tube, and this he has constantly shewn to those who have attended his public lectures; and to him I freely acknowledge myself indebted for the hint, by which I was incited to make trial on the living of an operation of so much importance to mankind.

I first introduced my probe, a little bent at the end, through the nose, into the tubes of several dead subjects; and having thereby acquired a facility, I did the same upon a person who was very deaf, on whom all other means had proved ineffectual; —no sooner had I with-

* Hist. de l'Acad. 1724, p. 53.

drawn the probe, than he said he could hear much better. This success excited my farther endeavours, so that I had pipes of different sizes adapted to a syringe, and have since injected the meatus internus in the following manner, with success. The pipe is made of silver, about the size and length of a common probe, and a little bent at the end; this being fixed to an ivory syringe full of liquor (viz. a little mel rosarum in water), must be introduced between the ala and septum of the nose, with its convexity towards the upper part of the aperture of the nares, and thus continued backwards and a little downwards, till it comes near the elliptic orifice, then its convexity is turned towards the septum, by which the inflected extremity enters the tuba Eustachiana with ease. The liquor is then impelled through it into the tube, by which the sordes, if any, being diluted, is washed out, and regurgitates through the nose or mouth, or both, with the injection, and, if the quantity be large, may be seen.

November 3d, 1754. — M. S., about forty years of age, was troubled with a very considerable deafness, so that she could not hear any thing said at a common distance, except the voice was very loud and shrill; people were therefore obliged to speak into her ears. This rendered her incapable of service, so that her mistress resolved to dismiss her. It was of two years continuance, but had grown much worse of late: it was originally caused by cold. I syringed her outward ears, first of all, without the least benefit; but as soon as the internal meatus was injected, she instantly affirmed that she heard much better; and by repeating

it for two or three days, she heard, and continues to hear, as well as any body, and remains in her place.

Nov. 17th, 1754.—S. L., aged fifty, applied to me for relief of a deafness in both ears, that had subsisted for a year and a half, and was the effect of a cold; he could not hear what was said to him without the most violent exertion of the voice, and applying one's mouth close to his ear,—nor could I make him hear at all; so that I was obliged to converse with him by means of a person that had a louder and shriller voice. Having syringed his outward ears without any success, the next day I injected the tube on one side, and washed away a very considerable quantity of congealed mucus, in little clots of a blackish colour and putrid smell, regurgitating with the liquor through his mouth; he immediately heard what was said by some person talking in another part of the room. The morning following, I did the other ear, and with the same success; and by repeating the operation two or three times, in as many successive days, he can now hear a common conversation, and, if near, distinguish what is said, though the voice be very soft and low; but cannot hear sounds at a great distance.

Nov. 18th, 1754.—L., threescore years of age, having been exceeding deaf for thirty years, desired to have this operation performed on one of his ears. I first injected the external ear of the right side, and extracted a large plug of inspissated wax; but this did not relieve him in the least. The next day I syringed the tuba Eustachiana of the same side; he could then hear distinctly the ticking of his watch applied close to his ear, which he could not do before,—his deafness

returned again in the evening. I repeated the operation two mornings more, the effects of which were exactly the same as the first.

November 20th, 1754.—E. H. had been so exceedingly deaf (from a cold) for six years, that she was incapable of any kind of employ whatever. I tried this operation, and continued its use every other day for a fortnight. The benefit that she received, though not equal to the second case, is nevertheless so great, that she can wait at table, hear what is said pretty well, though not spoken directly to her, and is become very useful in the family where she lives.

November 30th, 1754.—A., aged twenty-seven, deaf in both ears from a cold, and of two years standing; one much worse than the other. I began with the deafest, and extracted much wax, &c. from the external meatus, without the least benefit; but on syringing the tube of that ear, she received so much relief that she can hear considerably better with it than with the other. I then injected the other ear, on which it produced no alteration at all, though repeated several times.

February 1st, 1755.—A. A., deaf to the greatest degree imaginable, could understand only one particular person, whose voice, or rather physiognomy, he had long been used to. He had been thus for eighteen years, and was suddenly seized, or as it were struck, with this disorder, together with an affection of his eyes, which presented a variety of colours continually floating before them, to the great detriment of his sight; and this, together with his deafness, has

continued with very little alteration till the latter end of January last. About that time I syringed the Eustachian tubes, when he instantly heard his own voice, which he could not in the least before: I repeated the operation for three or four times, at a day or two distant from each other. He soon perceived a remarkable alteration for the better, together with this peculiar circumstance, that if spoken to as loud as was before necessary, the sound irritated his ear, causing a very painful titillation, or (as he termed it) a scratching in his ear. The same thing happened when he spoke; nor could he distinguish what himself or others said, except the voice was many degrees softer than he had long been used to; he can now hear a middle-toned voice, and converse with others very tolerably, if the room be free from noise. He formerly taught the learned languages, by which he acquired three hundred pounds, all which he has spent in fruitless endeavours to regain his hearing. He has been twice deeply salivated, his head profusely sweated for a long time together, and he has undergone several physical courses, but nothing ever procured him the least help till this operation was used; and it is remarkable, that the disorder of his eyes disappeared after the second time his ears had been injected.

Thus, five out of six cases received more or less benefit from the operation. I have endeavoured to ascertain the symptoms that indicate an obstructed tube, but have not been able to do it with any degree of certainty; nor can I see the great utility of it, could it be done; for the only disorders of the ear

that at present admit of chirurgical helps, are those of the external meatus, ulcerated and swelled tonsils, &c. all of which are generally visible; and when they are not the cause of deafness, little or nothing is ever attempted, the patient being left to shift for himself. But now another probable chance at least is given to the unhappy sufferer, and being the only one, (the others either improper, or tried before without success,) may be made use of without delay, or attendance to corroborating symptoms, at least till they render themselves more conspicuous and certain than I have hitherto been able to find them; and as the operation is not at all dangerous, it neither has, nor will, I believe, be thought painful by those who desire to recover their hearing.*

After these valuable remarks of Dr. Sims's and Mr. Wathen's, I shall next introduce the experiments of Dr. Hamel, physician to the Emperor of Russia, made during his descent into the sea in a diving-bell:—
“When he had arrived at about four or five feet below the surface of the water, he began to feel pain in his ears, which became more and more severe as he descended. He now feared that it would become quite intolerable, and made some efforts to introduce air into the Eustachian tubes, to counterbalance the inordinate pressure of that externally against the membrane of the tympanum. It was a long time before he could succeed in this, and then only with the right ear; on the air suddenly entering this, the pain in-

* Philosophical Transactions, vol. xlix. p. 213.

stantly ceased ; but it became more and more distressing in the other ear. When he was at the depth of fifteen or sixteen feet, it seemed as if a stick was forcibly thrust into this ear. At length he made the air pass also on this side, which it did with a remarkable explosion, and the pain suddenly ceased. Not the least inconvenience was felt in respiration, even at a much greater depth, though the pressure of the atmosphere must have very considerably increased. On rising, he again experienced pain in his ears, resulting from the dilatation of the air in their interior cavities ; but its escape was much easier than its entry. He felt, at about each foot of distance, as it were a bubble of air escape from the ear into the mouth, and each time this took place the uneasiness lessened. As the orifice of the Eustachian tube is closed, in the manner of a flattened funnel, towards the mouth, which acts like a valve, it is very difficult to make the air pass from the ear into the mouth under the ordinary atmospherical pressure ; but in the diving-bell, under water, the action of deglutition alone is sufficient : it seems as if the muscles of the cheeks, during this action, opened the orifice of the tube, and that the condensed air then forced the passage. In making this experiment, it is necessary to close the nostrils, and then to make a strong suction with the mouth closed ; the air then comes from the internal cavity of the ear into the mouth, and a slight degree of pain is felt, which ceases on swallowing the saliva, because the air then re-enters the Eustachian tube, and the equilibrium is again established. From these circumstances, Dr. Hamel thinks that the diving-bell might prove a remedy

in deafness from obstruction of the Eustachian tube. In the conversation he had with the workmen who ordinarily went down in it, he found that they experienced similar sensations in their ears; and one of them said, that when the pain had become very violent, he sometimes heard a noise like the sound of a pistol-shot, and then it instantly ceased." — *Med. Journal*, 1820, p. 255.

Mr. Symonds, a deaf and dumb gentleman who resided at Reading, ascended in a balloon twice: it is said he was induced to do so in the hope of obtaining his hearing by that means. He, however, received no benefit from the experiment.

Where the Eustachian tube is completely obstructed or obliterated, whilst the other parts of the organ of hearing remain perfect and free from disease; or where the membrana tympani is thickened, cartilaginous, or ossified, some surgeons consider the perforation of the tympanum as the only means of cure. This operation is performed by simply passing the instrument into the meatus, and probing it through the anterior and inferior part of the membrane of the tympanum; for in this position the manubrium of the malleus will be avoided,—a circumstance particularly to be attended to, in order that no part of the machinery may be injured. In directing the instrument, care should be taken that it does not penetrate the vascular part of the membrane, so as to occasion an effusion of blood, otherwise the success of the operation may be defeated. Sir Astley Cooper informed me that he had performed this operation with a common probe.

CASE.

William Johnson, about six years of age, deaf and dumb from obstruction in the Eustachian tube. I injected the tube with my new instrument; but as no great benefit resulted from it, I perforated the tympanum, and in consequence of the parts healing, I was under the necessity of repeating the operation, and with the happiest results, for now the patient can both hear and speak.

VISCID MUCUS IN THE EUSTACHIAN TUBE.

Congenital deafness, and also that which manifests itself soon after birth, often depends on the thickened mucus which is lodged in the Eustachian tube; I have observed it to be the most frequent cause of deafness and dumbness in those young children which have come under my care: this fact I consider very important, as it has led to a decided and successful mode of treatment in cases which would, if not properly treated, have become confirmed, organic, and incurable. This species of deafness is attended by no peculiar diagnostic symptoms to mark it; there are neither distressing noises in the ear, nor any of those other sensations which indicate a diseased state of the auditory nerve, or certain morbid causes acting upon it; on examining the parts in these cases by dissection, I have found that the obstruction lies in the cartilaginous extremity of the tube.

In young children this affection frequently proceeds from taking cold; in fact, deafness in infants more

frequently arises from catarrh than from any other cause; in them the sensibility is so extreme, and the parts so delicate, that inflammation is often induced by the slightest exposure. Nurses and others engaged in the care of children are not sufficiently attentive to defend their helpless charge from the inclement atmosphere of our unsettled climate: when that affection of the Schneiderian membrane called a cold, extends from the nose to the throat, deafness, temporary or permanent, will be the obvious consequence. As a prophylactic means, I cannot too much impress upon the minds of parents the high importance of guarding their young and tender offspring from exposure to the cold: I think it my duty to dwell upon this point, because I am well aware that, from the best of motives, children are exposed to dangers of which the fond and anxious parents have no apprehension; and thus the seeds of serious disease may be sown, by means which had been adopted with a view to brace and invigorate the frame.

Whenever the tube is closed by viscid or glutinous matter, or when inflammation is about to produce a permanent organic change, the continued and regular use of emetics is of singular efficacy.

In commencing the treatment of these cases, I have found it best to employ the usual antiphlogistic means, to a degree suited to the respective peculiarities, being at the same time careful not to lower too much the powers of my little patients. I am convinced that much of the success in the treatment of children depends upon the mode in which the remedial agents are employed; and that the great care and watchfulness

with which active and lowering treatment ought to be conducted, cannot be too strongly enforced. When the first symptoms of high action have subsided, then I order gentle emetics, composed of tartar emetic and ipecacuanha, given in small doses, and repeated every five minutes until free vomiting be produced; during the action of the emetics, the patients are allowed to take freely of any mild tepid diluent, as barley-water, milk and water, &c. I prefer giving emetics to young children in divided doses, it being the safest and most effectual method: there is so much difference in children as to their susceptibility to emetic medicines, that what would fail to produce effect in one, might prove to be an over-dose for another.

It is requisite to repeat the emetics frequently, in order to remove the collections of mucus which lodge in and obstruct the tubes. The period required for the success of such means must vary in different cases, according to the degree of obstruction.

No remedy is so suitable for the purpose of removing these obstructions as emetics; of this, every well-informed practitioner must be fully convinced, when he considers the nature of their action. The operation of emetics is not, as is imagined by the vulgar, confined to evacuating the contents of the stomach; these remedies produce great increase of the secretions of the mouth and throat, as well as of the juices of the stomach; by their action, the biliary and pancreatic ducts are emulged; the secretions of the liver and pancreas are augmented, as well as those of the glands in the vicinity of the mouth and throat; stagnant fluids are put in motion; morbid congestions and accumu-

lations in various parts of the system are removed; the excretion of mucus from the lungs is promoted; the general absorption of the system is increased; the circulation is rendered freer, the blood is diffused more equally over the system, and topical determinations are in many instances lessened or removed; the cuticular and pulmonary exhalations are very sensibly promoted; a commotion also is excited in the nervous system, which is often highly salutary in nervous disorders. The excitement produced rouses the sensibility of every part, without producing debility; and thus the different minute parts of the organ are enabled to recover their energy, and structural mischief that may be forming is prevented.

The subjoined cases are some of the many in which the plan I have just described has been successful: were I willing to swell this volume, I might add numerous others; but these will suffice to prove, more strongly than any theoretical statement can do, that the mode is highly valuable, and merits the attention of the profession.

CASE.

Master O. N., a year and a half old, was born deaf and dumb. This child, when I first saw him, May 27, 1828, appeared to have great stupor; and by his nurse I learned he was almost always asleep; for, be it recollected that children in this state cannot express themselves, therefore they are more to be pitied than the blind. He seemed to labour under hydrocephalus: he had many of the symptoms, such as being uneasy on raising his head from the pillow, and wishing to lie down

immediately; pain in the head; dilatation of the pupils; suffused redness of the eyes; great sensibility and aversion to light; sleep suddenly interrupted; nausea, vomiting, costiveness, and other pathognomonic symptoms of the disease. I applied some leeches to the temples, and a few days afterwards I repeated them. The common practice in hydrocephalic cases is to bleed largely, and in some instances to open the jugular vein; but I consider great caution necessary with regard to copious bleeding, especially with young subjects. As his head did not seem preternaturally enlarged, I was in hopes the above disease was not confirmed. After having the ears well cleansed, and administering some slight aperients, I had two small blisters applied, and kept open a short time, but without any effect. I then had recourse to the emetics, which had a most beneficial influence, as the child appeared the next day much easier and lively. I had the emetics repeated twice a week, for a month; at the expiration of which time the patient could hear. He has been improving; and I have to add, that he can now say all the letters of the alphabet, except W, and he talks as well as most children of his age: his hearing is at this time quite perfect. I attribute his cure entirely to emetics.

CASE.

Miss D——, aged five years, deaf and dumb, the daughter of a merchant in the city, was brought to me by her mother, accompanied by her medical attendant, on Dec. 22, 1827. It appeared this child had had the tympanum perforated twice in both ears, blisters had

been applied, she had been electrified and galvanised, and had the moxa applied repeatedly, without effect. The parents of this child were anxious that nothing should be left undone by them for her relief. As no means had hitherto been of service, however powerful the remedies employed, I was at some loss how to conduct my treatment: it occurred to me, however, that the defect might arise from an obstruction of the Eustachian tube, and, guided by this idea, I lost no time in examining it, which I did by passing a small probe into its superior part, which did not appear either ossified or unnatural, but obstructed by viscid secretion. Considering this a case for my new mode of treatment, I immediately commenced with powerful emetics, repeated according to the strength of the patient. In the course of a few days she began to hear with a trumpet; and at the expiration of nine months was much improved, and able to talk: she has since perfectly recovered her hearing and speech. She was completely cured by the use of emetics alone.

CASE.

George Tomling, eighteen months old, completely deaf and dumb, the son of a poor widow, was sent to the dispensary, Aug. 4, 1828: his mother informed me, that the child caught cold from travelling with her outside the coach during a long journey. When I first saw him, the nose was completely stopped up with that unpleasant mucus so often observed to distress children: the mother said, that before the cold, the child could hear any thing; but when I saw him, he was completely deaf. This, like the former case,

affords a strong proof of the influence of emetics in the cure of deafness; the organ was here entirely stopped up, so as to prevent the pulses of air entering, and producing the impression of sound. By the use of emetics, the obstruction was effectually removed, and the child enabled to hear as well as previous to the attack of this severe cold: he was cured by emetics, and now both hears and speaks.

CASE.

Master M., aged two years and a half, had become deaf and dumb from taking cold. When he was about a year old, the servant who had the care of him having taken him out for an airing, imprudently detained him in the park too long, on a very cold day; the consequences of which exposure were febrile symptoms, accompanied with sore throat. On examination, April 9, 1828, I found the Eustachian tube obstructed, probably from inflammation when labouring under the sore throat; there was also a discharge from the meatus. I employed the emetic mixture, which was repeated several times, at intervals of a month; this completely removed the obstruction: the discharge was cured by means of injections, and a slight alterative course of medicine was prescribed. The child is now able both to hear and speak. When I first saw him, he could not hear with a trumpet six feet long; but readily distinguished sounds by means of the trumpet soon after the emetics had been given.

CASE.

James Lawlor, a boy about five years old, was sent

to the dispensary, from Ireland, February 5, 1829: his mother, who accompanied him, informed me that he was born deaf and dumb. He was also blind of one eye. Finding on examination an obstruction in the Eustachian tube, I ordered an emetic: when I saw him three days afterwards, his mother told me that he could distinguish loud sounds. The emetic was consequently repeated, with even greater apparent success than before; and as he continues under my care, I anticipate the most favourable results. I adduce this case as a proof that slight affections, if early attended to, may be treated by this curative process with the fairest prospect of ultimately effecting the total or partial removal of the malady.

DISEASES OF THE INTERNAL EAR.

The diseases of the internal ear are so much the more difficult to treat than those of any other part of the organ, as the means of detecting them are more difficult, and from the symptoms not being peculiarly marked; neither have we, in cases of deaf and dumb, the means of gaining information from the patients themselves. Various causes, it is clear, may affect the internal ear, or real seat of hearing, and suspend its functions. It would be highly desirable to have the means of determining the seat of disease of the internal ear; but, fortunately, these defects are not so frequent as of the external parts.

The causes of partial or complete deafness may be of two kinds: those arising from original organic, or functional defects; and those arising from neglect,

accident, or disease. A morbid state of the internal ear may be congenital, and a cause of dumbness, or it may produce the same defects as regards the power of speech, if it occurs in the early years of the patient's life. Various causes may affect the immediate organ of hearing, so as to disturb or destroy its functions. When the cause is in the sensorium itself, it is the most dangerous; and the deafness which is produced by a tumour pressing upon the origin of the nerves is complete and absolute, for no impression can then be conveyed through the organ to the mind. Deafness is frequently occasioned by fever, catarrh, &c. It may also arise from blows or falls, producing commotion of the acoustic nerve. It sometimes proceeds from convulsions in children.

Mr. Swan has observed, as I have stated in a former part of this Essay, that it is possible for sounds to be conveyed to the organs of hearing through the medium of the facial nerves. In the paper to which I allude, he mentions the case of a woman who was born with the meatus externi imperforate. "She did not begin to talk intelligibly till she was seven years old, and did not talk tolerably well till she was about twelve. She can hear perfectly well when a person addresses her at the distance of six or seven yards, but not nearly so well when the person speaking is behind her. When a linen cloth and a piece of flannel were put over her face, she heard distinctly; but when a large woollen cloth was put over these, she could not hear any of the same questions uttered in the same tone. On repeating the same experiment, it was found that she heard more faintly according to the extent of the covering put on

her face. The same was the case with tunes played on the piano-forte. When the face was covered, the sounds were fainter; but when she placed her hand over the piano she heard much better; yet not so well when a silk handkerchief was tied round her arm." As we find that the sensibility of the nerves concerned in the production of the senses is increased by proper use, it is reasonable to suppose, that in dumb people the facial nerves would have more power of receiving and conveying impressions of sounds if they were properly exercised. The remarks of Mr. Swan are certainly deserving the notice of those who devote their attention to the instruction of the deaf and dumb; for the most minute dissection in these cases has never developed any unnatural appearance in the structure of the auditory nerves. There are no diseases more obscure than those of the internal ear; yet, like affections of other internal organs, many of them admit of relief.*

* From the success the Author has met with in the treatment of deaf and dumb cases, he was induced, some time since, to address a letter to the Governors of the London Deaf and Dumb Asylum. His object was, that there should be an attending surgeon or aurist appointed, who should minutely examine the children offered for presentation, prior to their being admitted into the asylum, and report his opinion to the committee, as to how far they were curable or otherwise. The following is the letter above mentioned:—

Soho Square, Jan. 11th, 1817.

GENTLEMEN,—In presuming to address you on the subject which so materially interests the Institution for the Deaf and Dumb, your patronage of which does you so much credit, I beg leave to premise, that my object is not to interfere in the least with the present medical establishment, as I have the highest opinion of the professional

M. Saissy states that the labyrinth may be affected by the same kind of diseases which attack the cavity of the tympanum: he describes six as more particularly deserving of notice. They are, 1st. The thickening and hardening and defective secretion of the membrane of the fenestra ovalis and of the fenestra rotunda. 2d. Malformations in the fenestræ. 3d. Malformations of the labyrinth. 4th. Inflammation of the membrane which lines the cavities. 5th. Morbid state of the aqua labyrinthi. 6th. A deficiency of this fluid: Man-

talents and deserved reputation of the medical officers you have been pleased to nominate. These gentlemen, I have no doubt, are too liberal in their sentiments, not to admit, that the defect of being deaf and dumb calls for an exclusive attention, greater than can be paid by any practitioner in general practice, however distinguished his abilities or extensive his science, from wanting that *particular experience* which one *exclusively* confining himself to this department of surgery must possess. In consequence of this, I beg leave most respectfully to suggest to your consideration the advantage that would result to the Institution were an aurist appointed to attend and minutely examine the particular defect in each child admitted into your establishment. By this means an opportunity would be given of trying such methods as appear best calculated to give relief; and by this plan, I conceive, many of the objects of your laudable charity might probably be found curable, restored to society, and rendered useful; by which the bounds of your humane establishment would be extended, and greater scope given to your highly benevolent views.

I have the honour to be, Gentlemen,

With great respect,

Your most obedient humble servant,

JOHN HARRISON CURTIS.

*To the Chairman and Committee for the
Deaf and Dumb.*

dini has found a cochlea in which the volute made but one turn and a half.

The following cases will illustrate the foregoing observations :—

CASE.

Mary Haines, aged four years, was admitted a patient at the Royal Dispensary on the 22d of Sept. 1825. This child was born deaf and dumb, and at the time she was brought to me could neither hear nor speak. Her mother has had six children, and this is the only one that is deaf. The mother thinks the occasion of her daughter's imperfection was her being frightened by a horse when in a state of pregnancy. This child had the usual remedies applied. From her emaciated and weakly state when she was first admitted, I was fearful she would not live ; but my fears proved unfounded, as her general health is much improved. She has now obtained her hearing and speech (February 23d, 1828), after three years attendance.

CASE.

Selina Hewett, aged seven years, brought by her mother to the Dispensary, was also born deaf and dumb. This patient gradually amended under my treatment; and since her advance towards puberty, she has, among other changes, completely acquired the faculties of hearing and speech. Instead of becoming, as she has done, a useful member of society, she would certainly have remained a burden on her friends, had not her case attracted benevolent notice.

CASE.

George M'Nab, aged six years, was admitted a patient at the Royal Dispensary on the 4th of May, 1825. He had been deaf and dumb from birth, and at times appeared weak in his intellects. As his father wished something to be done for his relief, I applied blisters behind the ears, and had them well syringed; but the blisters were obliged to be discontinued, as the glands of his neck were much affected. After the blisters were healed, the boy complained of acute pains through his head, which he communicated to me by signs. I had his ears fomented, as there appeared great fulness about the head and ears. I also prescribed small doses of alterative medicines, which he took every other night for three weeks; and occasionally a brisk dose of purgative medicine. On his first admission his ears were quite dry, apparently without any secretion. One morning his nurse observed a quantity of dark-coloured pus on his pillow and night-cap, which had issued from his right ear: in about a fortnight afterwards, a similar discharge was observable from the other ear. I recommended the fomentations to be continued, with a view of encouraging the discharge; and after it was suppressed, I had the satisfaction to find a healthy secretion of cerumen take place. I am inclined to think that there were tumours in the vicinity of the organ of hearing, or on the brain, which gave way in the first instance to the alterative plan. Since he has obtained his hearing, speech has followed, and his manner and appearance are altogether improved. He could hear sounds by means of a large trumpet, when the discharge

had been suppressed; after which he accustomed himself to the use of a small trumpet, until he could hear perfectly.

CASE.

Mary Ann Hague, aged seven years, was first admitted a patient at the Royal Dispensary, January 12th, 1823, at the particular request of one of the governors. At this time she was completely deaf and dumb. On inquiry, I found that she had originally a fever, which lasted some time, during which she was in great danger, her life being despaired of. On her recovery, the loss both of hearing and speech was complete. After having the cerumen dissolved, and the ears well syringed, I applied blisters behind them, which were kept open six weeks, at the same time putting her under a course of gentle alterative medicine: these means appeared to have no effect, consequently I discontinued them, and applied stimulants within the meatus, and both internally and externally to the throat, and in the vicinity of the ear. Even this plan did not succeed, which made me inclined to give up the case; but in consequence of the importunities of the mother for an only daughter, who was also a very interesting child, I was induced to continue my exertions. From the success of blistering in other cases, I considered it as still affording the best chance of recovery. I accordingly put her on my first mode of treatment; and so successful has it proved since that time, that on April 10th, 1826, after three years attendance, I had the satisfaction to state that she could hear and speak. I insert this case to con-

firm the observations I have made on the necessity of perseverance in the treatment, and the duty of not giving up any case without repeated trials.

CASE.

Miss P——, aged five years, being left to the care of a servant of a thoughtless disposition, during the absence of her mother, in consequence of her fretting, the servant carried her into the cellar, by way of frightening her. This had instantly such an effect that she became entirely deaf and dumb, in which state she was brought to me. After an inquiry into the cause of these defects, I considered it as a case of nervous deafness, and treated it as such. She has considerably recovered her hearing and speech, but still the influence of the fright has not left her; but I trust, however, from the present advantages gained, that in the end the cure will be complete.

I insert this case with a view of deterring any one from alarming children, as it is an evil whose consequences remain a long time, sometimes till death: it not unfrequently produces epilepsy, and a long train of diseases.

Those confirmed cases which have resisted every scientific method of treatment, and are proved to be beyond the reach of medicine, are still to be relieved by some of the very ingenious contrivances which have been from time to time invented. I have been at much pains to collect all the information relative to the various mechanical aids that have been afforded to the deaf. The first I shall mention are the French artificial ears: these, being closely adapted to the ear, collect the

sound; but in their original state they did not transmit it: to remedy this defect I have added a small tube, which, by contracting the passage, occasions the sound to enter with greater impetus.

There is a contrivance called the Spanish ears, made of shells. There are also the German silver ears, which answer better than either the French or the Spanish.

I have invented a hearing-trumpet, in the form of a parabolic conoid, on the same principle as the speaking-trumpet used at sea: this shuts up like an opera-glass, and is contained in a small case, which may be carried in the pocket without inconvenience.* The newest invention of this kind is a hearing-trumpet having two orifices, one inserted into the ear, the other into the mouth; this I have found to answer better than any thing that I have heretofore used. I am indebted for the first idea of this instrument to Sir Edward Stracey, Bart. who has kindly communicated to me some very important information relative to the subject of acoustics.

ABSTRACT OF THE REPORT MADE BY M. HUSSON TO
THE ROYAL ACADEMY OF MEDICINE AT PARIS,
ON THE METHOD ADOPTED BY M. ITARD FOR
THE CURE OF THE DEAF AND DUMB.

M. Itard had presented to the Minister of the Interior three memoirs: the first relating to the

* Vide the Author's Treatise on the Physiology and Diseases of the Ear, fourth edition, London, 1826, containing a Plate of improved Acoustic Instruments.

various methods employed up to this time for the cure of congenital deafness, and including those employed by the author himself during the course of a long practice; the second giving an account of experimental treatment adopted in nearly two hundred cases, with the view of determining the advantages and disadvantages of injections through the Eustachian tube into the internal ear—a method which a recent report of the Institute would seem to recommend to public confidence; the third, in which after combating the above process, M. Itard represents as exclusively deserving of confidence, a medico-physiological method, calculated, according to his statement, to relieve a great many cases of congenital deafness. It is to the last of these alone that the present memoir refers.

We should form an erroneous idea of the state of the deaf and dumb, says M. Husson, if we supposed that they were all entirely without the sense of hearing: there are many among them who make no use of the sense indeed, because it can only be exercised by an effort of attention, which is painful. Now, if these individuals be accustomed to methodical exercise of the faculty which enables the ear by degrees to mark and compare different sounds, the sense is improved, just as a weakened function is developed by gentle exercise. This was the idea which first led M. Itard, more than twenty years ago, to try on twelve deaf and dumb persons a series of exercises and experiments, the result of which was to restore, without operation or treatment, six of them to speech and hearing.

M. Itard had recourse at first to the most penetra-

ting sounds, to stimulate the sense of hearing : he accomplished this by striking on a large bell, which he had suspended in the room ; he diminished every day the intensity of the sound, either by removing the patient farther from the bell, or by striking it less powerfully. When he perceived that the hearing was becoming dull again, he suddenly roused it by one or two very powerful sounds, and passing immediately to weaker, had the satisfaction to find his patients as sensible to them as they had been before. At a later period, in order to keep up the excitability of the organ, M. Itard made the bell vibrate near the patient's ear, and gradually removed it, without rendering the sound more intense. By these means he increased and kept up the susceptibility of perception, till sounds were heard at the distance of twenty-five feet, which could not be perceived at more than ten feet when he began. These experiments were performed in a long narrow corridor—the patients were placed in a line, and along the wall was marked the point at which each ceased to hear ; thus forming an exact scale or register of their progress.

But it was necessary also to teach the ear the power of determining the direction of sound. For this purpose he had a small bell, which he rung while he walked round his patients ; and then made them, with their eyes bandaged, point to the spot whence the sound came. This they did at first with difficulty, but after a few days with considerable facility.

To this set of lessons, which indicated the power of perceiving the direction of sound, succeeded another, the object of which was to make his patients sensible

to a kind of musical rhythm. He took a tambour, and beat upon it some slow and simple marches; after a few days his patients were able to do so themselves, marking the time with precision. To this instrument succeeded the flute, the sounds of which, from their analogy to those of the larynx, might form a kind of introduction to those of the human voice. After having taught them to hear these sounds, to judge of their distance, their direction, and their repetition, it was necessary to teach his patients to distinguish them from each other—to imitate them; in a word, to call the functions of the larynx into operation,—and this was the greatest difficulty which M. Itard had to overcome—a difficulty depending upon the two following circumstances:—First, there are very few persons entirely deaf; and secondly, children born slightly deaf become as completely dumb as those who are entirely deaf. In the first, there is absolute absence of hearing, and consequently the larynx (so to speak) cannot *reflect* on the sound. The second, whether their deafness be natural or accidental, require, to overcome it, a degree of attention and study which cannot be expected of a child, and thus it passes into the same state as those who cannot hear at all. Thus, adds M. Itard, in order that our education may take place by sound, it is necessary that the organ of hearing be perfect; when otherwise, it becomes as if it did not exist at all. He mentions, as an example, a child at the Deaf and Dumb Institution not differing from those who hear and speak, except in confounding the *e* mute with the vowel *e* and the diphthong *eu*. M. Itard has also remarked, that in Spain and Italy the *half deaf* may

be instructed by an ordinary education, because the language of these countries is not loaded with the enormous number of mute syllables which exist in the French — syllables which such individuals do not hear, and which, therefore, constitute an insurmountable bar to their being instructed in the ordinary mode of education.

To bring those who are *naturally* half deaf to hear and speak like those who are so *from accident*, and who have been partially deprived of the sense of hearing after the earliest part of their education had been completed, M. Itard adopts the following method:— Two young persons, nearly of the same age, one affected with congenital, and the other with accidental deafness of six years standing, were placed under his care: the former, partially deaf from birth, had received a particular education, according to the directions of M. Itard, and had learned, at the end of five years, to understand with sufficient ease words directly addressed to him, and to speak intelligibly; but his sentences were detached, without connexion, extremely simple, and slowly uttered—so that, although he spoke, he could not be said to converse. The other, on the contrary, partially deaf from accident, although less intelligent and more deaf than the other, and reduced like him to *direct* audition, was able to speak in a free, easy, animated manner, (which only required the person with whom he conversed to be placed opposite to him), without either repetition of his words or raising his voice. M. Itard proceeded to determine, by various means, the part which the different senses had in producing the general effect, viz. how much depended

really on the ear, how much on the eye, and how much on the intelligence. He soon found that with the latter, the meaning of the sentence was the principal assistance; whilst the child naturally deaf was limited to the eye and ear. It was thus rendered obvious, that in such cases it is not sufficient to accustom the ear to distinguish vocal sounds, and the eye to judge of their visible mechanism; but that it is, above all, necessary to cultivate the understanding, to enrich the mind with the materials of conversation, to familiarise it with the combination of ideas, and the signs which represent them.

According to M. Itard, absolute deafness is extremely rare—he admits not more than one-fifth to be so: that of the four others, two confound vocal with other sounds, and the remaining two hear articulate speech distinctly. Thus, such individuals may be divided into four classes. In the first are comprised the deaf and dumb who distinguish all the sounds of the voice when they are addressed to them directly, slowly, repeatedly, and in a loud tone. The second includes those who distinguish vocal sounds, both vowels and consonants, except such of these last as are similar—for example, *ba* and *pa*, *fa* and *va*; they likewise confound *o* and *ou*, *e* and *eu*. The third class is composed of those who confound all syllables, however dissimilar—such as the French words *pain* and *faim*, *gant* and *dent*; although they still have the faculty of distinguishing the vowels. Lastly, we have those who confound all vocal sounds, distinguishing them, nevertheless, from others—that is, they perceive the difference between articulate and inarticulate sound.

M. Itard observes, that to whichever of these classes the patient may belong, he frequently, by proper instruction, acquires one degree of improvement, but seldom two; and that the amelioration in those of the first class, to persons not accustomed to the subject, might easily be mistaken for entire restoration.

After demonstrating the great distance that exists between *direct* and *indirect* hearing,—that is to say, between the faculty acquired by the deaf of understanding and repeating articulate sounds which are addressed to them, face to face, by the speaker; and the faculty of distinguishing, by the ear alone, similar sounds coming from different points,—of originating ideas, and expressing them in regular sentences; after pointing out the difficulties in attaining this last point, it is shewn that the *language of signs* is the only method of accomplishing this; therefore M. Itard recommends the patients being placed in an institution for this express purpose, where they may be taught exclusively the use of signs without speech.

CONCLUSION.

From what has been stated, it will appear that the acoustic organ is of a very delicate and complex nature, and liable to many lesions of its structure, as well as derangements of its function; it has been shewn how essentially the faculty of speech depends upon the sense of hearing; and also to what a melancholy extent that most afflictive dispensation of Providence, the deaf and dumb affection, exists. The various methods that have been adopted for the cure or alleviation of deafness have been enumerated, namely, surgical and medical treat-

ment, and mechanical contrivance, as well as the different plans that have been employed in the treatment of the deaf and dumb.

It was important to go into these details, that the reader might be put in possession of what has hitherto been the inefficient mode usually pursued, and that he might form a juster estimate of the improvements which I have had the honour to make in this highly important part of the art of healing. It will be readily perceived, that the pathology of the Eustachian tube has been in a particular manner dwelt upon; and this was considered important, as it was from duly considering that part of the organ, its various morbid affections, and the consequences necessarily resulting from its obstruction, producing temporary, and, if not relieved by proper means, permanent deafness, that I was led to the adoption of a most important improvement in the mode of treating deafness in the early years of childhood. It must be allowed, that the continued and regular use of emetics in deafness is one of the most important practical discoveries in the treatment of diseases of the ear: the cases given afford ample proof of the efficacy of the method.

In all cases of obstruction of the Eustachian tube, from whatever cause, emetics have a decided advantage over other remedies. In no case do I approve of the operation of puncturing the tympanum, injecting the Eustachian tube, or, in fact, any operation, until the emetics have been fairly tried; and with respect to the operation of injecting the tube, it is often troublesome, uncertain, and may even, where it fails, increase the incurability of the disease. The

safest practice, however, is that which I have pointed out; and it will also be found most successful, as I have experienced; for I may observe, that it is not by theory that opinions are to be formed, but from daily practice and observation, as I am satisfied from constant opportunities of treating diseases of the ear in every form, to a greater extent than any other individual in this country; for, perhaps, it is not generally known, that the governors of the Royal Dispensary for Diseases of the Ear, in order to afford relief, have, with the most benevolent views, permitted all cases of deaf and dumb to be admitted without letters of recommendation. The advantage to myself, by increasing my experience, enables me to speak with confidence and decision in all diseases of this particular organ; and I trust it will not be arrogating too much, when it is considered, that since its establishment, upwards of 7950 patients have been admitted, under my care,* independently of what have occurred in my private practice.

The essential connexion that exists between hearing and speech, which has been shewn above, has been very much overlooked by parents, as well as by those under whose care the sufferers are placed; and thus, many individuals who might have been relieved have been allowed to remain in this most deplorable condition. It is to be hoped that the earliest attention will in future be paid to such cases, by parents and those who have the charge of children.

* Of which 3120 have been cured, and 2330 relieved.—Vide Clinical Report of the Institution.

It must appear evident, from a perusal of the cases which I have related in this Essay of the different kinds of deaf and dumb, and the successful manner in which they have been treated, that it is a matter of high importance to persevere in a steady manner, as, on this, much of the ultimate benefit essentially depends. The practitioner must not relax his exertions, although he may not for weeks be able to mark any decided amelioration: by a judicious modification of the treatment, as the respective cases may in their progress of cure require, and steady perseverance, many a valuable member may be added to society, who, from neglect, would be deprived of the blessings of social intercourse.

I have found no remedies so efficacious in cases of deaf and dumb as emetics, and blisters applied behind the ears, and kept gently discharging in the form of an issue: previously to employing these means, the ears should be well cleansed. The length of time for which it is requisite to continue the discharge from the blistered surface, must vary according to the peculiar circumstances of the case.

A defect in the faculty of hearing is frequently the cause of backwardness of speech in young children. Parents who find their children do not speak at the period when speech usually is developed, should not neglect to have the organ of hearing carefully and properly inspected. This want of hearing does not often arise from any organic or permanent defect, as I have stated in a former work. If the ears are completely syringed, and the other means employed which have been fully described, a sensible change will take place, and the children will very soon acquire their speech.

This is a sufficient inducement for early attention, and were it regularly paid, I flatter myself there would not be then found so many suffering from this malady. If the prejudice so long entertained in this country, that diseases of the ear are incurable, could be removed, and persons labouring under this defect would at an early period of the malady apply for relief, with the same alacrity as for other diseases, there cannot be a doubt but that the greater number of cases would be cured, by yielding to proper treatment; but one great source of error is, that parents are not sufficiently aware of the danger which is often connected with disease of the ear. Can any thing be more absurd than to suppose that a case in the second or third stage of the puriform discharge will recover without scientific aid? Besides this, when the near connexion of the ear and brain is considered, and the intercourse of the nerves and blood-vessels which takes place in all the organs of sense with the brain, there can be no doubt, that in all affections of this primary organ the adjacent parts become more or less affected, and take on the cerebral disease,—so that no cure of this kind can be completed without partaking of its original source.

My concluding observations, then, may be brought simply to this point:—1st, That it is the duty of the practitioner to use every means for the cure of the cases placed under his care, and to vary his plan of treatment according to circumstances, in order to attain his object; 2d, That if he should unfortunately fail, after trying every means which experience suggests, and a reasonable time has elapsed, then he



should endeavour to remedy the defect by the assistance of acoustic tubes, the most ingenious and scientific of which I have endeavoured to describe in another part of this work; but if disappointed in their assistance, and it should prove that neither by medicine nor the acoustic tubes can any relief be obtained—then, and not till then, do they become fit objects for an asylum. And even under such circumstances, cases should not be admitted indiscriminately, and without any examination, into these asylums, merely by a plurality of votes.

The opportunities of observing and treating diseases of the ear that have been afforded me by the Royal Dispensary,—an establishment which not only forms a school of instruction to the junior members of the profession, but which also furnishes a greater and a more diversified field of experience than falls to the lot of any other practitioner in this country,—enable me to speak with confidence as to the benefits which may be derived from the knowledge and practice of acoustic surgery.

THE END.

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