

**A probationary essay on the special pathology of the accessory organs of hearing : submitted ... to the examination of the Royal College of Surgeons of Edinburgh ... for admission ... / by James Mercer.**

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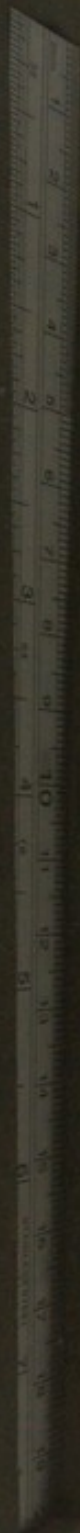
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PROBATIONARY EXAMINATION

ON THE

SPECIAL PATHOLOGY

OF THE

ACCESSORY ORGANS OF

STRUCTURE,

BY THE AUTHORITY OF THE PRESIDENT

TO THE EXAMINATION OF

Royal College of Surgeons

WHEN CANDIDATES

FOR ADMISSION INTO THEIR

IN CONSEQUENCE TO THEIR REGULATION

AND ORDERS OF EDUCATION

BY

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EDINBURGH:

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MILN.

*J. G. Bant*  
*M.D.*

A

PROBATIONARY ESSAY

ON THE

*from the*

SPECIAL PATHOLOGY

OF THE

ACCESSORY ORGANS OF HEARING ;

SUBMITTED,

BY THE AUTHORITY OF THE PRESIDENT AND HIS COUNCIL,

TO THE EXAMINATION OF THE

**Royal College of Surgeons of Edinburgh,**

WHEN CANDIDATE

FOR ADMISSION INTO THEIR BODY,

IN CONFORMITY TO THEIR REGULATIONS RESPECTING THE

ADMISSION OF ORDINARY FELLOWS.

BY

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PROBATIONARY TESTS

SPECIAL PATHOLOGY

FOR THE STUDY OF THE

ANATOMY OF THE

JAMES W. MASON, M.D.

NEW YORK

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TO

GEORGE LUND, Esq. M.D.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS, EDINBURGH.

AND

ROBERT PATERSON, Esq. M.D.

PHYSICIAN TO THE LEITH DISPENSARY.

DEAR SIRS,

*As the present may, perhaps, be the only opportunity which will ever be in my power of thus publicly testifying my gratitude for the innumerable obligations under which your kindnesses have laid me, I therefore dedicate this to you, as an act, no less of duty, than of friendship: And if this little remembrance can tell, that I have hitherto wanted the opportunities, not the will, of repaying these, I shall consider it as having fully executed its commission, remaining,*

MY DEAR FRIENDS,

*Ever sincerely yours,*

JAS. MERCER.

EDINBURGH, 28th August 1840.



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ON

## SPECIAL ACOUSTIC PATHOLOGY.

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OF all the subdivisions into which the science of General Pathology has been separated, there is none which has been less investigated, and of which less is positively known, than that to which belongs Special Acoustic Pathology. In carefully studying this branch of medical science as we find it treated in our various systematic works, as well as in the greater number of those treatises specially devoted to the investigation of the nature, causes, and treatment of the different forms of deafness, we are astonished at the very limited amount of information which their respective authors possess of their subject. Their nosological arrangements are loose and perplexing. Their ever recurring attempts to explain, upon principle without the possession of facts, the real nature of the morbid lesions, capable of producing the various forms of deafness, are vague and hypothetical;—the treatment which they recommend and adopt, consists in the application of numerous remedies, belonging to different classes of remedial agents, calculated to produce the most opposite therapeutic effects; and, as a natural consequence, their success has hitherto been so very limited, as to cause the regularly educated medical practitioner to become disgusted with the management of these diseases,—the treatment of which has fallen almost entirely into the hands of the ignorant charlatan.



This deficient state of our knowledge of Acoustic Diseases, appears to depend much on the mode of investigation which has hitherto been adopted, for the obtaining of a precise knowledge of their nature. Instead of endeavouring by those means which the natural formation of the accessory portions of the organ affords, in the obtaining of that most valuable of all indications for the treatment of diseased action—a positive diagnosis of the tissue which is affected, with the actual state of parts at the period of examination—too much trust has always been placed by the surgeon on the ever-fallacious subjective symptoms stated to him by the patient, without his having recourse to an ocular or manual examination of the different parts, and personally ascertaining what are the morbid changes which have been produced, and the mode of treatment most applicable to their successful removal.

The utility of Physical Diagnosis is well exemplified in the marked success which has attended the investigation and treatment of the diseases of the thoracic, and of some of the abdominal, viscera, by the introduction of percussion and auscultation. The same, indeed, may now be said in regard to the diseases of the uterine passages and the extremity of the intestinal canal. What a few years ago were looked upon as difficult and obscure classes of disease, can now, by the use of the speculum, be brought within the limits of the general principles of pathology and therapeutics; and their distinction and treatment have thereby become as easy and simple as any of those diseases which, occurring on the surface of the body, are under the immediate inspection of the physician.

Such a mode of examination has for a considerable number of years been spoken of in regard to acoustic diseases; but, till lately, its utility has never been urged with such confidence, as to attract the attention of the generality of the medical practitioners of this country.

Having been engaged for some time past in examining into the nature and treatment of these diseases, I found



myself very much assisted by its adoption ; and from the experience so obtained, I am convinced that it is perhaps the only means we shall ever possess, for enabling us to arrive at any thing like just conclusions regarding the morbid changes which take place in the more deeply seated parts of the External and Middle Accessory organs of hearing.

Those parts of the organ of hearing, which are placed *external to the labyrinth*, and which have been denominated by De Blainville and Breschet the *accessory organs of hearing*, are, from their situation, the most exposed to the influence of external agents, capable of producing a morbid action ; and as impairment of the function of hearing will most frequently be found connected with a morbid state of these structures, I propose, in the following pages, to attempt an investigation of their nature and treatment.

As this path of investigation, however, is very difficult, and comparatively untrodden, and as our knowledge of morbid anatomy can only be placed on a sure basis by having recourse to that assistance which a proper knowledge of normal structure affords, I shall divide my subject into three parts :

FIRST, The General Anatomy, Pathology, and Treatment of the diseases of the External Meatus.

SECOND, The Structure, Pathology, and Treatment of the diseases of the Membrana Tympani ; and,

THIRD, The Structure, relative Anatomy, Pathology, and Treatment of the diseases of the Cavity of the Tympanum and its appendages, especially the Eustachian Tube.

As the nature of this Essay forbids any lengthened disquisition, my remarks upon the anatomical structure of the parts must be brief and general, and I shall therefore only describe them in so far as they tend to the elucidation of the different pathological changes.

## PART I.

GENERAL ANATOMY, PATHOLOGY, AND TREATMENT OF THE  
DISEASES OF THE EXTERNAL MEATUS.

## SECTION I.—ANATOMICAL STRUCTURE OF THE MEATUS.

The Meatus Auditorius Externus is that portion of the *external accessory organ of hearing*, which extends between the base of the large cavity of the auricular cartilage—the Concha—externally, to the membrana tympani internally; by the interposition of which it is separated from the cavity of that name. In this situation it lies in the greater part of its extent between the articular condyle of the lower jaw, and the concave surface formed by the junction of the squamous and mastoid divisions of the temporal bone. It varies greatly in length, both individually, and in the different periods of life at which it may be examined. In the adult state, it is generally about one inch and a quarter in length; and viewed as a whole, it is of an oval form, its transverse diameter being about a quarter of an inch, while the perpendicular exceeds it by about two lines.

It runs in a very tortuous course from without, inwards. At first it passes forwards under the tragus, inclining at the same time a little upwards; it then turns rather abruptly in the opposite direction, backwards and downwards for a very short space; when it again turns forwards and downwards, and ends in a very oblique extremity,



which forms the periphery of the external wall of the cavity of the tympanum.

This obliquity of its termination is caused by the projection of its floor into the cavity of the tympanum, a little farther than its roof, so that the former is longer than the latter by about the tenth of an inch. Occupying the entire circumference of this part, we have a minute groove, which, in the recent state, lodges the periphery of the membrana tympani. In the fœtus, at full period of utero-gestation, this, the annulus membranæ tympani, is the only portion of the tube which is formed of bone, the rest being constituted of fibrous and fibro-cartilaginous tissue; but as age advances, this bony portion gradually increases in size and extent; until, in adult life, it equals in length the fibro-cartilaginous portion, and forms that distinct division of the temporal bone, the processus auditorius externus.

When the roof of the meatus has been removed, these different curves are seen to be (as above described) three in number; one external, which is considerably the largest in mean diameter; a middle, which is the shortest and narrowest; and an internal, which, though longest, is not equal in caliber with the external.

It is usually stated that the meatus is formed "partly of bone and partly of fibro-cartilage;" but when examined analytically, it shall be found that *five distinct elementary tissues enter into its formation*. The first of these is the *dermoid lining*, derived from the integument of the auricle; the second is the *glandular tissue* forming the Whartonian glands for the secretion of the cerumen; the third is the *triangular fibro-cartilage of the meatus*; the fourth, the *cellulo-fibrous tissue, seated at the upper and back part of the tube*, extending between the base of the concha and the surface of the root of the zygoma; and the fifth, is the *bony tissue formed by the processus auditorius*. For all useful purposes, however, we may arrange them under four heads; merging the cellulo-fibrous and the fibro-cartilaginous into one kind.



The dermoid tissue of the meatus is the prolongation of the integument covering the auricle, passing along the meatus, and applied on the external surface of the membrana tympani in the form of a cul-de-sac.

Regarding the real structure of this layer, some doubts have existed, as to whether it possesses all the elements of the true skin as seen on the surface of the body, or is merely a prolongation of its cuticular portion. Some anatomists (and I think rightly) maintain that it does contain all the elements of true skin, but modified in density, in consequence of being seated in a partially protected tube, and thereby appearing to obtain somewhat the appearance and partake of the function of a mucous membrane. Others again even go so far as to assert that we have another layer beneath the dermoid, and corresponding to a perichondrium and periosteum ; but this opinion is more theoretical than true.

From a careful examination of this lining of the meatus during spontaneous putrefaction, it would seem to me to be a membrane which, though containing all the elements of true skin and capable of being directly traced to it, appears, nevertheless, when considered physiologically, to perform the office of one of a compound structure, *resembling therein the lining membrane of the nasal and facial cavities* which belongs to that class of membranes denominated by Bichat the *fibro-mucous*.

This dermoid layer is, in some situations, extremely delicate in structure. This delicacy of structure is most conspicuous at its blind extremity, where it is in contact with, and covers the outer surface of, the true membrana tympani ; but, in the two outer thirds of the tube, we find it to be much thicker, and to have imbedded in its substance the ceruminous glands. Its whole internal surface is covered with numerous very fine hairs, excepting that part covering the membrana tympani. At the external part of the tube, they are thick and strong, and form a means of defence to the meatus against the entrance of insects.



*The small glands* may be said to represent the *second elementary tissue* of the meatus, which, though of trifling moment in respect to its anatomical structure, yet bear a degree of importance in the morbid state.

These bodies are from *one to two thousand* in number, and principally seated in the substance of the lining membrane of the floor of the middle curve of the tube. None of them are found in its inner portion.

The quantity of cerumen which they secrete varies according to circumstances. In its physical properties, it is of the consistence, colour, and appearance of soft soap. In chemical composition, it is principally formed of albumen, containing a small quantity of colouring matter, a few alkaline salts, and a strong aromatic oil, which gives it a peculiar and characteristic ammoniacal odour.

*The third elementary tissue of the meatus* is that which is formed of the *cellulo-fibrous and fibro-cartilaginous*. This tissue forms about the outer half of the tube; the fibro-cartilaginous portion being seated at its anterior and inferior part, immediately behind the condyle of the lower jaw, whilst the cellulo-fibrous is placed superiorly and posteriorly in front of the root of the zygoma. The cartilaginous portion consists of two parts, separated by a small fissure, the *fissura santorini*, beneath which we find a quantity of loose cellular tissue existing between it and the parotid gland. One extremity of the cartilage is attached to the rough extremity of the *processus auditorius*, while the other is in connection with the base of the *tragus*. The remainder of the tube is completed by the cellulo-fibrous tissue, extending between the base of the *concha* and the root of the zygoma. This latter part is the loosest of all the tissues of the tube; and we shall consequently find, when treating of its morbid states, that, when attacked by inflammation, the disease runs its course more rapidly, and is followed by effects more permanent, than those resulting from it in the other tissues of the tube.

*The fourth elementary tissue, is the osseous*, which forms



its greater part. This consists of two distinct portions of bone ; one placed anterior and inferior, and constituted of the processus auditorius ; and the other situated superior and posterior, and formed of the concave surface of the root of the zygoma. The length, course, and peculiarity in the termination of this portion of the tube, have been already mentioned, as well as the nature of the membrane which covers it.

Such are the different elementary tissues which enter into the formation of this accessory portion of the organ, and, in the description of them, I have confined myself to the enumeration of the most important facts connected with them.

The nosological arrangement of the diseases of this part will be founded upon them as a basis, and I shall thereby be better enabled to point out the peculiar effects which follow inflammation affecting either of them. This I consider to be the best method of classifying any set of diseases, for, unless the tissue which is affected, be taken into account, as well as the effects which are produced in it by disease, it will be impossible ever to understand those various morbid appearances which are continually presenting themselves during the progress of any disease.

## SECTION II.—PATHOLOGY OF THE DIFFERENT TISSUES OF THE EXTERNAL MEATUS.

Agreeably to the preceding arrangement of the tissues of the meatus into *four elementary kinds*, I shall also arrange its diseases into *four distinct forms*, according to the individual tissue which is involved.

The first elementary form of morbid action seen in connection with these tissues, is that of inflammation of the dermoid lining of the tube, assuming the appearance, and partaking of the nature, of diffuse inflammation of the cutaneous texture over the surface of the body, and receiv-



ing the name of Erysipelas. But, in using this term to designate the form of disease, in this tissue, I wish it to be distinctly understood, that *it is only applicable to that form of inflammation which affects it as a dermoid tissue, and not as a periosteal*. Considered in the latter sense, it exists as another form of disease.

If the morbid action, mentioned above, be confined to a part of the meatus where its tissue is comparatively loose, so as that one or other of its immediate effects be produced, then we shall have the second elementary form, *Phlegmonoid Inflammation*. The third form of morbid action is seated in the Whartonian glands, and constitute what has been denominated *Glandular Inflammation*. And the last is that form of inflammation which affects the lining membrane of the inner half of the meatus, *considered not as a dermoid tissue, but as a periosteum*. This form has been variously named by different authors, but without any fixed meaning being applied to the name so given. The most usual terms are, "Metastatic Inflammation," "Inflammation of the cellular membrane in the inner half of the meatus," and "Periosteal Inflammation." For the sake of expediency, I shall adopt the last designation, *with reference, however, to the meaning above expressed*.

This arrangement of the elementary forms of disease of the meatus, will be observed to be somewhat similar to that which has been proposed by Kramer of Berlin—with the exception, however, of the modification in the first and last forms, which I have adopted from the consideration of the structure and uses of the parts implicated in the diseased action; for, although the descriptions of this author are remarkably good and philosophical, still there is an occasional diffuseness and want of arrangement in them, which would lead one to suppose that he sometimes confounds the one with the other, and thus exposes himself to that criticism which he has dealt so unmercifully to all preceding authors. On the whole, however, his nosologi-



cal arrangement of these diseases, is the most scientific and correct in principle of any which has hitherto been published, and must have tended very much to raise them to a proper footing among the divisions of General Pathology.

DIVISION I.—ERYSIPELATOUS INFLAMMATION OF THE MEATUS,  
OR *DIFFUSE INFLAMMATION OF ITS LINING MEMBRANE CONSIDERED AS A DERMOID TISSUE.*

This form of inflammation is generally produced by the direct application of a current of cold air, or of cold water, to the surface of the meatus. It is sometimes also induced by mechanical injuries inflicted on the outer part of it, and not unfrequently by the injudicious use of strong stimulating injections thrown into it.

The symptoms which accompany it, are by no means prominent or severe, so little so, that it often happens the attention of the patient is not directly attracted to them, unless they be connected with some constitutional derangement produced by the same exciting cause. If, moreover, the patient has been previously labouring under an impaired sense of hearing, then his attention and anxiety regarding himself become increased, by the still greater diminution of that sense, occasioned by the newly excited action. The local symptoms complained of are, itching, more or less urgent, burning pain in the whole of the meatus, and a feeling as if the tube contained an object of larger diameter than its own—thus producing a feeling of distension within, and a dragging pain about the ear and over the whole corresponding side of the head. This symptom of distension, however, is not so prominent in this as in that form of inflammation of the membrane considered as a periosteum, and where the bony surface of the meatus is more or less affected; nevertheless its presence and severity may be often looked upon as indicative of the



extent and seat of the morbid action, and the effects which may be expected to result from it.

Along with these symptoms, the patient complains of various noises in the affected ear, a slight confusion of the head, and an impaired sense of hearing. These symptoms, however, are, more or less, present in all diseases of the ear, and can only indicate in a general manner that some part of the organ is the seat of a morbid action, without being sufficient to point out its nature or locality.

On inspection of the tube\* in this disease, it is, generally speaking, very sensitive, and bleeds on the slightest touch. The whole of its walls present a bright redness which appears to be quite superficial, and there is a little swelling and a slight diminution in the entire caliber of the tube. At the commencement of the disease, the ceruminous glands partaking of this general erethism have their secretion usually diminished, causing the interior of the tube to appear dry and parched: and if any ear-wax be found at the bottom of it, it is hard and inspissated; but if the morbid action has continued for any length of time, the ceruminous matter is found to be somewhat increased in quantity, and also slightly changed in its physical properties.

If the disease has continued for a few days before the examination has been made, the surface of the meatus will often be found to present a few small vesicles, of which some are still perfect, while others have burst and discharged their contents, which, concreting into small crusts, are apt to be removed by the patient incautiously rubbing the meatus, to allay the unpleasant itching which their presence occasions; and thus we sometimes also find a number of small abraded and ulcerating points. Most frequently, however, these latter appearances are not dis-

\* The description of the mode in which this is done, and of the instruments necessary for its performance, will come better under the section of the general treatment of the diseases of the meatus, to which part the reader is referred.



covered unless the disease be very acute, and seen shortly after its commencement. All that is usually observed on examination, is a very extensive desquamation of the cuticular layer of the membrane, which hangs down into the tube and becomes mixed up with the tenacious ear-wax, forming a hard substance which becomes firmly adherent to the walls of the meatus, and completely shuts it up. When this occurs, it proves a fruitful source of irritation to the recently inflamed membrane with which it is in contact; and if it be not speedily removed, the inflammatory action will be apt to extend itself into the surrounding softer tissues. This will give rise in these to such a degree of hypertrophy, as will press upon and induce a considerable diminution in the caliber of the tube, and constitute one of the forms of stricture of the meatus. This latter consequence, however, is most frequently the result of repeated attacks of acute erysipelatous inflammation of the meatus improperly treated; or when it has been complicated with the second form of inflammation, the phlegmonoid.

Along with this general erysipelatous inflammation of the tube, we very often find the *membrana tympani* alike affected from mere extension of the morbid action. If such be shewn, by examination, to be the case, we must look on the complication as being of greater importance than the elementary disease which it complicates; and in giving our prognosis of the latter, we must, to a great extent, be guided by the existence or absence of the former.

In the diagnosis of this form of morbid action, there is not much difficulty, provided we obtain a complete view of the affected parts. By adopting the proper means for this end, we may be enabled, in every instance, to distinguish this disease with great facility from all the others yet to be described. By remembering the progressive appearances of erysipelas on the surface of the body, and comparing them with those observed within the meatus, as above described, the analogy of the two diseases will at



once be seen ; and, as there is generally no abnormal discharge from the meatus, we can still be assured that no solution of continuity of surface exists in it, and that the morbid action is entirely confined to it.

The prognosis at first may be favourable in the greater number of cases ; but, unless we have been clear in our diagnosis that no complication exists in any of the other tissues, and appropriate remedies have been applied, it is apt to assume a more important and unfavourable character. In giving our decided opinion, therefore, we must be guided entirely by circumstances, taking into especial account the time during which the disease has already continued, and, above all, the state of parts presented on present examination.

DIVISION II.—PHLEGMONOID INFLAMMATION, OR *CIRCUMSCRIBED INFLAMMATION OF THE CELLULO-FIBROUS TISSUE OF THE MEATUS.*

Under this head I intend to include that form of inflammation of the meatus which is generally circumscribed, and attacks its cellulo-fibrous portion, or the loose cellular tissue which surrounds it. Of all the elementary forms of disease of the meatus, this is perhaps the least frequent, being generally found in childhood, and connected with the irritation of teething or some morbid action in the parotid gland, particularly in scrofulous constitutions.

When it occurs in adult life, the symptoms with which it is attended, are heavy, dragging, and beating pains in the meatus, which become gradually increased in severity, particularly during or after taking a meal, from the influence which the articulation of the lower jaw has in compressing the inflamed portion of the tube against the mastoid process. These pains sometimes become so violent as to cause great restlessness in the patient ; and if the disease be seen in children under such circumstances, the



constitutional irritation which is produced renders it much more formidable in appearance than it really is. After these symptoms have continued for two or three days, a *sudden discharge of a small quantity of purulent matter*, more or less tinged with blood, takes place from the tube, when they almost immediately subside and leave the patient in a more comfortable condition.

This description of symptoms, however, only applies to those cases where the inflammation is very severe, and affects a considerable part of the loose tissue of the meatus ; and, under such circumstances, it is very apt to be confounded in its symptoms, progress, and termination with those attending acute inflammation of the lining membrane of the tympanum. But when the inflammation is less severe and more limited in its extent, it is only attended with a slight tensive, dragging pain, a little heat, buzzing, and dulness of hearing in the ear affected, which continuing without any increase for a few days, a small quantity of pus is discharged from the meatus, when all these symptoms immediately vanish, and no more attention is ever directed to them by the patient.

On examining the meatus under the former circumstances, we will find it very painful on pressure, considerably swollen at one part, and almost entirely closed ; but if an abscess has previously been formed, and has discharged its contents, then we shall also find a small quantity of thin reddish muco-purulent fluid in the bottom of the meatus, the quantity of which may sometimes be increased at will by pressure externally round the base of the concha, or by depression of the lower jaw. Along with these local appearances, we shall generally find a diffuse erysipelatous blush extending along the whole of the meatus. In consequence of the swollen state of that tube, however, it is almost impossible, at first examination, to observe the condition of the membrana tympani, a circumstance which we have already stated to be of the greatest importance in



every form of acute inflammation of any of the tissues of the meatus.

The situation of the abscess will be most frequently found to be in the loose cellulo-fibrous tissue at the upper and back part of the meatus; and if the collection of matter be great, it will be apt, at the same time that it opens itself into the meatus, to cause absorption of the integument in the space between the concha and mastoid process, and thus a fistulous aperture will be established between the meatus and this part.

It sometimes, however, happens that the matter, instead of being formed in this situation, collects in the tissue between the parotid gland and the fibro-cartilage of the meatus, and being prevented from obtaining an exit for itself inferiorly or internally, gradually insinuates itself *through the fissura Santorini*, and opens by a small aperture into the floor of the middle curve of the meatus. This latter situation for the collection of the matter, is most apt to occur in scrofulous children during the shedding of the teeth, or when they are labouring under cynanche parotidea; and when it does collect here and is discharged in the manner just stated, its cause and origin are often difficult to be detected, unless great care be taken in the examination, and all the collateral symptoms and appearances be taken into account, for the discharge in such a case, though essentially purulent in its nature, often simulates a morbid ceruminous secretion occurring in the same habit of body; and the difficulty thence arising is still more increased by the fistulous aperture leading to the cavity of the abscess being seated deep within the floor of the meatus.

In the diagnosis of this form of disease, there are several circumstances connected with its symptoms, progress, mode of termination, and appearance of the discharge, which might lead us very easily to confound it with some of the other forms of disease occurring in this situation, viz., glandular and periosteal inflammation of the meatus, and



acute inflammation of the lining membrane of the cavity of the tympanum, followed by a profuse secretion of pus, which, producing a rupture in the membrana tympani, is discharged by the external meatus.

With the first of these—glandular inflammation—it may be confounded by the appearance of the discharge which takes place when the disease occurs in a person of scrofulous constitution; but by a little care in the examination of the meatus, as to the point whence the discharge comes, as well as by observing the changes which take place in its physical properties, according to the stage of the disease, there will be no great difficulty in drawing the distinction. That which is characteristic of the glandular inflammation, is a pure white or bluish-white creamy discharge, very much resembling what is seen in acute gonorrhœal vaginitis, and in simple glandular inflammation of the upper part of the vagina and cervix uteri. It should be remembered also, that, in glandular inflammation of the meatus, the discharge is seen covering two-thirds of its whole surface, and coming in increased quantity from no particular point; whereas in phlegmonoid inflammation, we find it coming from one particular point, which is swollen and more or less ulcerated; and pressure applied externally in those situations already mentioned, will generally tend considerably to increase its quantity.

With the second form of disease above mentioned,—viz. the periosteal inflammation of the meatus—we may be still more apt to confound it; not only from the appearance of the discharge, but also from its symptoms, progress, and termination. The discharge, in both cases, is essentially purulent; but in the phlegmonoid inflammation, it is usually more profuse and homogeneous, and has little or no smell. In the periosteal, however, where the quantity is generally small, it often contains, after a short time, a number of gritty particles, consisting of minute exfoliations of the osseous portion of the tube mixed with the discharge, which always evolves a fetid, sulphureous smell, similar to



that of a purulent discharge from a bone in a state of caries. In its symptoms, progress, and termination, it may be also distinguished from the periosteal inflammation by their comparative mildness, and their rapid course and termination; but these diseases can only be positively distinguished from each other by an actual examination of the meatus.

The phlegmonoid form of inflammation is found localised, and having all its peculiar concomitant appearances visible in the outer part of the tube; whereas in the periosteal inflammation, they are found much more deeply seated, and always connected with a carious state of the osseous surface of the tube, which can be easily detected by the use of a fine silver probe slightly bent at its point.

From acute inflammation of the lining membrane of the tympanum, it is often to be distinguished with difficulty, but by taking into consideration the comparative mildness of the symptoms, as well as those peculiar local circumstances which attend this form of disease (and which, to prevent unnecessary repetition, I shall defer describing till I come to treat of it specially in the third part of this Essay), we may obtain very readily an exact diagnosis regarding the nature of the disease which engages our attention.

The prognosis of this affection, as already stated in regard to the erysipelatous form of inflammation, may generally be favourable, even from the first; provided we have no constitutional peculiarities present to render it more severe, or that it be not connected with any morbid action in the deeper seated tissues of the tube, particularly the *membrana tympani*. In the former case, we must be guided by the past and present state of the health of the patient; and in the latter, we must entirely depend on our own diagnosis and examination of the meatus, before we can state whether or not the function of hearing will be impaired consequently on the disease under consideration.



DIVISION III.—INFLAMMATION OF THE GLANDULAR TISSUE OF THE MEATUS.

The third elementary form of disease in the tissues of the meatus, is that of inflammation of the glandular tissue, forming the Whartonian glands. From the appearance of the discharge which accompanies it, various terms have been applied to it by different authors—such as “Simple Otorrhœa” and Catarrhal Inflammation of the meatus; but all these are merely subjective terms, without any special reference to the particular tissue in which the morbid action takes place.

The most usual period of life at which it is seen is in infancy and childhood, during the first and second dentition. It then occurs most frequently in its simple and idiopathic form, whilst at the other periods of life it is generally seen connected with some of the other elementary forms already described, and particularly with the erysipelatous.

The symptoms which accompany it are very similar to those already enumerated, as attending the erysipelatous inflammation of the meatus; with these exceptions, that the pruritus which attends the former is more intolerable than in the latter, in which it does not bear a very prominent appearance; and in consequence of its exciting cause being often connected with a slight degree of gastro-enteritis, resulting from the irritation in the gums, we usually have the constitutional symptoms bearing a more prominent part in the early stage of the glandular than in the erysipelatous inflammation.

On examination of the meatus, if the disease be extensive and acute, and affecting the entire glandular tissue, we usually find that its walls are very much swollen, and this, indeed, sometimes to so great an extent, that it will be difficult to introduce a common silver probe along the passage, without inflicting intense pain on the patient. The



surface of the tumefaction is usually of a pale appearance, unless it be connected with erysipelatous inflammation, when it is of a deep red colour. During the first part of the disease, the secretion of ear-wax is entirely suspended, but within a few days after its commencement a very profuse discharge takes place, at first transparent in appearance, and resembling simple mucus. This, however, is soon changed to an opaque, dirty-white, or yellowish-green coloured fluid, sometimes streaked with a small quantity of blood, and possessing a very strong disagreeable ammoniacal odour, which is quite characteristic of the nature of the disease.

This discharge, dropping continually from the tube, and diffusing itself over the cheek, soon becomes inspissated, and leaves upon the surface a tenacious, dry, greenish crust, which being incautiously rubbed away by the patient, often produces a slight degree of erythema in and around the part, which state is kept up and increased by the continual discharge, unless this be checked by timely and appropriate remedies.

At some periods of the day, the discharge suddenly becomes more abundant than during the rest of it, and before this increased eruption, the child is usually more fretful and scratches incessantly at the ear. The cause of this periodicity of the discharge, is, that the secretion from the inner part of the tube becomes pent up by the swollen state of the external part, until it collects in sufficient quantity to force itself through the obstructing point. Under such circumstances, it will be evident, that unless active and speedy remedies be had recourse to, the membrana tympani may be forced to give way internally, and thus give rise to a severe complication of the primary disease. It has been denied by Kramer, that this disease "ever destroys the membrana typani, either by ulceration, resulting from pressure, or by immediate solution of continuity;" but I am inclined to look on this assertion as being too general in its application; and cases not unfre-



quently arise in practice where the integrity of the membrane is destroyed in the manner above stated, and which can easily be proved by the results of such cases, and careful examination of the meatus after the disease has been subdued.

The duration of this disease is quite indeterminate. When allowed to follow its natural course, the limitation of fourteen days has been given to it by Alard and Itard; but the length of time during which it may continue to run on, if not properly treated, will vary much, according to the effects which the acute stage of the disease has produced, and the peculiar nature of the constitution of the individual in whom it occurs. It often happens that the most prominent of the local symptoms subside, and nothing remains but a slight discharge, possessing the properties already stated, being only a little more transparent, and almost resembling pure mucus.

On examining the meatus under such circumstances, there may be observed at one or two points a few small granulations projecting into it of a bright red colour, moist, rough, and very sensitive, which, if touched incautiously, discharge a small quantity of blood. These elevations are the ceruminous glands in a state of chronic inflammation, with enlargement of their substance, in which state they still keep up the discharge, and will continue to do so for an indefinite length of time, if means be not adopted for their complete removal. To these appearances the name of *glandular polypi* has been applied; but this term is applied to them with very little justice, in consequence of their dissimilarity in structure to other forms of polypi of the meatus, which shall hereafter be described; and if permitted to designate them, I should suggest the simple term of Granulations, in consequence of their exact resemblance, both in form and structure, to those seen on the mucous surfaces of the lower eyelids, resulting from chronic inflammation with enlargement of the meibomian glands.



In the diagnosis of this disease, we must distinguish it from the phlegmonoid and periosteal forms of inflammation. In some instances, and particularly in those having the contents of the meatus discharged periodically, we must also distinguish it from acute inflammation of the tympanum. But with this latter disease it will not often be confounded, if its apparent course, connections, and premonitory symptoms, be taken into account.

From the phlegmonoid, as well as the periosteal inflammations, this disease may be distinguished by the extent of surface over which it is seen; the great and general tumefaction of the tube; the exposed situation in which it is principally found, and, above all, by the peculiar characters of the discharge, as already mentioned. By attending carefully to these, as well as to its apparent cause and accompaniments, no difficulty will in general be experienced in arriving at a proper conclusion, as to the exact nature and seat of the morbid action.

The prognosis may in general be favourable, even in the earlier stages of the disease, provided we find it extended over the whole surface of the meatus where the glands are usually situated. If, however, it occurs in a scrofulous person, and has continued for some time before being seen, we must look to the capabilities of the constitution for overcoming the local action, before incurring the danger of producing a new irritation in a more important part, by the removal of the morbid action, and the suppression of the discharge from the meatus. Under such circumstances the prognosis must be more guarded. But if the patient's health and constitution be good, there is not much to be dreaded in regard to the tendency and results of the disease; all that we have to fear being the permanently hypertrophied state of the glands projecting into the meatus, and impeding or modifying the transmission of the sonorous undulations to the membrana tympani; or a thickened state of the latter membrane, produced by the extension of the inflammation during the acute stage of the disease,



preventing it from being set into that state of oscillation, which is natural and necessary for the perfect performance of its function. In both these latter circumstances, a greater or less degree of deafness must follow the disease, which can only be removed along with the cause which produced it.

DIVISION IV.—INFLAMMATION OF THE LINING MEMBRANE OF THE MEATUS CONSIDERED AS A *PERIOSTEUM*, WITH CARIES OF THE PROCESSUS AUDITORIUS.

The last variety of idiopathic inflammation, which I shall describe in connection with the tissues of the external meatus, is that which affects its lining membrane *considered as a periosteum*, and which, for the purpose of expediency, has hitherto been denominated periosteal inflammation.

Of all these different forms of disease which have already been described, this appears to be the most frequent in adult life. And, although the opinion of Kramer is to the contrary, I must say, though with deference, that I am borne out in my opinion, by the cases which have come under my notice. This might, indeed, have been expected, when we consider the relative differences in the size of that portion of the tube in which it occurs at different ages. In the infant at birth, it consists only of a ring of bone, adapted to the reception of the membrana tympani; but as ossific development takes place, it is found in adult age to consist of a large and distinct process, of about three-fourths of an inch in length.

The causes which give rise to this form of inflammation, may be classed along with those which occasion the others, viz., cold, moisture, &c., applied to the surface of the meatus, mechanical injuries inflicted on the outer part of the tube, or the existence of an irritation in the immediate neighbourhood of the ear. The symptoms by which it is attended, when seen in its most acute form, and in its first



stage, are generally very severe. The patient then complains of deeply-seated, dragging, and tearing pains in the meatus, which extend themselves over the whole of the corresponding side of the head. This pain becomes much aggravated by any violent jerking motion of the lower upon the upper jaw, as in gnashing the teeth, or sudden closure of the mouth ; as also during the night, or on the application of any increased degree of warmth to the outer ear or side of the head. In a short time the pain generally assumes a beating character, and often comes on in paroxysms, which partake of the nature of otalgia. Along with these there is usually more or less heat in the bottom of the meatus, and considerable diminution in the power of hearing. After these symptoms have continued for a few days, the discharge of a small quantity of pus takes place from the meatus, when they diminish much in their severity. This discharge is at first of a yellowish-white appearance, and corresponds in nature and properties, as in colour, with those of healthy pus. In a few days it changes its appearance, consistency, and smell. Instead of having the previous yellowish-white colour, it becomes of a dark green, much thinner in consistency, and usually contains a number of small gritty particles, which, on elutriation, are shewn to be thin lamina of bone. And instead of having the sweet, mawkish smell of true pus, it assumes the rotten, sulphureous odour which is produced by a carious surface. Such a state of symptoms may continue for a very long period ; in some instances which I have seen, even for years, without the attention of the patient becoming particularly fixed on the state of his ears, until the loss of hearing on one or both sides is so great, that, being unable to follow his daily avocations, he applies for that relief which cannot be afforded him, and has the misery of knowing that his thoughtless procrastination will be attended with irremediable deafness.

On examining the meatus, the appearances will of course vary according to the stage of the disease and the length



of time which it may have continued. In the first stage there will be observed at the bottom of the meatus, a circumscribed tumour projecting into its cavity, and completely obscuring the membrana tympani. On this tumour being touched, the exquisite pain which is felt at once points out its nature. There is little or no tumefaction of the cellular or glandular tissue of the meatus, and but a slight degree of redness in the integument of the outer part of the tube.

If the disease, however, has continued for a few days longer, so that an abscess has formed and discharged its contents, then the appearances will be entirely changed. The bottom of the meatus will be filled with purulent matter, slightly tinged with blood, having a fetid smell, and sometimes turning a brightly polished silver probe to a dark brown colour. The swelling at its internal part will be seen to be of an elongated form extending towards the membrana tympani, the surface of which will be of a granular appearance and very vascular; and if the centre of this tumified spot be carefully examined with a slender bent probe, a small fistulous aperture will be found extending itself to the osseous structure of the meatus, the surface of which will be felt rough, and entirely denuded of its usual covering. As the disease goes on, small portions of the bone are discharged from time to time, and this occasionally continues to such an extent, that the whole of the bone forming the outer wall of the tympanum becomes gradually exfoliated, the membrana tympani destroyed, and its cavity thereby completely exposed.

Most frequently, however, it continues for a very long period in a chronic state of inflammation, occasionally becoming increased in its action on the application of any exciting cause, such as cold or moisture; and during the whole of this time, if the diseased action be placed near the membrana tympani, a gradual change takes place in its structure, which, even if the primary disease has been perfectly eradicated, will always continue in its abnormal



state, and permanent deafness, as already stated, will be the result, unless the patient choose to submit himself to those means of relief which shall be hereafter mentioned.

From what has already been stated regarding the diagnosis of the other elementary forms of disease of the meatus, it will be evident that the present requires to be distinguished by its symptoms and discharge, from the phlegmonoid and glandular inflammations of the meatus, as well as from the acute inflammation of the lining membrane of the tympanum.

From the former of these, it may be distinguished by the nature of the discharge, containing, as it usually does, small portions of exfoliated bone, and possessing the peculiar fetid smell of pus produced from a carious surface. And this distinction may be still further proved by examination of the meatus with the speculum and silver probe. By the one, we observe the extent and locality of the disease, and by the other, with a little care, the carious surface of the bony portion of the tube will be felt, which will at once point out the nature of the disease, and almost serve, in the absence of other means of diagnosis, to distinguish it from all the others. The same may be said in regard to the diagnosis between it and the acute tympanitis. If care be taken in examination, its cause, situation, and extent, will be exposed to view; and little difficulty will be encountered in separating it from any of the other forms of disease with which it may be confounded.

The prognosis will require to be more guarded in this, than in any of the diseases already spoken of, either in regard to the immediate results of the acute stage, or the ultimate results of the chronic. It will sometimes happen, that the severity of the premonitory symptoms, and the tendency to the extension of the morbid action, are such, that the membranes of the brain become affected and the death of the patient inevitable. This melancholy result is most apt to occur in scrofulous and cachectic constitutions; but in individuals of a healthy constitution, we shall most



frequently find that the morbid action resolves itself, slowly through a long period of time, or more speedily by the application of appropriate remedies, but in either case, it will be apt to leave such effects as will cause such a considerable loss of power in the special function of hearing. This loss of function is consequent on the change of structure induced in the membrana tympani, in consequence of its proximity to the morbid action in the meatus. And as this takes place to a greater or less extent in almost every case, we must modify our opinion accordingly, that "although the disease is capable of being entirely overcome, yet there must remain great doubts as to whether the entire power of hearing will ever be regained."

### SECTION III.—GENERAL AND SPECIAL TREATMENT OF THE DISEASES OF THE EXTERNAL MEATUS.

Preparatory to entering on the description of the treatment of these diseases, it will be necessary to mention in this place the artificial means which are within our reach for the examination of the meatus, as well as the manner in which such an examination must be conducted.

In consequence of the length and peculiar curves which exist in the meatus, the greater part of its extent, as well as the membrana tympani, are almost completely concealed, and can only be explored by such means as will tend to overcome these curves, and introduce a strong light along the passage.

In order to obtain such a view without the use of instruments, it will be necessary to place the head of the patient in the strong light of the sun, if it can be obtained, and with the auricle and external aperture of the tube in the direct axis of the uninterrupted rays. By grasping the upper and back part of the helix with the forefinger and thumb of one hand, and pulling, by its means, the entire auricle upwards and backwards, in the direction of the



vertex, and at the same time pulling it gently from the side of the head ; then placing the point of the forefinger of the other hand upon the tragus, and pushing it gently forwards, at the same time inclining the head of the patient strongly to the other side, thus exposing the canal to the bright sunshine, our object will be generally attained when the auditory passage and *membrana tympani* are sound. But when morbid changes have taken place in these parts, particularly in the tube, and its curvature is increased, while its caliber is diminished, some artificial means must be used to obviate these conditions, and convert it into a straight canal for the transmission of the rays of light to its further extremity.

Numerous forms of specula have been proposed from the time of Hildanus to the present period ; but I shall merely describe that which is proposed by Kramer, as being the simplest in construction, as well as the easiest in its application.

The description which that author gives of his instrument is the following:—"The essential part of the speculum is a metallic funnel, one inch and five lines long, divided longitudinally into two arms. The farther extremity of the funnel is of an almost cylindrical form, one line in diameter and several lines in length, so that it can be introduced with ease even into an unusually narrow meatus. Both halves of the funnel are united by their superior borders, at right angles, to two forcep-handles fastened by a joint. Pressure on these handles, when the funnel is introduced within the tube, opens it, the wide separation of which gives a commodious space for the sun's rays, for the eye, and for the instruments of the operator. The inner surface of the funnel should be painted, or rendered perfectly dull ; a polished surface reflects the incident luminous rays, and materially interferes with the examination."

The only remark which seems necessary, is in regard to the concluding direction to have the inner surface of the funnel rendered dull. This I have found to be of consider-



able importance ; for the first instrument of the kind which I had constructed, had its funnel formed of brightly polished Nickel silver ; and, when used with the strong rays of the sun, was found to have so many glittering points upon its surface, that the eye became completely dazzled, and, consequently, could not explore the more deeply seated parts of the tube.

In order to conduct the examination by means of this instrument, the patient must be placed on a stool near a window, towards which the affected ear should be directed ; and the examination should, if possible, be undertaken while the sun is shining brightly. The auricle is then to be drawn strongly up, in the manner already described, and the patient allowed to hold his mouth a little open, in order to free the external part of the auditory tube from the pressure which the muscles, forming the cheek and angles of the mouth, exert upon it. The speculum is then, with its funnel closed, introduced as far into the meatus as its width or sensibility will admit of, or as is required for the purpose of investigation. The handles of the instrument being at first directed downwards, should, when the funnel is fairly introduced, be carried across the cheek, in order to take advantage of the greatest diameter of the tube for expanding the arms of the funnel within it. The handles being now gently pressed together, cause the divided arms of the funnel to separate as far as the structure of the meatus will allow ; and the head of the patient being kept in the direction already indicated, the sun's rays will be transmitted directly to the bottom of the meatus, and sufficient room obtained to discover any diseased conditions which may exist therein.

No artificial illumination can equal or render this light unnecessary ; on which account it must always, where possible, be had recourse to. But if we are so situated, in consequence of atmospheric changes, or the situation of the apartment, that we cannot obtain this mode of illumination, then we must have recourse to artificial means,



Various forms of apparatus have been recommended and used for this purpose, all of them being based on the principles of increasing the intensity of the light, by the reflection and convergence of its rays.

Cleland was the first aurist who invented an apparatus, if it may be so called, for the artificial illumination of the meatus. It consisted of a convex lens, three inches in diameter, fixed in a handle, and held before a wax light. But this, it will be seen, could be of little use, in consequence of the few and feeble rays which could be transmitted through the object-glass.

Bozzini tried to improve this a little, and to increase its powers, by placing a concave mirror behind it. Deleau, with the view of still further improving it, had the light placed between two oblique, concave mirrors; but this might have been seen to be erroneous in principle, in consequence of a crossing of the rays reflected from the concave surfaces, and a total want of correspondence in the focal points. And Buchanan, wishing to take advantage of all these improvements, placed the light in the interior of a metallic globe, the surface of which was brightly polished.

The apparatus of Kramer is more powerful than any of these, in consequence of his adoption of the argand lamp as a light. This apparatus consists principally, of a square box constructed of tin plate, the inner surface of which is painted black, in order to prevent any reflection of the rays of light. In the centre of its floor is placed the argand lamp, with a thick cylindrical wick, the reservoir for oil being placed without and behind the box. A glass is placed over the lamp, and passes through an opening in the top, and at a convenient distance from the flame, and behind it, against the inside of the box, there is a plated concave mirror. In the anterior face of the box there is inserted a tin tube, fourteen inches in length, which is likewise blackened inside, and at each extremity, is provided with a double convex lens, two inches and a half in diameter. The luminous rays, thrown from this lamp, pass-



ing through the first convex lens, along the tube and through the second, are collected into a very bright focus of the size of a shilling, at about the distance of six inches from the extremity of the tin tube, placed in the anterior wall of the box.

The only objections to this lamp are its size, which renders it so far inconvenient, as that it cannot be used except on its stand ; and that, from the number of its pieces, it is not adapted for being moved about and being serviceable under every circumstance.

Instead of this, I have for some time past used a very simple, portable, and convenient lamp formed upon the same principles as that which is used in all the Metropolitan Police establishments of this country ; and appears to me to serve all the purposes and afford as efficient assistance, as the bulky and expensive lamp of Kramer.

For the relief of all these morbid actions, we must have recourse, in their acute, and very often in their chronic and more advanced stages, to those local remedies which belong to the antiphlogistic class ; and, as it will be unnecessary to enter into anything like a lengthened detail of each little point of practice, or even of all that has been recommended for their treatment, I shall only specify the modes of treatment, which, from a consideration of the pathological conditions already detailed, appear to be the most rational, and, as I have found from experience, the most successful, trusting that the judgment of the surgeon will at once point out to him the circumstances under which they may individually, be most appropriate or successful.

In all the acute forms of inflammation, therefore, it will be necessary to remove a greater or less quantity of blood, from the tissues which are affected. This is usually done either by the application of leeches, or cupping glasses, applied behind and beneath the mastoid process of the affected side ; either of which will generally be found successful in the reduction of the morbid action. But I have



found a still more rapid effect produced by the application of two to four leeches to the hollow of the concha and the outer part of the meatus, placing them as far within it, as they can possibly be got to adhere, by having the meatus previously washed out by the syringe and tepid water. By the application of only two leeches in this situation, and (after their removal) of warm fomentations, by means of a large sponge soaked in tepid water, and laid over the affected ear, the auricle of which should be kept in a horizontal position, as much blood may be obtained as would be discharged from three times their number applied on the outside. Besides this, the depletion takes place from the vessels of the part affected, which, being relieved suddenly of part of their contents, gives a much greater chance that the morbid action may be more speedily, and perhaps more effectually, checked, or at least prevented from producing any of its more important effects.

After a sufficient quantity of blood has been removed, very great relief will be obtained by the application of warmth, combined with moisture, to the outer part of the ear, the surfaces of the meatus, and the membrana tympani.

This may be done in three ways. First, by the application of a large linseed flour cataplasm, placed over the affected ear, and renewing it according to circumstances. But the great weight of this application, and the continued draining of the moisture from it along the neck of the patient, with its consequent evaporation, will be productive of so much inconvenience, that it is very difficult to persuade patients to allow it to remain for any length of time; they choosing rather to abide the results of a disease, which they too often look upon as of a trifling nature, to undergoing the inconvenience of the application, though required for its perfect and complete removal.

The second mode in which the same agency may be used, is in that, which has been lately denominated "the elegant substitute for the poultice," viz. lint soaked in



warm water, and applied over the part affected in the same manner as the poultice, and then covering this with a piece of oiled silk, to prevent the too rapid evaporation of the water. It is easier to persuade a patient to allow this to remain for a long time than the poultice ; but the complaint still made is the discomfort and coldness produced by the effusion of the water over the surface. It will, however, be more frequently tolerated by children, than the poultice, in consequence of its lightness, and the small degree of pain produced by its presence.

A modification of this method consists, in the use of a large sponge soaked in very warm water, and then compressed, so as to discharge the greater portion of its contents, but still leaving a small quantity with a considerable degree of heat. This being applied over the surface, and then covered over with oiled silk, combines all the soothing effects of the poultice or its substitute ; while, in consequence of not being so saturated as to permit any of its contents to escape, and from the greater convenience of its application, it will often be preferred by the patient to the other two modes already mentioned.

In regard to the medication of the fluid with opium, camphor, or other narcotic substances, I do not think that they are ever required. The objection to them is, that the extent of surface of the meatus being so small, the quantity of solid opium, or other narcotic to be used in the solution, ought to be very considerable, in order to produce any therapeutic effect ; and, if the alcoholic solution of any of them be used, in place of the substance, we shall only have the influence of the spirit upon the surface of the tube and the membrana tympani, which will be productive of more mischievous results to these parts than the disease itself.

There is still another mode for the application of heat and moisture to the meatus, which I have often used with the very best effects, and which, in so far as I know, has not hitherto been recommended in the treatment of dis-



eases of this part, viz. the application of water in the form of vapour. This is accomplished by means of the apparatus recommended by Dr Macartney of Dublin, in the local treatment of inflammation, following on injuries of the extremities. It consists of a metallic reservoir containing water, and having a funnel-shaped aperture, to which is attached one extremity of an oiled-silk tube, kept distended by means of small rings, while the other end is secured over the auricle. By means of a spirit-lamp, placed on a stand beneath the apparatus, the contents can always be kept at a temperature sufficient for the production of vapour; and, by the occasional renewal of the alcohol in the lamp, an uninterrupted evaporation of the water will take place, which, as it arises, passes along the tube, and is applied directly to the entire auricle and the interior of the meatus, without coming in contact with any other part. The effects which follow its application are soothing and pleasant to the feelings of the patient; and the statement of Kramer, that "there is no disease of the ear that affords a rational indication for douches to the external meatus, whether of water or of vapour," is too general, and will not accord with the results of experience.

Along with these, if the disease be very acute, or of some standing, and counter-irritation, be deemed advisable as an accessory remedy, this should be done, either with the antimonial ointment rubbed over the mastoid process and behind the lower jaw, or by the use of vesication, by means of *Emp. cantharid.*, or the iron heated in water, such as used and recommended by Sir A. Carlisle. In regard to the antimonial ointment, I have found it of most benefit when the disease is in a chronic state. But if it be acute, and a more speedy and decided counter-irritation be required, then we must have recourse to vesication, and if this be wished for with speed as well as certainty, the preference ought to be given to the heated iron.

The application of this is very simple. It consists in taking a piece of bar-iron, suited in size, shape, and thick-



ness, to the part over which it is to be applied. This is to be placed between the folds of a piece of silk, which are to be brought to a point, for holding and applying it—on the surface of the iron, opposite to that which must be applied upon the skin.

Having thus secured the iron, it is to be suspended by the extremity of the silk, in a vessel of boiling water, for about the space of one minute, or until the iron will have acquired the temperature of the water. It is then withdrawn and applied rapidly, behind and beneath the mastoid process, and along the anterior edge of the sternomastoid muscle ; and retained firmly pressed on the skin for half a minute. It may then be removed, and a roll of cotton wadding secured on the place, by a perpendicular bandage over the head.

In less than half an hour afterwards, a bleb, equal in size to the surface of the iron employed, will be found fully distended with serum, and in a state of irritation as severe as would have been produced by the application of the *Emp. cantharid.* kept applied for the usual time ; but with this difference, that we can always depend on procuring a perfect and speedy vesication, whilst in using the *Emp. cantharid.*, we are too often placed at the discretion of the apothecary.

The pain attending its application is not very great, and even this may be rendered still less by defending the surrounding parts, and confining its influence to the part on which it is applied ; and the time which it lasts much shorter than that produced by the cantharides ; for, as soon as the cotton wadding begins to produce its usual effects, the pain entirely subsides, and resembles in its nature that which follows an accidental scald.\*

\* Since this sheet was put to press, I have observed, in the July No. of the *Med. Chir. Review*, a notice, taken from the *Journal des Connoissances Medico-Chirurgicales*, of a similar, and I should say, "a more handy method" of applying heat as a vesicant, and which is stated by the author, M. Trousseau, to be in very general use in France, and known under



Along with these remedies of local action, there is another class which must be mentioned, viz. stimulant, or astringent injections, or ointments. Although they have long, and perhaps still continue to hold the most prominent part in the treatment of acoustic diseases, I am inclined to believe, that, with the exception of one or two of the most simple (and even in the application of these the utmost care is necessary), I do not think them at all worthy of that confidence which is generally reposed in them. When used in an indiscriminate manner, they absolutely do more harm than good ; and I have often seen more destruction of parts produced by them than by the diseased action itself. Nay, what is still worse, they are often the cause of serious change of structure in the tissues of the meatus, without there having been any morbid action in existence previous to their application.

When, however, from a careful examination and collation of symptoms, they may be deemed necessary as adjuvants to the other remedies employed, they ought to be of the mildest description, and applied in the manner which shall be pointed out when mentioning the treatment adapted to the individual diseases of the meatus ; but in every such case, we must rather trust to the influence of those more powerful remedies already mentioned, than on them. But, while thus expressing my opinion so strongly against their general use, I by no means wish it to be inferred, that they ought to be completely expelled from the treatment of the diseases of the meatus, to which only they can be applied. On the contrary, I believe that, if judiciously applied, they will often be of great assistance to the other means employed, and sometimes even the most important, provided our diagnosis be perfect. But I rather express myself thus against their daily and indiscriminate use, from the conviction already stated, that there is more harm done

the appellation of M. MAYOR's *hammer*. " It consists in simply immersing the iron part of a common hammer in water boiling on the fire for a minute or two, and then applying its round disk on the part which we wish to vesicate."



by their application than is generally believed ; and I have often been called on to relieve a morbid action produced by them, and not by the operation of natural and unavoidable causes.

In the special treatment of these different forms of inflammation, I shall briefly allude to those means which will generally be found most beneficial, and most consistent with those principles of therapeutics which guide us in the treatment of diseases in other parts of the body.

In the acute erysipelatous inflammation, we ought, in the first place, to apply a few leeches within the meatus, in the manner already mentioned, and continue the depletion afterwards, by means of the vapour douche, or lint and water poultice, or sponge. These should be repeated according to circumstances, and if there be any constitutional irritation present at the same time, it must be treated according to circumstances, as the judgment of the practitioner will point out.

If it also be connected with an increased ceruminous discharge, as indeed is often the case, then great benefit has been found from the use of a weak solution of the acetate of lead, or sulph. alum. et potassæ, in the proportion of 1 to 4 gr. to 1  $\frac{3}{4}$  of aq. rosæ ; applied to the interior of the tube, several times in the day, by means of a camel hair pencil ; endeavouring, if possible, to confine its application to the part affected.

Whenever any of these substances are used, we must remember to have the meatus carefully syringed out, at least twice a-day, as a point of cleanliness ; for the acidifying principle of salt coagulates the albuminous matter of the discharge from the ceruminous glands, and forms a number of thick, viscid, caseous masses, which adhere to the walls of the tube, and tend to keep up the irritation which already exists. Tepid water or a mixture of equal parts of milk and water should be used for this purpose, and it should be carefully thrown in, by a common ear syringe having a bulbous or button point.

We sometimes find a diseased action in its more chronic



form, producing a general, and sometimes extensive, thickening of the dermoid layer of the meatus, with extensive desquamation of its cuticular portion, and causing considerable diminution in the caliber of the tube, and dulness of hearing. Under such circumstances, Mr Earle practised and recommended the application of the solid nitrate of silver to the desquamating surface, as well as the injection of a very strong solution of it, for the purpose of causing complete desquamation of the cuticle of the meatus, and changing the action in the substance of the corium. He succeeded in two instances by the latter mode, but it is one which appears to me to be very hazardous in its results upon the membrana tympani; and if the same effects be in any case desired, they should be obtained by the application of the solid nitrate to the part affected, which can always be done through the medium of the speculum.

In the acute form and first stages of the phlegmonoid inflammation, we must have recourse to the same means as in regard to the erysipelatous, viz. leeching the meatus, and subsequent application of warmth; but if a collection of matter has formed and become discharged, then we shall often find, that, besides these, the application of an astringent solution will be of considerable benefit, not only in abating the discharge, but also in preventing the margins of the ulcer from granulating, and projecting themselves into the meatus, in the form of polypi. Sometimes also the application of the solid nitrate of silver will be of still greater advantage; but in every case let it be applied only to the part affected, and not to the whole meatus.

The astringents generally used, are those already mentioned, viz. *acetas plumbi* or *sulph. alum. et pot*; the strength of the solution varying of course according to the stage of the disease. This disease generally runs its course rapidly, and will not often require the aid of blisters; but if they be deemed necessary, any of the modes which have been recommended may be used. If it take place in children, the antimonial ointment should be pre-



ferred, on account of the great irritability and vascularity of the skin at this period predisposing to the supervention of erysipelas, with its worst effects, after the application of a vesicant to its surface.

As already stated, the granulations from the margins of the ulcerating surface sometimes become very much enlarged, and project into the cavity of the meatus in the form of polypoid tumours, which require a special mode of treatment; but, as I shall have to treat of this subject under a distinct head, I defer farther description till I come to it, and only allude to the subject in this place, to point out that such tumours are sometimes connected with an ulcerating surface, and can be distinctly traced to inflammatory action in some part of the tube.

In the glandular form of inflammation, besides these remedies of local action, we shall very often require to call in the aid of general remedies, in consequence of the peculiar nature of the constitution in which it most frequently occurs. The individual remedies which must be employed under these circumstances, must of course vary according to the complications which may be present; but there is one thing which must always be attended to, the *removal of every source of irritation existing in the gums*. I have often seen the disease subside rapidly, after the scarification of the gums, or the protrusion of the teeth through their substance; and in every instance of this disease in children, the state of the mouth and gums ought to be most scrupulously attended to.

The most beneficial of the remedies of local action, is the acetate of lead. This salt, when in solution, and introduced gently into the ear, has very great influence in alleviating the inflammation, and checking the profuseness of the discharge; but it should always be remembered, that in this disease, where there is a very considerable discharge, its albuminous particles, coagulated by the action of the salt, may collect at the inner part of the tube, and, unless removed by the frequent use of the syringe, will produce a



mechanical impediment to the hearing ; and that, in this disease, there is more necessity for frequent ablutions of the meatus, than in any other which is incidental to it.

If the glandular bodies become much enlarged by a long continuance of the inflammatory action, they form what have been already denominated *granulations of the meatus*, being quite distinct from the polypi last described. In their treatment, the best remedies are, either the application of the solid nitrate of silver to their surface alone, or a very strong solution of acet. plumbi or sulph. alum. et potassæ, applied by means of a hair pencil. By the frequent use of these, particularly the latter two, which are preferable, they are speedily reduced in size, and brought to their normal state, when the continuance of either of them, in a very weak form, will completely remove the morbid action. But in some instances, in consequence of the structure of the glands being destroyed by the remedies, little or no cerumen will be secreted, and a slight degree of deafness may be consequent. This, however, may be partially overcome by the lubrication of the meatus with almond oil or spermaceti ointment for some time, and if circumstances appear favourable, a small quantity of ungt. nit. hydrarg. may be applied ; but its effects should be carefully watched, lest it produce a slight erethism in the other parts of the tube.

It very often happens, particularly in aged individuals, that the quantity of the secretion becomes somewhat changed in its properties. Instead of being secreted in its almost fluid form, it is of a thick, viscid, and plastic consistence, which, adhering to the curves of the tube, becomes so much inspissated as to form a hard dry and solid mass ; and in some instances, where I have removed it after it had been for two years in the tube, on being cut, it grated against the edge of the knife like a piece of chalk.

When such a collection of cerumen exists, it forms a complete barrier to the introduction of any sonorous vibrations, and almost perfect deafness ensues. And it some-



times happens where the mass becomes suddenly disjoined from the walls of the meatus, and other circumstances concur, it is ejected from it ; when the sudden accession of perfect hearing is so complete, that the sensation is described by the patient as similar to the report of a large gun, or a peal of thunder. On examining the meatus when thus impacted with cerumen, its detection can very easily be made. At the extremity of the speculum, in the middle, and sometimes even in the first curve of the tube, a dark brown, dry, and opake mass is observed, which, on being touched, produces no uneasiness to the patient ; and on questioning him, he will state, that no ear-wax had been discharged from his ears for a considerable time, and that his deafness has come on very gradually, unconnected with any pain or discharge from the meatus. The removal of this is very easily effected by repeated syringing with tepid water, containing a little brown soap in solution, as recommended by Dr Haygarth ; and if time be afforded, a great deal of trouble may be saved by introducing, some time before syringing, a few drops of almond oil, which tends to separate the mass from the walls of the tube, and thereby favours the speedy ejection of it by the syringe. The surgeon must never be disheartened at the slow progress which he makes in effecting its removal, for it will sometimes occur, where it has been collecting and drying for years, that it will take several hours before he make a perfect cleansing out of both tubes ; but even with this sacrifice of time, he will always have the satisfaction of restoring the patient at once to a perfect state of hearing, and removing what had been supposed to be an incurable disease.

Whenever a complete removal of the ear-wax has been effected, a few drops of warmed almond oil should be introduced, and the entrance of the tube stopped with a small quantity of cotton wadding ; for the sensation produced by the removal of the ear-wax, and the sudden introduction of sound to the internal ear, is so peculiar, that the individual occasionally faints immediately afterwards, and for some



time is unable to bear the slightest noise. If there be any degree of redness seen in the meatus after being cleared, warm fomentations, or a very weak solution of the acetate of lead, should be applied ; and two or three drops of ol. amygdal. should be introduced night and morning, and the meatus syringed at least twice a-week, till the morbid qualities of the secretion become changed.

In the treatment of the *periosteal inflammation*, we must be more active in the application of our remedies than in any of the preceding. Leeching, fomentation, and counter-irritation behind the ears, should be applied rapidly after each other, and repeated as long as there are any indications for their use ; and, above all, we must keep the tube clean by frequent ablution. If the fetor of the discharge be great, then we should apply a weak solution of the chlorinated soda or Labarraque's solution, about  $\mathfrak{z}$ ss of the solution to the  $\mathfrak{z}$ j. of water, and increasing its strength according to circumstances. But if there be no great smell, then a strong solution of acetate of lead may be used, about  $\mathfrak{z}$ s. to  $\mathfrak{z}$ i. of Aq. Rosæ, and allowing it to be dropped into the ear, and retained for at least five minutes at a time. This should be repeated several times during the day ; and as in almost every instance of this form of inflammation there is more or less change of structure induced in the membrana tympani, with a consequent diminution in the power of hearing, there is nothing to dread from this substance being brought in contact with its surface.

If the margins of the dermoid layer surrounding the carious surface become elevated, they must be reduced by the application of the solid nitrate of silver, applied to their most prominent points by means of a slender curved caustic holder carried along the speculum, while the meatus is exposed to the bright light of the sun, so that the diseased spot can be distinctly seen and accurately reached with the caustic. If a spicula of bone make its appearance, it should be carefully removed, and as the exfoliations are



always of a small size, this can be easily done ; and no artificial means should ever be had recourse to, for the purpose of accelerating the process of exfoliation.

It sometimes occurs, as a sequence of repeated attacks of either of the three first forms of inflammation, that extensive effusion takes place, both into the substance of the lining membrane, and into the loose cellular tissue surrounding the outer part of the tube, which causes such a diminution of its caliber, as to prevent the entrance of sound to the membrana tympani. To such a state of parts the term Stricture of the meatus has been applied ; and, like the same affection occurring in other canals of the body, may be divided into *partial* and *general* stricture.

It will be unnecessary to notice very minutely here the differences between these various kinds of strictures ; because, looking upon them as modifications of each other, the above arrangement is only of use in their treatment. I may state, however, from what I have seen of them, that the partial form is generally consequent on the phlegmonoid inflammation ; whilst the general is usually the result of the erysipelatous and glandular inflammations.

In the treatment of such obstructions, recourse may be had, either to those remedies which will destroy and remove a portion of the surface of the strictured part, or to such mechanical means as will keep the tube in a state of distension ; the irritation which this produces, causing a slight degree of inflammation and consequent absorption of the effused fluid. Of the two, I should in almost every instance prefer the latter, which, although slow, is more sure and safe in its results.

If the former mode be adopted, we must be very careful in the application of the caustic, and endeavour to confine its action to the surface of the strictured part ; for, if this be not sufficiently attended to, we will undoubtedly produce more unpleasant consequences to the patient than the mere impediment produced by the presence of the stricture. After the application of the caustic, the mea-



tus must be repeatedly washed, and particularly after the destroyed cuticle has begun to come away ; and, as soon as the irritation produced by the first application has subsided, it must be repeatedly applied, in order to produce the desired effect. This must be kept up for a sufficient length of time, during the whole of which, great attention must be paid to the state of the meatus, lest one or other of the previous forms of inflammation be induced, which (if such should occur) would at once require the use of the remedy to be suspended, and its future application be had recourse to with greater caution.

If the second mode be adopted, it may be effected in several ways ; either by solid bougies of the proper size, by sponge tents, or by a hollow and conical silver tube. The last is preferable, because it affords all the therapeutic influence of the bougie or sponge tent, and at the same time gives relief to the patient while under treatment, an effect which cannot be accomplished by the use of the others.

The tube which I have used is a cup-shaped funnel, about an inch and a quarter in length, having one of its extremities small, and adapted to the size of the strictured meatus, while the other is large and expanded, and, when viewed entire, exactly corresponds to the funnel of the speculum. To the large extremity of this tube, a portion of stout watch-spring is attached, which extends upwards and backwards, to be fixed into an auricular pad, placed between the auricle and the convex surface of the squamous portion of the temporal bone ; being similar in shape to that which has been recommended by Buchanan, in the treatment of wounds of the auricle, or where it is flattened and compressed against the side of the head. These different pieces of the apparatus being adjusted, the auricular pad must first be placed behind the auricle, and the small extremity of the silver tube being then cautiously inserted, and fixed in the stricture, it is easily retained there by the elasticity of the spring. The whole appa-



tus, being properly applied, is fixed *in situ* by a silk strap passing around and over the head, and the whole being of small bulk, can be easily worn beneath the hat or bonnet of a lady without being seen.

Such is the relief which this instrument affords over the other modes generally used, that, after it has once been tried, the patient will not, on any consideration, exchange it. And I have even seen, where it had been employed in cases of torpid nervous deafness, that the ease and elegance with which it could be worn, induced the patient to lay aside the trumpet, or other mechanical means which she had previously used, and adopt it exclusively.

POLYPI OF THE TISSUES OF THE MEATUS, AND THE DETECTION AND REMOVAL OF FOREIGN BODIES FROM IT.

In connection with the pathology and treatment of these diseases of the meatus, there are other two conditions of this part which will require to be particularly noticed as separate subjects, viz. *Polypi of the Meatus*, and *The Detection and Removal of Foreign Bodies from it*.

I. *Polypi of the Meatus*.—Polypoid tumours, as they are usually seen within the external meatus, may be the result of a morbid action in three distinct situations. The first may arise from chronic inflammation of any of the tissues which enter into the formation of the meatus. The second may be connected with a similar state of the membrana tympani; and the third may be the result of chronic inflammation of the lining membrane of the walls of the tympanum, the cavity of which they first of all completely occupy, and afterwards extend themselves along the external meatus, and ultimately make their appearance at the entrance of the tube. The nature and treatment of the first of these varieties of polypi, I shall at present describe, along with the diseases of this division of the organ, reserving that of the other two until we treat of the diseases of those structures to which they specially belong.



Polypi, produced from the tissues of the meatus, may be divided into two kinds ; first, the soft, bleeding polypus, generally produced from the fibro-cartilaginous structure of the outer half of the tube ; and, secondly, the hard and almost cartilaginous polypus, produced from the lining membrane of its inner half.

Polypi arising from the external half of the tube, may be situated in any part of the parietes of this portion ; but they are most frequently found connected with the fibrous tissue at its superior and posterior part.

In form, they are generally pedunculated ; their surface being rough, irregular, and glistening, in consequence of being covered with a thin layer of mucus, which often becomes tinged with blood, when the slightest degree of violence is applied to the tumour. When protruded externally, numerous small bloodvessels are seen ramifying on its surface, giving it a dark red appearance ; and its sensibility is so great that any investigation of the meatus, to find out its attachments, is attended with a very great degree of pain, and often followed by considerable hæmorrhage.

Exclusive of more or less deafness, gradually increasing in severity, the symptoms are obscure, only indicating generally that a morbid action exists in some of the tissues of the meatus, although its presence may occasionally be inferred from the appearance of the discharge which issues from the tube, consisting of a clear transparent mucus, slightly streaked with blood, and without the least smell. Occasionally a slight hæmorrhage takes place when the auricle is violently rubbed by the hand ; from excessive movement at the temporo-maxillary articulation ; or the introduction of a finger point within the tube. Instead of being detected, it is generally allowed to continue increasing in size, unnoticed by the patient, until it makes its appearance at the external aperture of the tube.

The second variety of polypus produced from the tissues of the meatus, is that which derives its origin from the lining



membrane of the inner half of the tube, and which differs very considerably in its nature from that last described.

In structure, it is more dense, and almost cartilaginous, and usually has a broad, sessile base, occupying a considerable extent of the parietes of this portion, and giving rise to more or less diminution of the caliber of the tube. Its surface is comparatively smooth, pale, and almost insensible to the touch; and, unless connected with a chronic ulcer, from the margins of which it sometimes proceeds, it is unaccompanied by any discharge from the meatus. It is, therefore, attended by little or no uneasiness to the patient, by which its presence may be inferred, and the only complaint is a gradually increasing deafness, consequent on the contraction of the tube by the progressively increasing volume of the tumour.

In the treatment of these two varieties of polypi, it will be necessary, in the first place, to establish a diagnosis between them, which can always be done by an ocular inspection of the tube.

The first of these varieties—the soft vascular polypus—if within reach and pedunculated (which may be known by the possibility of passing a fine curved probe between the body of the tumour and the walls of the meatus, excepting the small space corresponding to the pedicle of the tumour), should be excised at once with a small knife, having a convex cutting edge of a few lines in length, or with very fine double curved scissors. If these be objected to, the base of the tumour may be noosed with a ligature of silk or horses' hair; and the circulation being thereby strangulated, will cause it to slough away. The mode of removal by excision is unquestionably the best, inasmuch as it gives little pain to the patient, and is very speedily done.

The twisting off the tumour by means of pronged forceps is the most severe, in consequence of the great pain which it inflicts on the patient, and the danger of subsequent hæmorrhage; but whatever mode be adopted for the removal



of the tumour, its base should be carefully destroyed with the nitrate of silver, or any mineral acid, applied immediately after its removal, and always remembering to confine the action of the caustic to the part effected.

If the tumour be so seated, and formed, that it cannot be excised or noosed, it must be treated by the daily application of the nitrate of silver in the solid form, and between each application, a strong solution of acet. plumbi should be dropped into the meatus, previously freed of its contents by the use of the syringe. In general, this, or the former mode of treatment, will succeed in removing these polypi completely; but it ought always to be remembered that they are extremely apt to grow again, and that very rapidly. It will, therefore, be necessary that the treatment be continued as long as there appears to be the slightest tendency to reproduction.

Scarification and incision of the body of the tumour have also been recommended, with the application of caustics to the open surface; but they are apt to be followed by bleeding, and often, after repeated applications, they have no effect in diminishing their size.

The treatment of the second variety, *the chondromatous polypi*, must be greatly influenced by the concomitant circumstances. If they be connected with, and produced by, ulceration of the osseous tissue of the tube, and inflammation exists within and around them, our endeavours ought to be directed to the removal of these conditions of parts, when it will often be found that the size of the tumour gradually diminishes along with the removal of its exciting cause. Leeches applied within the meatus; counter-irritation behind the ears, and kept up for a length of time; warm fomentations; or the occasional use of a mild astringent injection of acet. plumbi, should form the topical treatment; whilst, if there be any indication for general treatment, we must be guided by those principles which direct us in the treatment of caries of the meatus, consequent on inflammation of its periosteal lining.



In those comparatively rare cases which are not connected with ulceration of the meatus, the treatment will depend on the form of the tumour. Where it is pedunculated, it may be broken off without any unpleasant consequences. If it be sessile, and has a broad base, constituting what is called exostosis of the meatus, we may still attempt the reduction of its size, or at least prevent its further increase, if it be of a soft nature, by the scarification of its surface, followed by the application of the solid nitrate of silver to its most external part. Scarification may be more easily used in this variety, in consequence of its comparative insensibility and slight degree of vascularity. By the incision of its substance, the caustic has much more influence on its internal structure, and destruction and absorption of its substance will *sometimes* be produced, and the normal caliber of the meatus may be ultimately obtained. In many instances, however, of this form of polypi, much cannot be effected for the restoration of hearing, and the patient must submit to his fate of irremediable deafness, arising from the gradual obliteration of the cavity of the tube, and complete inclusion of the membrana tympani.

II. *Detection and removal of the foreign bodies from the meatus.*—Children, during their playful moments, often introduce foreign bodies of different kinds, so far within the meatus as to require the assistance of the surgeon for their extraction; and the safe and easy accomplishment of which will depend very much on the nature of the object so introduced, as well as on the anatomical knowledge and dexterity of the operator.

Of all the “emergencies” connected with acoustic surgery, this may be said to be the most important, not only as regards the ultimate safety of the patient, but also the reputation of the surgeon. It sometimes happens that children are presented for examination, where the parents positively declare that there is a foreign body in the mea-



tus, and the surgeon, trusting more to their assertions, than to the demonstrative evidence of his own senses, attempts the removal of that which he soon finds to his confusion not to be there.

The medical periodicals abound with such cases; but, as the limited extent of these pages forbids the insertion of aught which is not of primary importance, I can only here state the important fact, that, *of all the cases of acoustic disease to which the surgeon may be hastily summoned, there are none in which he ought to be more careful in his examination of the patient.*

When called to the treatment of such cases, there are several points respecting which the surgeon ought to make particular inquiries. In the first place, the length of time which has elapsed between the introduction of the substance and the examination. Secondly, the probable size, nature, and consistency of the foreign body. Thirdly, the conditions of its surface; whether smooth and polished, or rough, angular, and spiculated. And, Fourthly, the exact part of the tube which it occupies, and the relations of its diameters to those of the meatus—all which may be discovered by means of the speculum and a strong light. In every instance, it is of the utmost importance that the removal of the object be accomplished as speedily as possible after it is ascertained that it really does exist in the meatus; otherwise, if allowed to remain in connexion with the soft tissues of the tube, it will give rise to so severe a degree of inflammation, that the tumefaction will be so great, as entirely to prevent recourse being had to any immediate steps for its removal.

If there be no great degree of tumefaction of the meatus on examination, we may at once resort to those measures calculated to effect its removal.

As a general rule, the meatus should be carefully syringed with tepid water, the injection being continued for a considerable time. The use of this simple remedy tends, in the first place, to alleviate the present sufferings of the



patient, and thereby enable him to endure the after treatment, necessary for its extraction, with greater patience. And it will sometimes occur, that the stream of water from the syringe will, by insinuating itself between the object and the walls of the meatus, effect such a change in the relation of its diameters to those of the tube, as to cause a spontaneous dislodgment of it, without any further means being required for its removal.

If it be small, have a smooth surface, and be confined to the outer part of the tube, then we might naturally expect such a result to take place ; but if, on the contrary, it be large, angular, and deeply seated, and the diameters of the substance and passage do not correspond, it would be a physical impossibility for such a circumstance to occur. If the substance be large, and thence firmly impacted in the tube, and if its retention be attended with such a degree of inflammation and swelling of the external part of the meatus as will form an obstacle to its safe removal, our attention must be directed, in the first instance, to the relief of such circumstances, so long as no constitutional symptoms supervene to call for the adoption of more urgent measures.

For the accomplishment of these indications, we must trust to the influence of those local remedies, already recommended for the treatment of idiopathic inflammation of the soft tissues of the tube.

The ultimate removal of the object, by manual operation, may be accomplished by the use of a flattened silver probe, bent a few lines from its point ; or by the use of a small, strong, steel hook. In the application of these, the curves of the meatus should be diminished by drawing the auricle upwards and backwards towards the vertex, thereby converting it into a comparatively straight tube, having its axis directed a little forwards. The surgeon then introduces the curve of the probe, or the flat surface of the hook, between the object and the walls of the meatus, at any point where he observes the smallest space between them,



and directs the other end of the probe, or the handle of the hook, in such a direction downwards, as will enable him to obtain a secure hold of the substance. Then, with steady and careful traction, directed forwards and outwards, and at the same time, slight rotation from side to side, and from above downwards, the substance may be dragged into the large curve of the meatus, behind the tragus, when its complete removal may be very speedily accomplished.

Such a mode of operation will generally be found successful in the removal of all bodies having a rounded form, such as peas, beans, cherry or plum stones, glass beads, or any other substance, which possesses similar properties as to size and state of surface. But the case is materially changed for the worse, when the foreign body possesses a hard, dense structure, and an angular or spiculated form, such as that of a piece of slate pencil, small nail, or splinter of wood; and still more is the difficulty increased, if it be seated deep, in the inner half of the meatus, and placed in contact with the outer surface of the membrana tympani.

The class of substances just mentioned, when passed into the meatus, usually occupy this latter situation, as might naturally be expected when their cylindrical form and (when compared with the capacity of the tube) small diameters are remembered. They are, generally, introduced into the meatus in their long axis, by which means they slip easily along it, provided they be got within the first curve; and if the head be then inclined in such a way as will change their direction, or cause their long axis to be placed in the short diameter of the tube, they will become more or less impacted in this situation, and the firmness with which they are held will be increased by the rash attempts of the parents to extract them when first discovered.

For the extraction of this class of foreign bodies the best instrument is a pair of long forceps, the distance between the limbs of which, when shut, must be considerably smaller than the caliber of the meatus, in order that they



may be carried to the bottom of it, through the small end of the speculum. Their extremities should end in elongated flattened eyes, resembling, in miniature, the clams of the common long midwifery forceps.

In every instance, we should begin with syringing out the tube, after which we should make a careful examination in a strong light as to the direction of the object, and whether it be entangled in the soft tissues around it; at the same time its proximity to the membrana tympani should be noticed, otherwise, we may injure it during the dislodgment of the foreign body from its position.

From what has been already stated, regarding the manipulations necessary for the removal of bodies impacted in the outer half of the tube, it only remains to notice one or two circumstances which must be attended to, in their removal from a more obscure situation. These may be summed up in the following considerations:—*Firstly*, we must endeavour to remove them, by the aid of a strong light and speculum, along which the forceps must be passed. By the use of the speculum, the only elastic portion of the tube is kept in a state of complete distension by the operator himself, whilst his right hand is at perfect liberty, to regulate the movements of the forceps; *secondly*, we must insinuate the blades of the forceps, between the walls of the meatus and the narrowest diameter of the foreign body, endeavouring, if possible, to carry the entire blades of the forceps beyond it, without, however, using too much force, lest we push the object still deeper into the tube; and, *thirdly*, having securely grasped it, endeavour to alter its relative position with regard to the long diameter of the meatus, to which it must be adapted before it can be extracted with facility.

If it consist of a splinter of wood, or a piece of slate-pencil entangled in the tissues of the meatus, its division may be attempted by a pair of long-bladed scissors; but this should only be tried where we fail in rectifying its position.



It has been long recommended, and often practised in cases where much difficulty is experienced in the extraction of a foreign body, to increase the caliber of the meatus by division of the auricle and concha, at their superior and posterior part. If this mode of treatment be applicable in any case, it can only be where the substance is situated in the outer half of the tube; but from this situation we should always be able to remove it, by the adoption of more simple and cautious measures. In those cases where the substance is impacted in the inner half of the tube, the division of the auricle cannot be of the least service; for, as just stated, though we can by its adoption enlarge the capacity of the soft parts, we cannot in the least degree enlarge the osseous portion of the tube.

If much force be required for the removal of the object, we must expect a proportionate degree of inflammation to follow, which is most dangerous, when it attacks the membranes of the brain. This often occurs after such operations, and then the utmost care is required on the part of the practitioner, to prevent a fatal termination.

It sometimes happens, that an insect gets access to the bottom of the meatus, when comparatively free of its ear-wax; and the feelings which its presence produce are often very startling. In some instances delirium is even produced, and lasts for a considerable time. The removal of the insect is best accomplished by filling the meatus with *Ol. Amygdalæ*, slightly warmed. This will at once destroy its life, when, by the use of the syringe, it is easily washed out of the tube. If any unpleasant feeling remains, it may soon be removed by warm fomentations, aided by the internal exhibition of opium.



## PART II.

GENERAL ANATOMY, PATHOLOGY, AND TREATMENT OF THE  
DISEASES OF THE MEMBRANA TYMPANI.

## SECTION I.—ANATOMICAL STRUCTURE OF THE MEMBRANE.

The membrana tympani is situated at the bottom of the external auditory passage, between which and the cavity of the tympanum it is interposed like a partition. It is thin, semitransparent, glistening, and dry looking. Its shape is an oval, truncated at one extremity, the superior. Rather more than the upper half of its vertical diameter is traversed by the handle of the malleus, which, when the membrane is examined in the living subject, by means of the speculum auris, appears directed from above downwards and backwards.

When the roof of the tympanum and the external auditory passage have been removed, the membrane presents the following peculiarities. Its external surface is concave, and its internal correspondingly convex, the apex of its concavity is situated a little beneath, and either before or behind the centre,—very rarely indeed occupying the central part of it. When this is viewed in the living subject, along the external auditory passage, the umbilicus, or central depression of the membrane, is indicated by a small, opaque, pearly coloured speck, caused by the



insertion of the extreme point of the handle of the malleus, into the substance of the true or middle layer of the membrane. This concave condition of the external surface of the membrane, must be particularly remembered when examining into the morbid state of the various tissues external to it, as well as into those peculiar to itself; for, if the whole surface of the membrane be not acted on, by very strong and direct rays of light, the dimness and shade produced by this concavity, might lead the examiner to suppose that a perforation of the membrane existed. The internal surface of the membrane, is exactly the reverse of the external; and this peculiarity of disposition is entirely produced by the mode in which the handle of the malleus is attached to it. The latter being fixed in its whole length, to considerably more than the upper half of the vertical diameter of the membrane, and having an inward direction inferiorly, draws the membrane, as it were, along with it.

The longer diameter of the membrane, which is directed from above and behind downwards and forwards, is about eight-twentieths or two-fifths of an inch, and its shorter, that from behind forwards, somewhat less than seven-twentieths of an inch. It is fixed by its circumference, in the circular groove of the annulus tympanicus, already mentioned as being situated at the inner orifice of the osseous part of the meatus. And, as in the adult, this orifice is cut obliquely from behind forwards, from above downwards, and from without inwards, so is the direction of the membrane. Hence it forms, with the upper and anterior wall of the auditory passage, an obtuse angle, and with the lower and anterior wall, an acute angle.

Analytically considered, the *membrana tympani* consists of a proper membrane and two borrowed layers, one of which, covering the external surface of the middle or proper membrane, is a delicate continuation of the lining of the auditory passage, with which it forms a cul-de-sac; and the other, situated on the inner surface, is a continu-



ation of the membrane which gives a lining generally to the cavity of the tympanum. The latter is evidently of a compound structure, fibro-mucous, and adheres very closely to the proper membrane, whilst the former is not so intimately connected with it, readily separates from it by putrefaction, and can be drawn out along with the rest of the epidermis of the external auditory passage, in the form (as above mentioned) of a cul-de-sac.

As I have already treated of the structure of this external layer, it will be unnecessary further to mention it. I shall therefore proceed to describe particularly, the structure of the middle or proper and the internal layers.

The proper membrane can be divided into two layers, an outer, thin one,—consisting of radiating fibres,—and an inner one, thicker, and less distinctly fibrous, which, when torn, does indicate a fibrous structure; the fibres running in a direction opposite to the former. The radiating fibres run from the circumference towards the centre, to be fixed to the handle of the malleus along its whole extent. Towards the centre they become stronger, and being, of course, more aggregated, the layer which they compose is there thicker and more compact than towards the circumference. The fibres which cross the radiating ones are also more aggregated at the centre. They run parallel with the handle of the malleus, turn round its extremity, and become intimately attached to its point, and forming the small opaque spot, seen on the centre of the external surface of the membrane.

At the circumference of the proper membrane, there is a firm ligamentous or cartilaginous ring, which is fixed in the bone. This ligamentous ring appears to be formed by an aggregation of the circular fibres, interwoven with the peripheral extremities of the radiating ones. The part of the membrane, midway between its centre and circumference, is the thinnest, the inferior half being thinner than the superior. It is in this latter portion of it, that passive rupture of its fibres takes place, from the pressure



of matter, or of any other fluid collected within the cavity of the tympanum.

The radiating fibres have been supposed by Sir E. Home and others, to be muscular, but this opinion has not been confirmed by the microscopic observations of more recent anatomists; and it appears to me, from frequent observations of the part, both in man and in some of the mammalia, that this muscularity of appearance in the middle layer, depends much on the circumstances and conditions in which the membrane is examined.

The internal layer is merely a portion of the lining of the cavity of the tympanum, prolonged over the inner surface of the true membrane, to the greater part of which it is most intimately united, so that it is impossible to remove it by dissection or maceration from the true membrane, without at the same time bringing away the latter from its groove. There is one part, however, of the true membrane, where it is not so completely united, namely, the part opposed to the handle of the malleus, extending from the tip of the handle upwards to its head. Here the inner membrane passes over, and covers the handle, and sends also a prolongation from thence along the incus and stapes. At this point also, there is a free anastomosis of vessels, between the external and internal surfaces of the membrane, particularly at its superior part. At this latter part, where the lining membrane of the tympanum passes from the margins of the annulus tympanicus, on the one hand, to the membrana tympani, and on the other, over the head of the malleus, which it suspends, as it were, from the annulus tympanicus, and supports it against the membrana tympani, we have that particular tissue situated and formed, *which is sometimes described as a muscle or ligament of the head of the malleus*; but from having often examined it in the ear of the sheep, I look upon it *as only a reflexion of the mucous lining of the tympanum over the ossicula auditus, and containing between its layers a quantity of dense, reddish cellular tissue, which intervenes be-*



*tween the head of the malleus and the true membrana tympani, and forms the medium for the transmission of blood-vessels to and from the membrane and the small bones.*

In the human subject, this oblique vascular line, corresponding to the head, body, and handle of the malleus, is particularly well seen, in mild cases of inflammation of the membrane, which, if allowed to continue, usually produces an œdematous or granular condition of the outer surface of the true membrane, corresponding in size and shape to the parts already mentioned.

The external surface of the true membrane is much more vascular than the internal. The former being separated from the outer borrowed layer, by a small quantity of loose tissue, in which the vessels ramify; whilst the latter is much more intimately connected with the inner layer. Hence the peculiar granular appearance of the outer surface of the membrane, during the progress of inflammation of its structure, and the comparatively favourable termination of the disease when seated in this part; while, when seated in the inner surface of the membrane, and involving its inner layer, ulceration and perforation of it almost always occurs.

## SECTION II.—PATHOLOGY OF THE MEMBRANA TYMPANI.

The concealed situation of this membrane, has given rise to, and supported, the most erroneous and hypothetical views, regarding its morbid conditions; and it is only within the last few years, since the ocular examination of the state of the auditory passage in disease has been had recourse to, that the possibility of this membrane, suffering from an independent disease, has been admitted.

Willis, Duverney, Saissy, Leschevin, J. Frank, Reidel, Vering, and others, have all treated of its abnormal states in this manner, admitting only of a relaxation of the membrane, and displacement of it from its natural position, by



a sudden and loud sound falling on the ear. But it does not appear that they ever supposed that any derangement in the circulation of it could take place, and be followed by effects similar to those seen under such circumstances in the other tissues of the body.

Kramer is the first author whom I can find admitting of idiopathic disease in the membrane, and it is evident from his work, as indeed he states candidly and openly, that, under the influence of the views of the authors just mentioned, and before he had investigated the subject more perfectly for himself, he had also denied the possibility of the *membrana tympani* suffering from an independent morbid action.

From what I have seen of its morbid states, by careful examination by means of the *speculum auris* and a strong light, I am convinced that there is not a fact in the whole science of pathology better established than this, and that a perfect knowledge of it is of great practical importance, in regard to patients suffering from an impaired sense of hearing, from a diseased state of its tissues.

The morbid states to which the membrane is liable may be divided, for practical purposes, into acute and chronic inflammation, with their results; and as this membrane is one of the diaphanous tissues, it rarely or never becomes inflamed, without some change taking place in its structure, particularly as regards its density.

Anatomically considered, they may also be arranged into acute and chronic inflammation—these morbid states occurring both on the outer and inner surfaces of the true membrane. In the former case, the epidermoid layer and the loose cellular tissue on the outer surface will be principally affected; while in the latter the mucous lining, or internal borrowed layer, will be the principal seat of the disease. When the morbid action occurs on the outer surface of the true membrane, it will be followed by more or less œdema, and a granular state of the surface; and if in the internal, ulceration will more likely occur, in conse-



quence of the intimate union between the inner surface of the proper membrane and the internal borrowed layer. This arrangement, however, I merely allude to, intending to follow that which is of the most practical importance, and which I have first mentioned; and accordingly will now consider, first, the acute form, with its results—opacity and ulceration—and, secondly, the chronic form, with its results—hypertrophy and polypoid excrescences from its surface.

#### ACUTE INFLAMMATION OF THE MEMBRANE.

This disease is by no means rare, although it is not so frequently observed as the chronic form of inflammation. It is most frequently seen in the adult periods of life, as an idiopathic disease, and when it occurs in children, it is usually connected with, and produced by, the extension of some of those forms of disease in the auditory passage, which have been already described. The most frequent exciting cause is the sudden and intense application of cold to the outer surface of the membrane, although the influence of this agent is occasionally so insignificant in appearance, that the patients are not at all conscious of it, at the moment of its application. Drops, injections, and ointments of a stimulating kind, introduced within the meatus for the cure of its diseased states, frequently excite inflammation of the membrane, although not of the most violent kind; and in some instances, particularly in children, the first development of the disease, may be referred to the periods, at which the cutaneous efflorescence attendant on measles or scarlatina, has been transferred to the membrane, in consequence of imprudent exposure, or similar injurious causes, having interfered with the natural progress of these exanthemata.

The symptoms attending the acute inflammation of the membrane are, sudden, acute pains at the bottom of the meatus, accompanied by buzzings, as if an insect were lodged in or fluttering about the ear, and more or less



diminution in the power of hearing. These pains become much increased by any loud sounds coming suddenly on the ear, by pressure applied upon its outer part, and by variations in the temperature of the atmosphere. Occasionally, they take on an intermittent character, becoming unusually severe, for a minute or two only, when they suddenly subside, to be renewed after a short interval. It is this form of pain which is sometimes looked upon as simple otalgia, and in every instance where such occurs, a careful examination of the state of the membrane should be made, lest, instead of being a purely nervous affection, it may be produced by a severe form of inflammation of the inner surface of the membrane, which, in all likelihood, will run on to ulceration and perforation. I cannot, however, assent to the too general conclusion of Kramer, that the inflammatory character of otalgia has been entirely overlooked, especially in its slighter forms; and that, under the appellation of ear-ache, it has been subjected, most improperly, to a local irritating plan of treatment. I have seen several cases of simple ear-ache, at least so far as the nature of the pain could indicate, where, after careful and repeated examination of the membrana tympani by means of the speculum, not the slightest change could be detected in its appearance or circulation. I therefore agree entirely with Itard and Bennet, that there is a purely nervous form of otalgia, unconnected with any inflammation of the membrane. The opinion of the latter author bears well upon the subject. He says, "he cannot concur with Kramer in denying the existence of a nervous otalgia. The pain attendant on neuralgic affections of the face not unfrequently commences in the ear, and that this is of a nervous character, appears sufficiently proved, by its sudden accession and remission, *as well as by the undoubted neuralgic character of the succeeding affection*. It seems, indeed, almost inconceivable that the ear should be free from neuralgic affections, when other parts, supplied by the facial and fifth pair of nerves, are so constantly the seat of such complaints."



If these symptoms be mild and the patients take care of themselves, they not unfrequently disappear in a few days. If, however, the inflammation becomes more extended or of greater intensity, we sometimes have considerable irritation and a more or less distinctly marked fever. This, however, is by no means common, and when it does occur, it may easily be distinguished by its general and local characters, from that which attends the inflammation of the lining membrane of the tympanic cavity.

When the *membrana tympani* is examined with the speculum, under such circumstances, it will be found to have lost entirely its normal appearance. Its external surface is of a blood-red colour, very much thickened and irregularly swollen, looking as though it were covered with small glands, in some measure protuberant, and resembling the nodulated surface of a strawberry. Thick bundles of vessels are seen running across it, and the depressed spot, indicating the attachment of the handle of the malleus to it, is entirely obliterated. Its surface is glistening and covered with a thin, yet viscid, and sometimes sanious-looking fluid, which, however, does not often assume the characters of true pus, unless the disease in the membrane be connected with a solution of continuity in its immediate neighbourhood, and which is often the case when the disease occurs in childhood. Sometimes the discharge assumes all the appearances of blood; and I have even seen a discharge of pure blood take place from the engorged vessels to a considerable extent, followed by a great recession of all the previously existing symptoms. If it be allowed to run its own course, or be treated by stimulating injections, or if the inflammatory action be principally seated in the inner surface of the membrane, then ulceration and perforation will in all likelihood take place, and will be apt to extend, until the entire membrane be destroyed. When such an event occurs, it is generally found to take place, before and below the insertion of the handle of the malleus; and sometimes there are more aper-



tures than one. If the diseased action be checked in its ravages, those portions of the membrane which are not destroyed, but only reddened and thickened, are apt to have formed on them polypous growths of various sizes and appearances. If, on the contrary, the case be mild or properly treated, the fever and pains abate, the *tinnitus* diminishes, although the deafness actually increases, in consequence of the still more œdematous state of the membrane, which accompanies the subsidence of the inflammation, and which produces a sense of considerable fulness and weight in the ear. The redness of the membrane also disappears, together with the formerly apparent blood-vessels. The tumefaction and roughness of the surface of the membrane disappear, but its normal transparency is not regained for a considerable time; and in the worst forms of the disease it is never recovered at all, nor does the hearing in these cases ever obtain its natural acuteness and sensibility.

In the diagnosis of this disease, we must endeavour to distinguish its symptoms from those of the phlegmonoid, glandular, and periosteal inflammations of the meatus, and from the acute form of inflammation of the lining membrane of the tympanic cavity; but as it is exposed to view, on careful examination of the bottom of the meatus, we shall easily distinguish it from the three first of these diseases, and by attending to their distinctive marks, there will be no difficulty in at once forming the diagnosis.

From the acute inflammation of the lining of the tympanum, it may be distinguished by the greater mildness of symptoms, both locally and constitutionally, and chiefly by its being accompanied, from the commencement, by an evident morbid alteration of the membrane, which, in internal inflammation of the ear, in spite of the severity of the symptoms, are altogether wanting at the outset of the disease, and are only superadded during its progress,—that is to say, when the inflammation has seized the membrane



and a rupture of it is threatened, by the pus accumulated in the cavity of the tympanum.

We may also predicate the disease, by taking into account the nature of the symptoms, with the appearance of a bloody discharge from the external meatus; at least I have not seen this discharge of pure blood take place in any other disease connected with the meatus, excepting the inflammation of the membrana tympani; but we must never trust to any of these subjective or possible symptoms, and ocular inspection should always be had recourse to, in order to determine the state of parts.

The prognosis may be favourable, provided the disease be subjected to early treatment, and before it passes into ulceration, or gives rise to other diseases; although, even during the first period of the disease, opacity and thickening of the membrane may take place, and the hearing be thereby permanently injured. When ulceration takes place, and perforation of the membrane remains after the subsidence of the inflammation, nothing can be done to remedy this defect; and although this morbid state is not by any means followed by complete deafness, yet it is accompanied by more or less dulness of hearing, according to the extent of injury which the membrane has sustained, and according as it is confined solely to itself, or is attended by loss of the ossicula auditus, and other morbid changes in the cavity of the tympanum.

#### CHRONIC INFLAMMATION OF THE MEMBRANE.

This form of disease sometimes occurs as a sequence of a very acute attack of inflammation of the membrane; but most frequently it is merely the continuation, in a diminished degree, of a less violent and subacute form, and which may last even for years. The symptoms by which it is attended, are somewhat similar to those attending the mild forms of acute inflammation of the membrane; but occasionally, the only indication of its existence, is an un-



easiness and slight tickling or pricking pain in the bottom of the meatus, accompanied by a slightly increased ceruminous discharge, which is more transparent and viscid than usual. On examination of the meatus, the membrana tympani is observed to be reddened, either partially or throughout its whole surface, exhibiting every shade of red, from the palest to a deep brown.

The texture of the membrane seems thickened, its surface opaque, uneven, and irregularly swollen; and over it may be observed, a number of granulations of different sizes, and partaking of the general colour of the membrane. Sometimes they are soft, sensitive, and bleeding readily on being touched, and at other times, insensible, and possessing a cartilaginous structure. It is only, however, in very chronic cases, where this extensive change of structure takes place, but in the generality of cases, the membrane will be found under some of those conditions just mentioned. Sometimes also, if the disease be the result of a previous acute attack, perforation and greater or less destruction of the membrane will be found; and as the Eustachian tube is usually free from any disease, while this continues in its chronic state, forcible expiration on the part of the patient, having his mouth and nose carefully stopped, will cause the air to escape through the aperture in the membrane, with a whizzing noise, heard in the meatus.

With these organic alterations of the membrane, there is always associated a morbid secretion of a muco-purulent or muco-sanguineous character, the quantity and quality of which vary much at different times in the same cases, without any definite and constant relation existing between them and the organic alteration of the membrana tympani. The meatus is usually healthy (with the exception of an occasional chronic excitement in the ceruminous glands), proving very satisfactorily, that chronic inflammation of the membrana tympani is an idiopathic and independent affection, and, when viewed in connection with the evident



organic alterations of the membrane, cannot for a moment be mistaken.

The diagnosis may always be established by carefully cleansing out the meatus by syringing, and afterwards investigating it, by means of the speculum and the bright sunshine. At the same time, a fine probe may be used, for testing the sensibility or insensibility of the membrane, or the nature of the polypoid excrescences which may cover it. Should perforation of the membrane exist, it may be rendered evident by the means already mentioned ; but if this experiment fail, then by introducing the catheter into the Eustachian tube, as recommended by Kramer, and by it, directing a stream of air into the cavity of the tympanum from the air-press, in the manner hereafter to be described, the air will certainly pass up to the membrana tympani, and through the perforation in the membrane.

The prognosis in this form of the disease must always be unfavourable ; for, in consequence of the length of time which it has continued ere it be submitted to medical treatment, and the great thickening and increase of substance which will have taken place in the membrane, all efforts to diminish such, and to reduce it to nearly its normal thickness, will prove useless, and the patient must remain in the state in which he is found in regard to his hearing—the morbid action only being capable of removal—without a corresponding increase in the sense of hearing taking place.

In connection with the chronic form of inflammation of the membrana tympani, the second variety of polypus of the meatus may be described, viz. polypi produced from the structure of the membrana tympani.

As already stated, these productions are sometimes consequent on an acute attack of inflammation of the membrane, with perforation, and partial swelling and thickening of its surface, yet they are most frequently the result



of the chronic form of inflammation. These tumours are always produced from the outer surface of the true membrane, and the external or cuticular layer, and the loose cellular tissue intervening between them. In size, they vary much, sometimes being as small as lentil seeds, and appearing only as a small conical elevation on the surface. To these the term "granulations" has been applied, but in structure and situation they are entirely similar to the polypi, the primary form of which they constitute. At other times they are large, and rarely exceed two in number; and when only one exists, it projects by means of a footstalk, into the cavity of the meatus—along the passage of which it gradually extends itself, by increase of substance, until at length it makes its appearance at its external entrance. When of small size, and viewed *in situ*, by means of the speculum, they appear of a greyish-white or pale red appearance, being about the size of the section of a hemp seed; and if the product of a very chronic action, they are often of a hard cartilaginous consistence, and insensible on being touched with a probe. When in such a form, they are rarely or never attended with any discharge from the meatus, unless connected with a chronic inflammation of the other parts of the membrane. If these tumours be large, and projecting along the tube, they will be found occupying more or less of its cavity. When so large, they are usually of a soft consistence, very sensitive, and apt to bleed on being touched, and are of a dark red appearance, mottled on the surface with numerous small blue veins, and covered with a thin coating of mucus, sometimes streaked with blood. The irritation which their presence produces, is very similar to that attending the soft polypi of the tissues of the meatus, from which it is often very difficult to distinguish them even after a careful examination.

In the diagnosis of this disease, we must be entirely dependent on an ocular examination of the meatus, for the symptoms by which it is attended are by no means so well



marked, as to afford any positive indication of its presence. It often, when left to itself, lasts for years, or sometimes even during the entire lifetime of the patient, for nature does not often appear to make any efforts for its cure. By syringing out the meatus carefully, investigating it by means of the speculum and bright sunshine, and testing with the probe, the sensibility or insensibility of the thickened membrane, or of the polypoid excrescences which cover it, we should always be able to detect its nature. Should the perforation of the membrane not be evident, on looking at it in this way, we may always assure ourselves of it, by the means already mentioned, viz. by requesting the patient to endeavour to inflate the cavity of the tympanum, by blowing the nose forcibly, with the mouth and nostrils closed. If the air do not then pass along the Eustachian tube and inflate the tympanum, a stream of air should be directed towards it from the air-press, by means of the Eustachian catheter.

The prognosis in this form of disease must always be unfavourable, in regard to the hearing; and I have never seen a case, where it had existed for any length of time, without hypertrophy of the membrane to a great extent having taken place, which will, moreover, remain for the most part, after the inflammatory action has been removed. If perforation of the membrane exist along with it, our opinion must be similar to what we might express in regard to the acute form of inflammation; only we must be more doubtful in regard to the increase in the power of hearing, which the patient may obtain after the removal of the inflammatory action; for in this form of the disease, the hypertrophy which remains is always greater than in the acute.

In giving an opinion, therefore, there must be taken into account the length of time which the disease has previously existed, the actual state of the membrane as seen on ocular inspection, and the probable degree of thickening which will remain after its cure.

The slight degree of pain, which in some instances



accompanies its invasion, tends to explain the negligence with which the disease is treated by the patients, and even by their medical advisers ; while, in other cases, where pain is altogether absent, this neglect cannot be charged on any party, as the patients (when there is also absence of any discharge) have scarcely any conception of the existence of their malady. And thus it happens that by far the greater number of these patients do not seek for assistance, till the disease has become incurable from disorganisation of the membrane, or when their groundless confidence in the curative powers of nature has been proved to be idle and deceitful. But unfortunately, even then, patients do not often obtain the proper assistance which they seek. The necessary information is never at once imparted to them that their disease is incurable, and that any curative attempt to increase their hearing, is too often a fruitless undertaking. The state of the *membrana tympani* is not examined into ; the most acrid, spirituous injections are applied to it in a state of inflammation, or even ulceration, which can only tend to increase the evil ; and not only is the strength of the patient thereby destroyed, in the most unjustifiable way, but the hope of a cure, which had thus recklessly been excited, most wantonly destroyed.

In conclusion, therefore, I would state, that, of all the diseases of those tissues which can be seen as entering into the formation of the external auditory passage, as already described, there is none which produces greater changes in the function of hearing than this, and none where the application of remedies is attended with less success ; and, at the same time, I must state it here, as the result of my own experience, that it is that form of disease which is generally produced by the injurious nostrums of unprincipled pretenders to medical skill, who, instead of benefitting their patients by such applications, absolutely leave them in a worse condition than that in which they found them.



### SECTION III.—TREATMENT OF THE DISEASES OF THE MEMBRANA TYMPANI.

In the treatment of these diseases, it is of the utmost importance not to overlook their inflammatory character, as the introduction of opium and other narcotics, which would benefit the nervous otalgia, and with which the mild forms of the disease may be confounded, will here increase the morbid action. In slight cases, the protection of the ear against the cold air, by means of a light linen cap, confinement in the room to bad weather, and the application of warmth and moisture over that side of the head, will be generally successful in removing the disease. The more severe cases, however, require much more active treatment, in order to prevent the unpleasant consequences already mentioned. If the membrana tympani be very much inflamed and swollen, and the patient feverish, a dozen of leeches should be applied around the ear, and two or four within the concha, in the manner already recommended in the treatment of acute inflammations of the auditory passage. With these, blistering or rubbing the tartar emetic ointment behind the ear, should also be had recourse to.

If the acute disease should continue, notwithstanding the treatment, by which ulceration or extensive induration and thickening of the membrane are threatened, the timely and judicious use of mercury, carried to the extent of salivation, may be attended by the same happy results which are so conspicuous upon its administration in some forms of internal ophthalmia. In every instance cleanliness is of the utmost importance; the ear must be syringed out with tepid water, and repeated several times during the day, according to the quantity of matter secreted, for, without thoroughly cleansing the auditory passage, especially the bottom of it, from all adherent mucus, our other remedies will effect very little.



If the disease be attacked during the period of its first development, we may confidently reckon on effecting a radical cure, and preventing all the consequences to which it gives rise. But if the malady has already existed for a long time, there will remain, after the subsidence of the more acute symptoms, a chronic form of inflammation possessing all those appearances which have already been described; and which will be found to be much more obstinate in yielding to remedial means. In every instance where the membrane is much reddened, swollen, and granular, we should still adopt one or other of those remedies which have already been recommended for the treatment of the recent forms of the disease. But if it be found only slightly reddened, with considerable thickening and insensibility to touch, we may then use such means as are only calculated for the removal of the slight degree of inflammation which is present. For the accomplishment of this, the most marked advantage will be derived from the application of a solution of the acetate of lead, cold or tepid, dropped into the meatus four or six times a-day. The strength of the solution may be increased according to circumstances, from gr. i. to grs. x. to  $\zeta$ i. aq. rosæ, in which last case, the membrane will be covered with the fine powder of the salt, which is precipitated from the solution, and its action will be kept up so much longer. If the inflammatory excitement be very obstinate, besides the use of the drops, saline purgatives, and spare diet, an extensive pustular eruption should be brought out and kept up for a proper length of time, by means of the antimonial ointment.

Instead of the salts of lead, solutions of nit. argenti; sulph. zinci; sulph. cupri, aq. potassae, &c. have been recommended, but they will always be found to produce an irritable state of the lining of the meatus, and tend to keep up, or exacerbate, the morbid state of the membrana tympani. The acetate of lead, however, does not produce any such effects, while it removes in a very rapid manner the



inflammatory state of the membrane ; and there is no reason to think that, by its use, there will be a transference of the inflammatory action to the membrane or substance of the brain.

If polypoid growths be formed on the membrane, and if these have, as usually is the case, a short peduncle, they have been recommended to be excised by means of a delicate, double-edged knife, having a bent, sickle-shaped blade, and a blunt, rounded extremity. It has also been advised to noose them with a ligature, and after their removal in either way, to have their remains carefully touched with solid nit. argenti, as soon as the acute pains resulting from the operation will allow of such a procedure.

From the depth, however, at which the polypous growths are situated, it is seldom or never possible either to excise or ligature them ; which latter is of the less importance, as, from the dragging of the ligature, the membrane is very easily drawn forward and endangered. Neither can they be got at with very fine scissors or small hooked forceps, as, from the narrowness of the auditory passage, there is not room to open the instruments sufficiently wide.

A better procedure than any of these is, simply to scarify, very gently, the surface of the tumours, then touch the cut surfaces with a finely pointed portion of nitrate of silver, and afterwards trust to the astringent properties of a very strong solution of acet. plumbi. Indeed, the efficacy of the caustic is often surpassed by that of the acetate of lead ; and I have often observed these tumours, under the influence of this salt, shrivelled up and eradicated, with more certainty than could have been expected from any operation ; while the reproductive power of the root was more easily kept down.

If the tumours be small, of the size of lentil-seeds, they should be treated in the same manner as the roots of the large polypi ; but in every case their removal will be a matter of difficulty. When, moreover, they are of a whitish



colour, insensible to the touch, of a cartilaginous hardness, and have a broad base, any treatment of them must be vain, and the application of caustic directly prejudicial, as only tending to augment their growth.

Even where we succeed in eradicating the growth so completely, as to destroy the last remnants of them, and no destruction of the membrane has occurred, we cannot confidently expect complete restoration of the hearing, nor (in many cases) even a material improvement. For the development of polypi in the membrane gives rise to the morbid alterations in its structure, so important, that its power of transmitting sonorous vibrations to the ossicula auditus, remains for ever more or less impaired.

If the membrane be in such a morbid state, and if, in consequence, the hearing has become seriously impaired; there remains nothing for its improvement, but perforation of the membrane. Even in those cases, however, in which the operation is really indicated, it ought not to be had recourse to, except both ears are affected to the same extent, and suffer from a high degree of deafness; or, when the ear which is least diseased suffers from deafness, so incurable, that perforation of the diseased membrane affords the only chance of probable improvement. While, however, contemplating the performance of this operation, we must always remember "that the most careful investigation of the ear to be operated on, must have proved that it is suffering from no other morbid condition, by which the success of the operation would be rendered fruitless."

Sir Astley Cooper was the first surgeon who proposed and carried this operation into practice; but he imagined that it was especially indicated, only in cases where the Eustachian tube was closed, or where the cavity of the tympanum was filled with blood. He had no knowledge of catheterism of the Eustachian tube, and, consequently, his diagnosis of its closure was doubtful, viz. the inability of the patient to force air suddenly into the cavity of the



tympanum, by forcible expiration with the mouth and nose closed; the absence of any *tinnitus*; whilst the patient was still capable of hearing the ticking of a watch, when placed between his teeth, or in immediate contact with the bones of the head. By the two latter circumstances, he supposed himself justified in concluding the individual case not one of nervous deafness, but consequent on closure of the Eustachian tube, and thereby requiring perforation of the membrane for its relief.

Closure of the Eustachian tube is the only indication which Himly can see for perforation of the membrane; in simple hypertrophy of the membrane, he anticipates no good whatever from the operation. Itard is also of the same opinion regarding the indications for the operation; and, though he express himself somewhat more definitely than the authors above quoted, by making it dependent entirely on an "invincible obstruction" of the Eustachian tube, yet he also fails in ascertaining whether the obstruction be really such as does not admit of removal. Saissy recommends the operation, only in cases where the membrane is hardened and thickened; and never troubles himself regarding the state of the Eustachian tube. Deleau has published a distinct essay on this subject, in which he dilates at great length on the operation in question, and states, that it may be resorted to with advantage, in thickened states of the membrane, in obstructions and obliterations of the Eustachian tube, and in obstructions of the cavity of the tympanum. He even proposes it in very young children labouring under deafness from slight obstructions in the Eustachian tube, which would admit of being removed by injections alone; because, at such an age, these injections could only be performed with the greatest difficulty. Unfortunately, however, in the greater number of the operations (of perforation) related by him, his diagnosis cannot have been perfectly correct; inasmuch as no good was derived by the patients from the operation. Kramer supposes that the thickening of the membrane, unaccom-



panied by any disease of the ear, affords the only true indication for its perforation ; but he is rather too sanguine in regard to the practicability of overcoming obstructions of the Eustachian tube ; which he supposes himself always able to do, by means of the air douche, or the catgut bougie. This, however, like other of his opinions already alluded to, is by far too general in its application ; for instances of obstruction of the Eustachian tube will occur, which the surgeon will entirely fail to overcome, and I myself have seen one case of deafness consequent on mucous obstruction of the tube, where the inflation of it would at once have removed the deafness, and where I entirely failed to introduce even the smallest sized catheter into the Eustachian tube. This impediment to the insertion of the catheter was caused by an obliquity of the vomer at its posterior margin, by which means, it was so curved to one side of the nasal passage, that it was in contact with the inferior spongy bone of that side. To attempt forcing the catheter into the tube under such circumstances, would be a step quite unwarranted, for it would undoubtedly be attended by very extensive crushing of the septum nasi. This malformation of the septum nasi is by no means rare, as I have seen it several times in the living, and very frequently in the dead subject, during dissection.

By almost every author who has considered this subject, it has been treated more superficially than its importance requires ; and it is also greatly to be regretted, that the interest at first excited by the success attending its performance, should have degenerated into such a mania for it, as that it should have been contemplated, as a general remedy, for deafness of all kinds, even deaf dumbness. It has thus been brought into that discredit, which, with very few exceptions, attend the indiscriminate application of any new operation or therapeutic agent, to the treatment of any class of diseases.

The principal difficulty attending the performance of this operation, is the impossibility of keeping the aperture



made in the membrane, permanently open. For it will very often occur, after the complete perforation of the membrane, that the aperture very speedily becomes closed up in spite of all our efforts to prevent it, and thus it will require to be repeated.

For the accomplishment of this object, numerous forms of cutting instruments have been proposed, by which the membrane may not only be pierced, but, at the same time, a part of its substance destroyed or removed. The method adopted by Cooper and Saissy was by means of a small curved trocar and canula, while Itard used a stilet of tortoise-shell; but it was soon found that the aperture so made always closed up. Himly constructed a small cup-shaped punch, with very sharp edges, which, when applied to the membrane with a slight rotatory motion, a portion of the membrane, corresponding to the extremity of the punch, is removed, and an opening made which does not close up so readily. This instrument, however, besides being well made and very sharp, requires a steady hand and a quick eye, to ensure the success of the operation. The quadrangular perforator of Buchanan is quite useless, for it does not admit of piercing the membrane, but requires to be thrust entirely through it.

By far the best and simplest form of instrument which I have seen, is the cutting part of Deleau's. The essential part of this instrument consists of a fine steel rod, three inches in length, and furnished with a very sharp point, having two cutting edges; one from above forwards and the other from below backwards. Each of these edges is hook-shaped, rising obliquely from before backwards, and by their union, form, together, an irregular and incomplete thread of a screw one line in length, with a very sharp point, which greatly facilitates the introduction of the instrument into the membrane. Both edges are made to enter as a drill, and being slightly rotated back again, on being drawn out, their incision is attended with a loss of substance of the membrane. I have used



this instrument several times, and found it to answer the purpose completely.

Attached to the original instrument, there is a complicated mechanical apparatus, calculated, according to the opinion of the inventor, to render the operation more safe, and supersede by its mechanism the movements of the operator's hand. But this principle applies here, as to all other surgeons' instruments,—that the simpler, the more safe ; and the more the success of an operation depends on the dexterous hand of the operator, the more certainly may such success be expected.

There is still another kind of instrument which has been lately proposed by Mr Fabrizi an Italian, the object of which is to make a circular opening ; the divided portion of the membrane being fixed and retained by a spiral wire, within a canula, having a cutting point. It is simple in its construction, and consists of a canula, into which slides the spiral wire above mentioned, which somewhat resembles a cork-screw. It is to be used in the following manner :—Pass the canula and spiral wire down upon the inferior part of the membrane, retain it there with the left hand,—being careful not to press it too firmly upon the membrane ; then, with the right hand, take hold of the small handle which turns the spiral wire, and turn it from *right to left*, being what is usually called reverse screwing. The instant the membrane is perforated, is sensibly felt by the operator. The wire is now no longer to be moved, but by its handle, to be retained in its situation ; then gently causing the canula to revolve from left to right,—which, having a cutting edge on its point, a circular portion of the membrane corresponding to the diameter of the instrument will be cut, and drawn into the canula, and held fast by the spiral wire.

This instrument, however, though looking extremely neat and simple as a piece of art, must be very difficult of application ; for this reason, that the size of the canula, when introduced into the meatus, occupies so much room,



that the membrane to be operated upon, cannot be seen so long as the canula remains in that situation. The operation when thus performed is, therefore, done in the dark, and, as it were, at random, on any part of the tympanum membrane, instead of the anterior or posterior-inferior third of it.

When the operation is determined on, it is best performed with the simple instrument that can easily be made to follow the movement of the head of the patient. For this purpose, the patient should be placed on a common stool near the window, with the ear to be operated on, directed towards the bright sunshine. The operator, then placing himself before or behind the patient, as may be most convenient, inclines the head of the patient towards the opposite shoulder, as far as the altitude of the sun may render necessary, in order to allow the rays of light to fall directly on the membrane. The speculum is then to be carefully introduced, by the left hand, into the meatus, and the perforator carefully conducted to the anterior and inferior third of the membrane, and then passed through with a gentle rotatory motion. When the membrane is only slightly thickened, it readily yields to the pressure of the instrument; and if the sense of touch in the hand of the operator be delicate, he distinctly feels when the opposition offered by the membrane is overcome. One or two drops of blood flow from the wound, and occasionally the patient feels languid and inclined to faint. Immediately after the operation, if the diagnosis has been correct, its success is as complete as it ever can be; and the patient should afterwards guard the cavity of the tympanum from the injurious action of cold or wet weather, as well as from dust, by means of a little cotton-wool or charpie, worn loosely in the meatus.

Should any degree of inflammation occur in the membrane, after the performance of the operation, recourse must be had to the general remedies already enumerated. It will rarely, however, occur, that any such thing will be



required. A careful examination of the membrane should be made daily, in order to observe whether there be any tendency in the margins of the artificial aperture to grow together, and if such tendency should exist, our greatest care will hardly suffice to keep it open ; it will generally be found impossible to do so, and the operation will again be required.



### PART III.

#### ANATOMICAL STRUCTURE, PATHOLOGY, AND TREATMENT OF THE DISEASES OF THE TYMPANUM AND ITS APPENDAGES; ESPECIALLY THE EUSTACHIAN TUBE.

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##### SECTION I.—ANATOMICAL STRUCTURE OF THE TYMPANIC CAVITY.

The cavity of the tympanum is a space lying at the peripheral surface of the ear-bulb, and of an irregular pyramidal form. Its greatest diameter, measuring from above downwards, as well as from before backwards, is about four-tenths of an inch; while, from without inwards, it is only about three-twentieths of an inch. It is bounded internally, by the outer wall of the osseous labyrinth; externally, by the membrana tympani, and that portion of the temporal bone into which it is framed. Anteriorly, it is led by a canal—the Eustachian tube—into the back part of the nasal fossa; and posteriorly, it leads backwards into the cells of the mastoid apophyses. Superiorly, it is bounded by a very thin osseous plate, which extends between the squamous and the base of the petrous portions of the temporal bone: and inferiorly, it is bounded and formed by an approximation of the external and internal walls; and in the dry bone we find, leading from it in this situation, the fissure of Glasser, and the canal which transmits the chorda tympani nerve from the cavity downwards, to join with the gustatory branch of the trifacial.



Traversing the cavity of the tympanum, we find a chain of small bones, extending from the membrane which forms the greater part of the external wall, to the *vestibular fenestra* on its internal ; by which means, these two parts of the organ are kept in direct connection with each other. Along with these small bones, we have the muscles, which act on them, so as to change their relative situation to each other. These muscles are only two in number, the *Tensor Membrana Tympani* and the *Stapedius* ; the other muscles, which have been described so particularly by Mr Tod and other anatomists, being merely loose, reddish striæ, formed of cellular tissue and bloodvessels, extending between the walls of the cavity and the surface of the small bones, and enveloped by a tubular prolongation of the lining membrane of the cavity, similar to what we observe in the abdominal cavity, for the transmission of the mesenteric arteries, from the aorta to the loose and floating intestines.

The whole parietes of the cavity of the tympanum are lined by a very delicate membrane, possessing a compound structure and function, and belonging to the class of fibromucous membranes ; one surface of this membrane performing the office of a mucous surface, while the other performs that of a periosteum. There is no cellular tissue intervening between the lining membrane and the osseous surface of the tympanum, as is generally stated ; for no sooner is the dissection of it attempted, than it immediately separates as a distinct and indivisible layer from the walls of the cavity, in a manner analogous to the separation of the periosteum from the shaft of a long bone. I therefore take leave to doubt, *upon anatomical principles*, the existence of the so-called disease of "inflammation of the cellular tissue beneath the lining membrane of the tympanum."

This lining membrane is extremely delicate, and, in some parts, very vascular,—particularly where it is reflected upon the ossicula auditus,—and is continuous with the mucous membrane of the throat, through the Eustachian tube. It invests all the elevations and depressions observed on the



walls of the tympanum, and extends into the mastoid cells. The outer layer of the membrane of the *fenestra rotunda*, or *membrana tympani secundaria*, is a continuation of it; and the inner borrowed layer of the true *membrana tympani* is also formed of it. It invests the small bones and the tendons of their muscles, where they run free in the cavity. A fold of it fills up the space between the crura of the stapes. The chorda tympani is also enveloped by it in its passage across the tympanum, and where it forms the inner borrowed layer of the true *membrana tympani*, it sends a covering over the handle of the Malleus, as well as another portion along the head of the same bone to the Incus; which prolongation of it has received the name of the "Ligament of the head of the Malleus."

At all those points, where it is reflected from the walls of the tympanic cavity upon the small bones and muscles, we find numerous bloodvessels lying between the folds of the prolongations, *which folds would appear to be destined only as a means for the transmission of bloodvessels between the walls of the tympanum and its appendages, which lie free within its cavity.* From the reddish appearance which these prolongations of the lining membrane present, *in consequence of the number of minute bloodvessels which they contain, it is very easy, at first sight, to mistake such for a muscular structure; but, if examined after successful injection of the bloodvessels of the cavity, the true nature of their structure will be at once apparent.*

## SECTION II.—ANATOMICAL STRUCTURE OF THE EUSTACHIAN TUBE.

The Eustachian tube is the passage of communication between the cavity of the tympanum and the posterior part of the nasal fossa. In length it is about an inch and a half, and directed from behind forwards, from without inwards, and from above downwards; its guttural orifice being considerably larger than its tympanic. Proceeding from the



tympanum its first part is an osseous canal, and the remainder is formed partly of cartilage and partly of fibrous membrane. The osseous part of the tube begins at the anterior and lower part of the tympanum, by a funnel-shaped orifice, and runs forwards and inwards on the outside of the carotid canal, and below that for the reception of the Tensor Tympani Muscle. It is about half an inch in length, and ends in a notched and irregular edge at the re-entering angle, between the squamous and petrous portions of the temporal bone. Its caliber contracts in its course forward, and is slightly compressed in form. In the dry bone, it is about one-twelfth of an inch in width. In the recent state, when the tube is lined by its mucous membrane, it is much narrower.

The cartilaginous and membranous part of the tube extends between the ragged termination of the osseous portion of the tube and the internal surface of the internal pterygoid process. It lies in a kind of channel formed by the outer and anterior side of the petrous portion of the temporal bone, and the posterior, inner, and lower margin of the great wing of the sphenoid bone. The superior and external wall of the tube is attached to this channel by its tympanic extremity; towards its guttural, it lies in the concavity or space, on the superior margin of the Constrictor Pharyngis Superior Muscle; which space is generally called the Sinus Morgagni,—the Levator Palati being placed against its posterior wall, and on its anterior the Tensor Palati Muscle.

These muscles, particularly the former, as well as the Constrictor Pharyngis superior, exert a very considerable influence on the Pharyngeal aperture of the tube; for whenever they are excited to contract, by the irritation arising from the presence of any foreign body in the back part of the nose,—as when the Eustachian Catheter is being introduced into the tube,—they so compress the anterior and posterior walls of the tube together as to shut it up entirely;



and unless the beak of the catheter be retained firmly in the tube, until the irritation produced by its presence subside, it will be forcibly expelled from it into the back part of the soft palate, or even a considerable way along the floor of the nose.

The cartilaginous portion forms the upper and back part of the tube, being fixed by dense cellular tissue to the irregular extremity of the petrous portion of the temporal bone, and to the root of the inner plate of the pterygoid process of the sphenoid bone. It does not extend to the mouth of the tube, but only fills up that place where the outer wall of the bony groove above mentioned (as continuous with the osseous portion of the Eustachian tube,) is defective. At the pharyngeal orifice of the tube, it forms a semilunar prominence, with its convexity turned upwards and backwards.

The membranous portion is situated at the anterior and inferior part of the tube; it is thin but rather strong, and is placed immediately behind the Circumflexus Palati Muscle. Below this, the membranous portion is the concave margin of the Superior Constrictor Pharyngis Muscle, from which, however, it is separated by a small quantity of loose cellular tissue, which surrounds this part of the tube and separates it from the internal carotid artery, as it is about to enter into its canal in the petrous portion of the temporal bone.

The cartilaginous and membranous portion of the Eustachian tube is about one inch long. Being compressed from without inwards, a section of it is an elliptical fissure. From its junction with the osseous portion, it goes on widening, so that *the point of junction is the narrowest part of the tube*. In the recent subject, it is stated by Kramer and T. Wharton Jones, to be about one-thirtieth part of an inch in diameter; but from a number of experiments which I have made on the living body with graduated catgut bougies, I found that in the perfectly normal condition, the largest



which I could introduce within the tympanic cavity, through a small sized Eustachian catheter, previously introduced into the tube, was *only one thirty-fifth part of an inch in diameter*. The mouth of the Eustachian tube, in the throat, forms an oval-shaped fissure about three-eighths of an inch long, bounded anteriorly and posteriorly by prominent swollen edges, the latter, however, being much the largest.

The fissure is directed obliquely from above and before, downwards and backwards, and is situated at the upper and external part of the Pharynx, behind the soft Palate. In its relation to the meatus of the nose, with which it may be said to be continuous, numerous descriptions have been given by various authors. Some depict it as opening into the middle meatus, while others, and they are by far the most numerous, represent it as opening into the Inferior Meatus. The observations of Kramer appear, from my own dissections, to be the most correct. "I have," says he, "carefully examined the sections of many heads, and have satisfied myself, that the lower angle of the guttural orifice of the Eustachian tube *lies a little deeper than the horizontal line of the lowest meatus*; while the superior angle is about as much *below the horizontal line of the middle meatus* of the nose."

If the beak of the catheter, therefore, be introduced carefully along *the inferior meatus*, it will come into direct contact with the fissure of the tube; but if it be passed along *the middle meatus*, it will come into contact, only with its superior angle, even if the point of the catheter be well depressed. If otherwise, it will glide over the upper surface of the extremity of the tube, and lodge in the large depression behind it; and thus situated, would entirely frustrate the attempts of the practitioner to introduce a column of compressed air along the Eustachian tube to the cavity of the tympanum. From the malposition of the catheter the column of air, if much condensed, *might force itself through the mucous membrane, which alone fills up the gap between the margin of the superior constrictor muscle and the occi-*



*pital and petrous bones* ; and thus become diffused in the loose cellular tissue around, as far as the angle of the lower jaw, and even for a considerable way along the anterior edge of the sterno-mastoid muscle.

The Eustachian tube is essentially a tegumentary canal ; and through it, atmospheric air is admitted into the tympanum, a condition which, by keeping up an equable pressure on either side of the *membrana tympani*, and giving free scope for the play of the small bones on each other, is necessary for the perfect exercise of hearing. Its lining membrane is continuous with that of the throat on the one hand, and with that of the tympanum on the other. At the pharyngeal orifice of the tube, it has all the properties of the mucous membrane of the nose and throat ; as it approaches the tympanum, it becomes thinner and finer, till it assumes all the characters of the fibro-mucous lining of the tympanum. Within the osseous portion of the tube, it no longer presents any of the mucous glands, which are found in the mucous membrane of the prominent edges of the guttural orifice, and in that lining the cartilaginous and membranous portion ; and which mucous glands perform so important a part in the economy, and particularly in the morbid states of the Eustachian tube, and apparatus of hearing generally.

### SECTION III.—PATHOLOGY OF THE TYMPANUM AND EUSTACHIAN TUBE.

Agreeably to the method already adopted, of classifying the diseases of the external meatus according to the tissue which is involved, I shall arrange in the same manner, those to which the cavity of the tympanum and the Eustachian tube are liable.



## DISEASES OF THE CAVITY OF THE TYMPANUM.

I. ACUTE INFLAMMATION OF THE LINING MEMBRANE OF THE CAVITY, CONSIDERED AS A *MUCOUS MEMBRANE*, WITH A MUCO-PURULENT ACCUMULATION IN THE CAVITY, CONSEQUENT ON IT.

Every experienced practitioner must have seen two varieties of inflammation of the tympanic cavity ; one slow in its progress, comparatively mild in its symptoms, and generally recovered from ; and the other most severe, rapid, and generally destructive either to the tympanum or to the life of the individual. To the first of these two varieties, the affection defined above, is, from a consideration of its progress, comitant symptoms, and termination, pathologically referred.

It has been variously named by different authors, *e. g.* "Internal catarrhal otitis, by Itard ; Catarrh of the Internal Ear, with accumulation of mucus in the cavity of the tympanum," by Saissy ; "Humid Catarrhal Otitis" by Deleau ; and "Simple Otorrhea" by the generality of authors. It is most generally seen in childhood and youth, at which periods of life there would seem to exist some predisposition to it, although it is by no means rare to observe it in the more advanced periods of life, and even in the strongest constitutions, when exposed to its usual exciting causes,—which resemble those of the various external forms already described.

The most common, undoubtedly, is cold applied through the Eustachian tube, through the membrana tympani, or generally to the side of the head. The extension of inflammation from the tonsils or the *fauces*, such as occurs in almost every case of scarlet fever and measles, is a most fruitful cause ; and, from my own experience, I should say, not only the most frequent, but most important of all its exciting causes. It may also arise from the extension of inflammation from the external meatus through the mem-



brane ; or from the membrane itself ; from any injury mechanical or chemical, applied to these parts ; but when it occurs from causes operating in this manner, by far the most frequent is the direct application of a current of cold air to the surface of the meatus, and membrana tympani. It has also been asserted to result from the sudden suppression of a distant and long-continued discharge. And though there is no doubt that it does occasionally occur in such circumstances, it may, in general, be traced to a more direct and positive cause.

The incipient local symptoms of this disease vary much in intensity, according to the severity of the causes by which they are produced. When the result of a catarrh of the facial cavities, a dulness of hearing at first occurs ; either unaccompanied by any painful sensations, or at most, by a fulness and weight in the ear or the head generally, or with a sensation as though a veil or flap were hung before the ear, which only required to be removed in order at once to restore the hearing. There is frequently a *crackling noise in the ear*, and a tickling irritation in the meatus. The crackling is particularly loud and frequent if the patient yawns, coughs, or sneezes ; and taken as a single symptom, indicates, that the Eustachian tube is also implicated. As the disease continues, the patient begins to complain of rather severe pain, and a slight burning in the bottom of the meatus, which is much aggravated towards evening, or when he is warm in bed. These pains are also considerably increased by the process of mastication ; loud sounds falling suddenly on the ear, or by any heat or pressure applied over the mastoid process. The pains generally occur in paroxysms, and very much resemble otalgia, or those pains which accompany acute inflammation of the membrana tympani ; but generally they are felt shooting over the whole side of the head which is affected ; downwards along the lower jaw, following the course of the chorda tympani nerve ; or sometimes along the anterior edge of the sterno-mastoid muscle. In cases where



there are no other well marked symptoms, this affection is very apt to be mistaken for rheumatism of the lateral muscles of the neck, or *tie-douloureux*, occurring in the cervico-facial branches of the seventh pair of nerves.

In a short time, however, and particularly if there have been much pain accompanying the first stage of the disease, the symptoms become changed in their character. The pain, which before was acute and lancinating, now becomes dull and throbbing; the deafness, which was perhaps only slight, assumes a more decided appearance, and the nature of the disease is finally demonstrated by a sudden eruption of muco-purulent matter from the external meatus, followed by immediate relief from all the previous symptoms. This latter appearance constitutes what is usually called the second stage of the disease, but improperly, as its peculiarity entirely depends on the nature of the cavity in which the disease occurs. When the case is favourable, the improvement is in proportion to the freedom of the discharge, which varies much in consequence of the thickened state of the matter closing up the opening in the membrane. On examination of the meatus, the perforation of the membrane may be seen, with its margins surrounded by the muco-purulent matter coming from the cavity within. This perforation is either the result of passive distention, gradually increased, so as to occasion ultimate separation of the fibres of the membrane, or, which is more common, by means of ulceration, which often takes place to a great extent in its substance.

Instead of the matter being discharged by perforation of the *membrana tympani*, it sometimes passes along the Eustachian tube, and is discharged into the back of the nose and pharynx; but this is by no means common; and the opinion of Itard on this point may be looked upon as being near the truth—that the greater frequency of the matter being discharged through the *membrana tympani*, than through the Eustachian tube, is in the proportion of about ten to one—for the incipient inflammation generally



closes the Eustachian tube so completely by approximation of its walls, as to prevent the exit of the matter in this direction. It sometimes, but rarely, occurs in this form of inflammation, that the ossicula auditus are disjoined and thrown out, mixed with the discharge, this circumstance happening more generally, in the form of inflammation next to be described.

In about a week or a fortnight after the eruption, the discharge begins to change its character, assuming more the appearance of mucus, and is very much diminished in quantity. The previous dulness of hearing goes away ; and if it has been properly treated, the disease is usually completely overcome within a month. The patient will often be left with a sense of hearing as good as before the occurrence of the disease ; and if an examination of the state of the membrana tympani be made, the perforation through which the matter escaped, will most frequently be found entirely closed up by a small leucomatous spot in the lower half of the membrane.

In the diagnosis of this affection, we must avoid mistaking it in its early stage, for any of those forms of inflammation which are seated in the tissues of the external meatus, or in the membrana tympani ; but it may be easily distinguished by a careful ocular examination of the meatus, which will enable the practitioner to detect any morbid action, either in its parietes, or in the membrane. The most important distinction which should be made, if possible, is from the more severe form of inflammation of the lining membrane, which will next be described ; for unless we are able to do so, we can never give a positive prognosis regarding it.

From this latter disease, it can only be distinguished by the comparative mildness of its concomitant symptoms. The febrile symptoms, if any be present, are by no means so violent or well marked ; the restlessness or pain is not so great, and the delirium, which generally attends the latter form of disease, is by no means a constant concomi-



tant symptom of the former. The principal part of the diagnosis, however, rests upon the course and termination of the disease; the greater length of time over which it extends, compared with the more severe form of inflammation, and the sudden eruption of matter from the meatus, with rapid secession and alleviation of the patient's suffering, with the absence of those appearances of the discharge which characterise that attending the periosteal form of inflammation, will often be our only means of distinguishing the one from the other. It will often, after all, be impracticable to establish an accurate diagnosis; but whenever we have the occurrence of symptoms, indicating the presence of so formidable a disease, it is prudent to dread the worst, and to apply suitable therapeutic remedies.

In giving a prognosis, we must be entirely guided by the diagnosis previously formed. If we are sure from concomitant symptoms, that it is the form of the disease above described, then we may generally give a favourable opinion, both in regard to the ultimate power of hearing which will be possessed by the patient, and in regard to his life. If, however, the symptoms be so severe as to indicate the worst form of inflammation of the lining membrane, then we must be guarded in our prognosis which must be doubtful, not only in regard to the future usefulness of the affected ear, but in many cases in regard to the life of the patient. This, however, will be more particularly considered in treating of the next form of inflammation of the lining membrane.

## II. INFLAMMATION OF THE LINING MEMBRANE OF THE CAVITY OF THE TYMPANUM, *CONSIDERED AS A PERIOSTEUM*; AND THE CONSECUTIVE ENCEPHALITIS, OR CARIOUS DEGENERATION OF THE OSSEOUS WALLS OF THE TYMPANUM.

This form of inflammation is by far the most important of any of those which occur in connection with the tissues of the ear; as is at once apparent when we look



to the numerous cases of disease of the middle ear, which are the result of it; where, although they have terminated in its mildest form, they have left behind such a degree of irremediable deafness, as renders the patient miserable for life. At the same time, from the very obstinately diseased state of the ear, the patient is liable, on exposure to the slightest exciting cause, to have his life brought into the most imminent danger, by the supervention of inflammation within the skull. Of still more importance is this disease, when we consider its occasionally rapid course and fatal termination—from the immediate extension of the morbid action to the contents of the cranium—which too frequently resist the influence of every remedy.

This form of disease has not hitherto been separated from the milder disease already described, by any author except Kramer. He designates it “inflammation of the cellular tissue and periosteum in the cavity of the tympanum, or true internal inflammation of the ear.” But, as already explained, this definition is not anatomically correct, seeing there is neither a layer of cellular tissue, nor a distinct periosteal membrane in the tympanum; its lining membrane anatomically demonstrated, being a single layer, but possessing a compound function considered physiologically, I therefore consider the above separation of the two diseases as alone calculated to give a true understanding of its real nature, and of those sequences by which it is usually attended.

The periods of life, as well as the nature of the exciting causes which give rise to this disease, are identical with those which produce the first form of inflammation of the lining membrane. It would, however, be unnecessary to describe them again, in regard to this, or to the other forms of disease still to be considered, seeing that these causes possess a greater or less degree of influence in producing them individually, as well as collectively.

The local symptoms of this disease are usually ushered in by the ordinary symptoms of pyrexia, slight horripila-



tion or decided shiverings, followed by a corresponding increase of heat, either partial or general, until at least a decided febrile paroxysm is established. Along with this there is pain in the ear, often neglected, from being mistaken (as in the former case) for earache ; occurring at first only in paroxysms, but ultimately continued and of a very severe and excruciating kind. These pains extend along the lower jaw, across the face, and upwards and backwards over the temporal and occipital regions, giving a degree of tenderness to the scalp of the affected side, so that the patient reclines upon it with difficulty. The eyes are injected, watery, and intolerant of light, the countenance flushed and anxious, the skin hot and dry, the pulse frequent and hard ; the *tinnitus aurium* is most distressing, and the *delirium* which generally accompanies the disease, even from its onset, is usually of a violent kind.

Such are the symptoms which characterise this disease, and which continue with gradually increasing severity till a profuse discharge of matter, and generally also of the small bones of the ear, takes place from the external meatus, when they, in general, become a little diminished in severity, but to what extent, will entirely depend on the nature of the termination of the disease. This termination is, as above stated, either by the extension of the morbid action to the membranes or substance of the brain, or caries of the osseous surface of the cavity.

When the inflammation extends to the parts within the head, and is of an idiopathic form, we have the above-mentioned symptoms in their most violent form. Indeed the evidences of a meningeal affection are sometimes so prominent, as to conceal entirely the real disease, the existence of which is only proved, by the inspection of the body after death.

It more frequently occurs, however, that we find an attack of inflammation of the lining membrane, running on to the secretion and discharge of a quantity of purulent



matter which relieves the patient for the time. The discharge may become slightly diminished, but the pain continues or becomes more violent; delirium again occurs, along with occasional shiverings, the patient becomes oppressed and drowsy, and ultimately comatose.

In some cases there is no discharge of matter, but the patient, after complaining for a day or two of deep-seated pain in the ear, becomes restless and forgetful, lies rolling his head from side to side, or tossing his arms, and in a short time sinks into fatal coma.

The morbid lesions which are found to be the results of this disease, may be arranged under two heads :

*First*, Those cases in which we find caries of a portion of the osseous walls of the cavity (generally of its superior and internal walls, involving the vestibule and semicircular canals) and affecting the dura mater, arachnoid membrane, and substance of the brain, and generally terminating in suppuration, with considerable ramollissement of the cerebral substance; or where the carious action extends through the posterior wall of the cavity, causing ulceration and erosion of the lateral sinus where it lies in the sigmoid groove of the temporal bone, and consequent discharge of its contents into the tympanum and along the external meatus; or lastly, where the carious action extends along the osseous portion of the Eustachian tube to its junction with the cartilaginous portion, where its walls are exceedingly thin, causing ulcerative absorption and perforation of the coats of the Internal Carotid artery, and escape of its contents into the tympanic cavity, in a manner similar to the last. In all these cases the death of the patient is inevitable, unless it be in that where the carotid is perforated; for where this occurs, the fatal termination may be, and has been warded off, by the ligature of the common trunk of the vessel.

*Secondly*, Those cases in which there is an extensive carious surface of the osseous walls of the cavity, but without extension of the morbid action to the parts just men-



tioned ; or where the action is confined to the cells in the mastoid process, which, becoming softened, is partially exfoliated and a fistulous opening established between the cavity and the surface of the head. In both these instances the life of the patient is generally preserved, and even his hearing may remain very perfect ; but the morbid action is liable to continue for a length of time—perhaps during the whole period of his existence.

In regard to the special morbid changes in those cases where the inflammatory action extends to the membranes and substance of the brain, I need only refer to the cases and works of Itard, Lallemand, and Andral, and to those of our own fellow-citizens Dr Abercrombie and Mr Syme, in all of which, ample details will be found as to the appearances usually observed in such cases.

In regard to the second class of this division, viz., those in which erosion and perforation of the lateral sinus has occurred, few cases have been reported. I am at present aware of only two cases on which I can positively depend. The first is that which is related by Dr Stark in the *Ed. Med. and Surg. Journal*, No. 129, which, proving fatal from repeated hæmorrhages, exhibited on dissection considerable thickening with interstitial deposits of recent lymph in the walls of the right lateral sinus, extending from the Torcular Hierophili, to about three inches down the jugular vein. At both these extreme points, clots of lymph and blood were adherent to the walls of the vein, and obliterating its caliber, and the whole of its lining membrane was much discoloured and possessed a gangrenous odour. No aperture is stated by this author to have been found, leading from the sinus to the cavity of the tympanum, and he therefore concludes that the case was an instance of that form of hæmorrhage, which is observed arising from other mucous surfaces in a state of disease. To this opinion, however, I cannot subscribe, considering myself justified in dissenting, by taking into account the extensive hæmorrhage from the ear and the comparatively small surface of the membrane



in the tympanic cavity. And if a careful injection of the jugular vein had been made, I am inclined to think that an aperture of communication would have been found between some part of the sinus and the cavity.

The second case to which I allude, is one which occurred very recently as the sequela of scarlatinal inflammation of the middle ear in a youth, attending a large classical academy near Edinburgh, and latterly under the professional care of Professor Syme.

In this case, death was the result of repeated hæmorrhages, and on dissection, along with the appearances found in the right lateral sinus, already described as seen in the former case ; “ an ulcerated perforation, with ragged edges, as large as the caliber of a crow-quill, was found, which would pour out blood in sufficient quantity to account for the fatal termination.” I do not consider myself at liberty to narrate farther, the various circumstances connected with this interesting case, as it will in all probability be published in due time by Professor Syme.

In regard to the third class of cases coming under the first division, viz., where ulceration of the osseous portion of the Eustachian tube, and erosion and perforation of the internal carotid occurs, I find only one case, related in the *Ed. Med. and Surg. Journal* for 1836. This case occurred in the practice of Dr Cheyne of Leith, and the hæmorrhage from the ear being distinctly arterial, the common carotid artery was tied by Professor Syme, and a favourable result took place. The hæmorrhage was entirely and immediately checked, and the patient's life was thereby saved.

The most common termination of this disease, is in extensive caries of the osseous walls generally—and, next to that, softening and destruction, with exfoliation of the mastoid process. When it ends in the first of these, which is by far the most frequent, the morbid action is kept up for a very long time. After the subsidence of the immediate symptoms attending the onset of the disease, and the perforation of the membrana tympani, followed by the dis-



charge of matter from the cavity, have taken place, we have from time to time eruptions of an increased quantity of matter, preceded by an aggravation of the symptoms and dulness of hearing, and the discharge having mixed up with it small thin exfoliations of bone from the parietes of the cavity. The fœtor of the discharge is very great, and similar to that which has already been described as attending caries of the osseous portions of the meatus externus.

In every instance, the dulness of hearing is in proportion to the disorganization which has taken place on the inner wall of the tympanum, or the number of the ossicula auditûs which have been disjoined and discharged from the ear. If the membrana tympani be destroyed, and the Malleus and Incus, with its orbicular process, be separated from the Stapes and discharged, but the latter bone be still in its normal situation in regard to the membrana fenestræ ovalis, it is not necessary for deafness to be the result, unless there be other circumstances present, which exert an injurious influence on the free and easy vibration of the Stapes and the membrane to which it is attached; or where the morbid action, which has produced so much destruction of parts external to the vestibule, has extended itself through either of the apertures with which it communicates, directly and indirectly, with the tympanum, and a corresponding diseased action be set up in the fibro-serous lining of the osseous, or the delicate structure of the membranous labyrinth. In both these instances, a change must take place in the fluids which they secrete and are in contact with (the peri-lymph and endo-lymph), which will prevent it from being set in motion, so strongly as to produce a proper impression on the ultimate fibres of the auditory nerve, which are spread out upon them. It sometimes happens, however, that the Stapes and membrane to which it is attached, gives way, in the earliest part of the disease, the peri-lymph of the vestibule and canals, and the



fluid of the cochlea, are discharged, and then the function of the organ is lost for ever.

In those instances where the primary morbid action is chiefly confined to the cells of the mastoid process, the disorganization proceeds very rapidly; the external parts being swollen, œdematous, painful and tender on pressure. After some time the cells are perforated, the skin covering them becomes reddened, and an abscess forms, which bursts externally, and becomes fistulous. Instead, however, of thus opening, the matter of the abscess sometimes penetrates between the muscles attached to this process, and opens low on the side of neck. In other instances, the carious mastoid apophysis is not penetrated, but the pus collected in its cells is evacuated through the tympanum and external meatus. Occasionally, the entire mastoid process becomes exfoliated; and when this occurs, the facial nerve is always divided by the separating portions of bone, and the muscles on that side of the face become permanently paralysed. Sometimes the carious action extends from the mastoid process, along that portion of the temporal bone which intervenes between it and the occipital bone, and after passing through the sutures between them, penetrates the diploe of the occipital bone, and there produces the same morbid action. Lallemand relates one such case, and I have lately seen another, where the disease had begun about twenty years ago, as the result of scarlet fever, and had continued without intermission of the discharge, or the entire absence of local symptoms, during the whole of this period. Slight pain was induced, by percussion, over a considerable portion of the corresponding half of the occipital bone, and this uneasiness was rendered still more evident, during, and after the application of a sponge, previously dipped in warm water, and laid over the part. It was also evident at the time I first saw the patient, from his appearance, the state of his mind, and the local symptoms of which he occasionally complained, that there had been



a morbid action going on for a considerable time in the membranes of the brain; and latterly these symptoms have become more prominent, requiring him to relinquish his profession entirely.

In every case, therefore, of chronic discharge from the ear, possessing the properties of that produced by a carious surface, a careful examination of the mastoid process should be made, and in the generality of instances it will be found, that the morbid action is chiefly located in this situation.

In the diagnosis of this form of disease, there is not much difficulty experienced if it be idiopathic; but if it be the result of a previous chronic disease, the sudden super-vention of cerebral symptoms may so mask the local nature of the disease, as that it may be altogether overlooked. When idiopathic, the severity of the pain in the ear, the intensity of the febrile symptoms, with the furious delirium attending them, should make us always suspect the real nature of the complaint, even although the other indications of cerebral disease be the most prominent; and if the life of the patient be spared until a discharge of matter takes place from the meatus, a positive indication of the disease will at once be afforded. In every case, however, which presents any of the above-mentioned local symptoms, the surgeon should always make a careful examination of the ear, particularly over the mastoid process. If this portion of bone be at all diseased, the most gentle percussion of it will cause the most excruciating pain. The same effect will also follow the application of a sponge, previously soaked in hot water and applied over it, when the uneasiness, which before was perhaps not very great, will speedily be increased to agonizing pain. By the use of either of these means of diagnosis, we may always point out the nature of the local disease, although rendered obscure by the general symptoms.

The prognosis in this case must always be unfavourable; but may be somewhat modified by the duration of the dis-



ease ; its probable cause ; the state of the patient's constitution ; and the presumed extent to which disorganization may have taken place. But the rapidity of its course, the serious nature of the complications, and the frequent fatality of its termination, should lead us in every instance to give a doubtful, if not an unfavourable prognosis ; for, although the more acute symptoms be not accompanied by cerebral disease, there is the strongest possible tendency to its rapid supervention, without any decided indications of its approach.

DIVISION III.—CHRONIC INFLAMMATION OF THE ENTIRE SUBSTANCE OF THE LINING MEMBRANE OF THE CAVITY, WITH A FLOCCULENT OR FUNGOID DEGENERATION OF ITS STRUCTURE ; POLYPI FROM ITS SURFACE, AND A MUCOUS ACCUMULATION IN THE CAVITY.

The seat of this form of inflammation, is usually in the entire substance of the lining membrane of the cavity and mastoid cells, and sometimes it extends itself along the Eustachian tube.

In addition to the causes already alluded to, as producing the acute form of inflammation of this membrane, the disease under consideration is very often excited by the extension of a morbid action, originating in the outer position of the ear ; though it perhaps more frequently commences in the back of the fauces and extends itself along the Eustachian tubes, to the tympanum ; and more frequently still, is it the result of the acute mucous form of inflammation of the lining membrane of the cavity. It often happens, also, that it is first presented to us after having continued for a very long period. Under these circumstances, the symptoms which characterize it are, a slight pricking, dragging pain in the bottom of the meatus, occasionally shooting into the head, and accompanied by a generally copious, and frequently bloody discharge ; which, when the Eustachian tubes remain pervious, often escapes into the pharynx and mouth. On investigation, it is found that this condition has existed for weeks or months ; the



patient being sometimes better, then again worse ; and that the beginning of the complaint was attended by very severe local symptoms, and relieved by the sudden discharge of a quantity of matter, which had ever since then continued. Usually, after some months, this discharge ceases to be sanguineous, it becomes mucous, then almost serous, and gradually subsides, and during this subsidence, the hearing will in some measure be restored.

If the *membrana tympani* be extensively destroyed, the cavity of the tympanum will afford a variety of appearances on examination. Generally, the membrane lining the cavity, is darker and firmer in appearance than usual, particularly while it is secreting pus ; but as the disease subsides, it assumes a more healthy aspect. If any of the *ossicula auditus* remain, they may be distinguished as suspended free in the cavity, from its upper and back part ; and if water be injected into the meatus, it will pass along the Eustachian tube into the throat, occasioning but little inconvenience. This effect, however, will be more readily produced, by injecting water through the Eustachian tube and tympanum into the meatus ; and the fluid which there escapes, will be tinged with the discharge from the surfaces along which it has passed.

It is a common circumstance for the mucous membrane to become thickened and flocculent, which, by obscuring the usual appearances of the exposed cavity and projecting a little outwards, may be mistaken for a polypus of the meatus, or of the *membrana tympani*. When the mucous lining is thickened and granulated, and affords a secretion more than sufficient for lubrication, the entire cavity of the tympanum will become filled up, and will thereby be defended from the injurious effects of atmospheric variations. At other times, diseased growths will be detected proceeding from the mucous surface, and constituting polypi of the cavity of the tympanum, which, as long as they continue, will maintain the diseased secretion. These growths may proceed from any part of the surface of the



tympanic cavity, and unless they originate very near the periphery of the membrana tympani, they usually take a considerable time ere they make their appearance at the ulcerated aperture in the membrane. If they take their origin from the roof or inner walls of the cavity, they entirely fill up, and become moulded to its shape before they are noticed; and it is only after they can no longer find space within, that they pass through the perforation of the membrane, and proceed along the external meatus,—stimulating polypi produced from some of its tissues, or the membrana tympani.

When they are seen in the meatus, they have all the appearances of the soft polypus of the meatus, or of that which is produced from the membrana tympani.

During the continuance of this disease, it exhibits the strongest tendency to assume an acute form, and to proceed to a carious state of the different parts of the tympanum, mentioned under the last described form of disease; and also to extend itself to the membranes and substance of the brain. This latter complication, most frequently, takes place during an otorrhœa from the tympanic cavity, which may have existed for a very long period, without producing more than ordinary inconvenience, but, upon the application of an exciting cause, either general or local, an increased action takes place, and the disease attacks the membranes of the brain.

In the diagnosis of this form of disease, we must be guided entirely by the concomitant symptoms, and the length of time which may have elapsed since the patient first began to have any uneasiness or pain in his ear, or discharge from the meatus. On examination of the middle ear, if the membrana tympani be destroyed, we may generally be able to detect some of those appearances already described. And above all, if a small quantity of fluid be injected along the Eustachian tube, it will be forced out of the tympanic cavity, through the perforation in the membrane, mixed with the discharge from the sur-



face of the diseased lining membrane, and occasionally also, small exfoliated portions of the bone will be found suspended in it.

When the polypi of the surface are large and very vascular, the discharge will be of a bloody nature, and occasionally assuming the appearance of pure blood. Hæmorrhage from polypi of the tympanum is by no means rare, and when it does occur, it is calculated to excite considerable alarm. This is not at all surprising, when we consider the tendency which the carious action has to extend itself, so as to involve the integrity of the lateral sinus or the internal carotid. In every instance, therefore, of a discharge of blood from the external meatus, the most careful examination of the state of that tube, as well as of the cavity of the tympanum, should be made, and the previous history of the disease duly considered; lest it should prove one of those unfortunate cases already described, and resist every attempt or remedy for its cure.

The prognosis is in the highest degree unfavourable, even when the disease is easily recognised and treated in the best and most energetic manner. The disposition to caries is often so great, that, in the most favourable cases, the function of the organ is materially and incurably injured. If the inflammation has spread to the membranes of the brain, and induced suppuration between these and the pars petrosa, or in the brain itself,—though it is not always possible to decide on the existence of this condition during life,—death is inevitable.

#### DIVISION IV.—TREATMENT OF THE DIFFERENT FORMS OF INFLAMMATION IN THE CAVITY OF THE TYMPANUM.

The remedies and treatment of the two forms of acute inflammation, must, indeed, be of a powerfully antiphlogistic nature to overcome the disease, or prevent a fatal termination. It will often be extremely difficult at first, to mark any difference between these forms of disease; and hence,



if the symptoms be severe, we must assume the worst opinion, and adopt the most active treatment.

If the constitutional symptoms should warrant the abstraction of blood from the arm, this should be immediately done, and in the most effective manner, so as to produce a decided influence on the constitution. Afterwards, active purgation, and the exhibition of large doses of the tartrate of antimony, should be carried as far as the symptoms warrant, and if the indications of cerebral disease become more severe, the system of the patient should be speedily placed under the influence of calomel and opium. Along with these general remedies, we must also use those of a more local action, such as a great number of leeches applied around the ear and within the meatus, and followed by the application of heat and moisture.

If the above-mentioned plan of treatment ward off a fatal termination, or if the disease resolve itself into a profuse muco-purulent secretion into the cavity of the tympanum, then the *membrana tympani* gives way, and affords vent to the matter accumulated within it, the discharge of which is to be kept up, as long as it is accompanied by any inflammatory symptoms, by the same emollient plan of treatment, and, by keeping the patient in a proper position, when the inflammatory character of the disease has disappeared, the cavity of the tympanum may be washed out by mild, cautious injections of lukewarm water, and ultimately a very weak solution of the acetate of lead.

When pus has formed within the cavity of the tympanum (which may often be suspected from the change in the symptoms), Itard recommends an artificial opening to be made in the *membrana tympani*, in order to afford exit to the pus, which might otherwise make its way out by destroying the mastoid cells. But this is quite unnecessary, for whatever resistance this delicate membrane may present to the exit of the matter, the perforation of it is soon enough effected by the inflammation itself.

In those rare instances, where the mastoid process has



become softened and given way,—affording thereby an exit for the matter,—an incision should be made through the soft coverings into the abscess, in order to expedite the discharge of the matter contained in it; but to have recourse to such an operation, without such indications, is entirely out of the question, although it has been proposed and actually carried into execution.

If caries of the osseous walls of the cavity takes place, and the disease becomes chronic, we must keep up, for a length of time, a powerful counter-irritation behind and below the mastoid process; but in this, we must be guided much by the constitution of the patient. If the excessive discharge give rise to a hectic state of constitution, or if the original appearance of the disease be connected with cachexia, the persevering use of appropriate remedies for these conditions must not be neglected. When the carious action extends towards the lateral sinus, and causes a perforation in its walls, nothing more can be accomplished for the suppression of the hæmorrhage than careful stuffing of the external meatus; but if we may judge from the result of the cases already mentioned, nothing will be of the least avail for their relief.

It is otherwise with those cases in which the internal carotid artery is opened by the ulceration; for here a ligature applied on the common trunk may often be successful in arresting the hæmorrhage. This, however, will depend much on the habit of body of the patient, and the freedom with which the collateral circulation in the base of the brain, can be established. For, if the communication between the carotids and the basilar arteries, at the circle of Willis, be very free, it is extremely doubtful, whether the retrograde circulation will not be as decidedly and speedily fatal, as if the circulation along the main trunk had remained unimpeded.

If the diseased action be in a chronic state when first seen, it is a common but dangerous error, that nothing ought to be done for its removal, on the idea that the mem-



branes of the brain will assuredly be affected, as the discharge ceases. But although this complication has occurred by the rash and careless suppression of the discharge, there is more danger to be apprehended while it continues, than would, in all probability, follow its suppression. In every instance, where we treat such cases, we must establish a new and temporary drain from the system, by means of a seton or issue in the nape of the neck, and keep up its action until all risk of a metastatic inflammation be gone. I have seen severe headaches induced by the suppression of an old discharge from the walls of a carious tympanum ; but they were uniformly and immediately relieved by the abstraction of blood, or a repetition of blisters behind the ears.

In the chronic form of inflammation, where we have a granulated condition of the lining membrane of the cavity, the indications of treatment will depend much on the diagnosis. If there be an aperture in the membrana tympani, but without any polypi projecting through it, then we are recommended to throw tepid astringent injections along the Eustachian tube, by means of the catheter, so that any matter which is collected may be discharged, and at the same time the astringency of the salt employed, be exerted on the lining membrane. If we can persuade the patient to undergo this plan of treatment, we shall derive much benefit from it ; but as it is difficult to accomplish this, we are often under the necessity of using them, thrown along the external meatus.

When a polypus projects through the membrane, it should be treated on precisely the same principles as have already been recommended for the removal of those produced from it, or the external meatus ; but where such tumours come from the cavity, we shall always find their removal exceedingly difficult, while their presence predisposes to a continued chronic inflammatory state of its lining membrane.



## II.—THE EUSTACHIAN TUBE.

DIVISION I.—ACUTE INFLAMMATION OF ITS LINING MEMBRANE, CONSIDERED AS A MUCOUS SURFACE; AND AS A RESULT, THE ACCUMULATION OF MUCUS IN IT.

The acute form of inflammation of the lining membrane of the Eustachian tube, is generally found connected with catarrhal inflammation of the facial cavities and fauces; although it sometimes occurs independently of that affection, when it is accompanied by a slight degree of inflammation of the lining membrane of the tympanic cavity. The causes which give rise to it, are analogous to those which produce the diseases which have been mentioned as producing it.

The symptoms which attend the inflammatory stage of this affection, resemble those of the mildest forms of inflammation of the membrana tympani, or the lining membrane of the tube; and frequently they are not of sufficient severity, to direct the attention of the patient particularly towards them, in consequence of their being masked by the predominance of the symptoms with which they are accompanied, particularly the catarrhal. The slight degree of deafness which attends it, is the only cognizable symptom of which the patient complains, as indicating a change in the condition of some part of his organ of hearing. As soon, however, as the second stage is established, *i. e.*, the increased secretion of mucus from the inflamed surface, the deafness becomes more intense, and the patient has a sensation, as though a veil or flap were hung before the ear, which only required to be raised to restore the hearing; and this he thinks himself capable of doing, by forcible inflation of the tympanic cavities, while the mouth and nose are compressed. During his attempts to perform this, he feels a *crackling or gurgling noise in the ear*, which not only occasions an agreeable sensation of relief to the head and ear, and diminution of the previously existing tinnitus; but is also immediately followed, by a



material improvement in the power of hearing. Though this improvement usually vanishes in a very short time ; yet it can be restored whenever the patient repeats the operation, unless the mucous membrane has become so much thickened, or the accumulation of mucus so great, as to impede entirely his attempts to force the air along the tube.

In a great number of instances, this disease lasts only during the existence of the catarrhal affection of the facial cavities or fauces ; and as these are progressively removed, it also subsides, leaving only a very slight degree of thickening of the membrane, with a tendency to secrete a greater quantity of mucus than natural, and thus keep up the deafness which, in all these cases, is characterised by its variableness in intensity, at one time being so severe as to render the patient miserable, while at another, it instantly vanishes, accompanied by a loud crack, during the blowing of the nose, yawning, or even mastication of the food. Frequently only one ear, though sometimes both, are affected ; but when the latter is the case, not only the dullness of hearing, but also the difficulty of overcoming the disease, is always greater, in the one, than in the other. And, however surprising it may be, considering the frequency of catarrhal affections of the nares and pharynx, and the extreme narrowness of the Eustachian tube, simple mucous engorgement of it is, on the whole, a rare affection.

In the diagnosis of this disease, we will be much guided by the nature of its complications, the mildness of the symptoms indicative of an affection of the ear, and particularly by the varying intensity of the deafness. The prognosis may generally be favourable, even when it has been neglected, and has continued for some time ; for a complete cure, or very material improvement, may be affected by the patient submitting to a proper plan of treatment. In recent cases, in which the mucous accumulation is very loose, more fluid in its nature, and perhaps confined chiefly to the large extremity of the canal, nature



sometimes effects a cure, by the unusual muscular contractions and violent movements of the body that take place during forcible gulping or vomiting ;—when the Eustachian tube becoming suddenly opened, the air rushes along it to the tympanum, accompanied by a loud sharp sound

It is in this comparatively rare class of cases, that emetics have obtained so much credit for their power in curing deafness ; but it is also evident, that if they really possess any such power, it is more by the mechanical influence of vomiting, than by any therapeutic effect which they are capable of producing on the tissues of the affected organ. This independent aid from nature, however, never occurs when the disease has become firmly established ; the morbidly increased secretive action of the membrane become habitual ; the quality of the mucus materially altered ; or particularly, when the disease has extended to the mucous membrane of the cavity of the tympanum.

It will be observed, that, in the above description of this disease, I have not mentioned ulceration of any part of the surface of the membrane, as a result of the acute form of inflammation, as I am not aware of any case on record, where such an effect resulted from it in the idiopathic form. I do not, however, wish it to be understood, that ulceration never occurs in this, as in the other parts of the gastro-pulmonary mucous membrane, but I believe it is never seen in this situation, unless produced by the direct extension of syphilitic ulceration of the fauces and back of the nares ; and, under such circumstances, it must be classed with its peculiar cause, and not as an idiopathic form of disease.

**DIVISION II.—CHRONIC INFLAMMATION OF THE LINING MEMBRANE OF THE TUBE ; AND AS A RESULT OF THIS, FLOCCULENT DEGENERATION OF ITS STRUCTURE, PRODUCING A STRICTURE OR COMPLETE OBLITERATION OF ITS CALIBER.**

This form of disease is most frequently the result of repeated attacks of acute inflammation of the lining mem-



brane of the tube, complicated as already described ; but sometimes it is the result of a chronic action, unconnected with any morbid change in the tympanic cavity. And when it does exist as such, there is almost a total absence of any peculiar morbid sensations in the diseased ear. In general, there is considerable dulness of hearing, coming on gradually during the course of several years, till it reaches such an intensity as to cause serious inconvenience to the patient. This may take place either in both ears at the same time, or first in one, and subsequently in another ; or, which is most frequently the case, one ear alone continues to suffer, the other not participating at all in the morbid action. Noises in the ear are frequently absent throughout the whole course of the disease, or merely occur at the commencement, when the vascular action in the parts affected is most excited, and then they may disappear for ever. At other times, however, the patient is never free from noises. If he be advanced in life, when the disease occurs, it is too often looked upon as one of a nervous character, and therefore irremediable. Neither of these conditions, however, indicate a favourable or unfavourable character of the disease.

These patients usually labour under chronic inflammation of the fauces and soft palate. These parts, together with the uvula,—which is tumid and pendulous,—are of a deep red colour, or livid and mottled over with large and turgid veins. The arches, formed by the velum palati, instead of presenting acute well-defined edges, form merely a thick tumified mass, passing the one into the other, without any definite limits ; the posterior palatine mucous glands are largely developed, so that the surface has the appearance of being strewn with millet seeds. Tumefaction of the tonsils is generally associated with these, and even the whole of the pharynx and intestinal mucous membrane, partake of this œdematous condition.

If the patient be more closely examined, his countenance will frequently indicate a scrofulous character, *e. g.*, by the



elongated *columna nasi*, and thickened and shortened upper lip ; there is a constant or frequent stuffing of the head, and much mucous secretion from the mouth and nose. No confidence however must be placed in subjective symptoms, for it is only by examination of the state of the Eustachian tube, by means of the catheter and air douche, or catgut bougie, that the surgeon can arrive at a definite knowledge of what change of structure, and to what extent, may have taken place.

When the mucous membrane has become only so much swollen, as that the walls of the tube are merely brought into contact, but not so perfectly as to offer an impediment to a stream of condensed air (although this impediment may be so great as to oppose the introduction of the forcibly expired air of the patient) into the cavity of the tympanum, it constitutes a case of stricture ; but sometimes the effusion of fluid into the submucous tissue is so great, and the approximation of the walls so extensive and firm, that an insurmountable barrier is thereby offered, not only to the introduction of condensed air, but even of any solid body, adapted to the size of the canal. These cases constitute obliteration of the tube, and when they are of long standing, resist all efforts for their removal, or even partial relief.

In establishing a diagnosis of these cases, we must, as already stated, trust entirely to a physical examination of the tube. When it is only a case of partial thickening of the membrane, constituting stricture of it, the condensed air which passes along the catheter, can sometimes only overcome it after repeated sittings. Then, small bubbles of air are at first heard to enter the cavity of the tympanum, or a fine, shrill-sounding stream passes along, which gradually becomes fuller and stronger, and mixed with a gurgling sound. Whenever this is accomplished, not only is there an agreeable sensation of relief to the head and ear, and diminution of the tinnitus ; but it is immediately followed by a material improvement in the power of hear-



ing, which, although vanishing again in a few hours, may be restored at each sitting, and perhaps become gradually and permanently established.

If the case be of short duration, the mucous membrane of the tube swollen throughout its whole extent, and in a uniform degree, the air-douche will perhaps be unable to pass along to the membrana tympani. The catgut bougie, however, if carefully placed in the axis of the pharyngeal extremity of the tube, will, by using a little force, be made to pass along its entire length, without encountering an opposition at any particular part, to the membrana tympani, occasioning a peculiar prickling sensation, whenever it comes into contact with this delicate membrane.

When insurmountable stricture or obliteration of the tube exists, the condensed air, even when the utmost degree of force is expended, cannot be made to pass along to the membrana tympani; nor is the least noise heard in the ear while the douche is streaming against the mouth of the Eustachian tube. On passing a catgut bougie to the mouth of the tube, it either cannot be made to enter at all, or it passes only a short way forward, according to the distance at which the obliteration extends to the mouth of the tube, the round edge of its opening is rendered so misshapen, by the tumefaction of the lining membrane, that the catheter is not supported by it, and the practitioner cannot ascertain, with certainty, the spot at which it is to be found and where the catheter ought to be fixed.

In other cases, again, the obliteration is seated about three-fourths of an inch along the tube, and at the part where the osseous and cartilaginous portions of the tube unite.

In regard to re-establishing the permeability of the tube, the prognosis must in the greater number of instances be unfavourable. It is only in the rarest cases that the utmost efforts of the practitioner, even when favoured by the short duration of the disease, can succeed in restoring the mucous membrane to its normal condition; and thus, either



by this means alone curing the deafness, or clearing the way for its subsequent treatment. But least of all may he hope for success, when a cachectic or scrofulous constitution offers irresistible opposition to all means of treatment, which will more especially be the case where the patient's mode of life exposes him to the influence of cold.

Obliteration of the tube is looked upon by Kramer as "absolutely incurable," and, consequently, the prognosis must be unfavourable; for, "in my opinion," says he, "the operation of perforation of the membrana tympani is to be altogether rejected in these cases, because the inflammation which has so seriously disorganised the mucous membrane of the Eustachian tube cannot have spared that of the tympanum."

This opinion may, in some instances, prove correct, but, as shall be pointed out when speaking of the treatment of the disease, cases are by no means rare where its adoption has been followed by the best results; and, consequently, though the prognosis should always be doubtful, yet it need not be altogether so unfavourable as this author would make us believe.

### DIVISION III.—TREATMENT OF INFLAMMATION OF THE EUSTACHIAN TUBE.

In the treatment of this form of disease, either acute or chronic, we must be guided much by the state of the tympanic cavity, as well as of the mucous lining of the nostrils. When the former cavity is affected, the treatment which has already been recommended should be adopted, but not so actively as for the idiopathic inflammation of its lining membrane. In almost every instance, there is a congested state of the fauces and soft palate, in which counter-irritation beneath the jaw will be found most useful; and, as we overcome the catarrhal affections, we generally subdue the morbid action in the Eustachian tube. Along with this, gargles of various kinds may be used, but I have never found them of much benefit to the real disease. They



may be of use, when employed only to subdue the morbid action in the mucous membrane of the throat, and thus prevent the disposition to its renewal or aggravation on the application of any exciting cause. For the purpose of acting on the entire surface of the membrane of the tube, Riolan proposed the perforation of the mastoid process, and then injecting medicated fluids along the Eustachian tube to free it of mucus accumulated within it; and the operation has been several times performed by two Swedish aurists, Jasser and Hagstroem.

Waiving the consideration, that the trephining of the mastoid process is, in itself, an operation which involves the life of the patient, the stream of water thus injected would be so feeble, that it could not exert any influence on the plug of mucus in the tube. This operation, therefore, should now be looked upon only as a matter of history, and not as one of practical interest.

Wathen, Douglas, Saissy, Itard, Deleau, and Kramer, have all used the water-douche, thrown along the canal, from a syringe connected with a catheter introduced into the Eustachian tube. Deleau and Kramer, however, gave it up, and substituted the air-douche. The latter author, notwithstanding, declares the water-douche to be of considerable benefit occasionally, not merely in the form of simple tepid injections, but even containing some gently stimulating substance, as chloride of sodium. This, however, I have tried several times, and have always found it, not only difficult to accomplish, but followed by an increase of the inflammation, and I have therefore laid it completely aside.

I have alluded to a mode of treatment, as well as diagnosis, of all the diseases of the middle ear which I have described, which has of late obtained no inconsiderable celebrity in acoustic surgery, viz. the introduction of compressed air from an air-press, along the Eustachian tube to the cavity of the tympanum; but, before giving a description of the necessary instruments, or the manner in



which the operation is performed, I shall give a few historical notices of the original invention, and of the progressive improvements which have been made upon it.

There is no doubt that the individual to whom the idea first occurred, and by whom it was carried into actual practice, was M. Guyot, a postmaster of Versailles. It appears from his own report, that, having laboured under deafness for a great many years, and consulted the most eminent men of the day regarding it, he had found no relief. Having, however, obtained a little knowledge of the peculiar structure of the ear, he supposed, from his own feeling, that his deafness arose from some obstruction of the Eustachian tubes; and that, if it could be removed, he would regain his hearing. For this purpose, he constructed an instrument, formed of a solid piece of wire, and of such length and curve, as would enable him to introduce it into the tubes from the mouth. By perseverance in his trials, and as it would almost seem, by providential tact, he succeeded in introducing his rude instrument as frequently, and as far into the pharyngeal opening of the tube, as was sufficient to overcome the slight degree of tumefaction of its membrane (which seems to have been the cause of his deafness); and thus his invention was entirely successful.

A report of his invention and success was communicated to the Academy of Sciences of Paris, and the following notice of it was inserted in their Transactions. "*Quoiqu'il en soit, les anatomistes ne croyoient point que la trompe d'Eustachi peut-être seringuée par la bouche, cependant M. Guyot, maître de la porte à Versailles, a trouvé pour cet usage un instrument que l'Academie a jugé très-ingénieux. La piece principale en est un tuyau recourbé, que l'on insinue au fond de la bouche derrière et au dessus du Palais, á dessein de l'appliquer au Pavillon de la Trompe qu'on vent injecter. Ou en lave au moins l'embouchure ce qui peut-être utile en certain cas.*"\* Little more than the merit of ingenuity appears to have been accorded to

\* *Mem. de l'Acad. des Scien. p. 37. 1724.*



M. Guyot; still, however inadequate the apparatus was, the idea was good, and was not altogether lost sight of. Our countryman Cleland, seven years afterwards, constructed and introduced into the Eustachian tube a flexible catheter, to which was adapted a syringe, which could either throw in "*warm water*," or "*force air* into the barrel of the ear, sufficient to dilate the tube for the discharge of the excrementitious matters that may be lodged there." \*

This operation was afterwards performed by Petit, Douglas, Wathen, Sabatier, Portal, and Leschevin, by all of whom, a detailed account of their success is given in their respective works; and, although not generally allowed, Cleland has the merit of having invented, and carried into actual practice, those principles of treatment of these diseases, the importance of which is only now becoming sufficiently acknowledged. The catheter, however, which was used by Cleland, was flexible; and the use of the inflexible silver one, was first proposed by Mr J. Wathen, some years afterwards.

Among all these aurists, the injection of tepid water along the catheter, for the removal of the obstruction in the Eustachian tube, was universally adopted, and continued in use till within the last few years, when Deleau pointed out the superiority of condensed air. The use of these aqueous injections is attended by considerable difficulty and many inconveniences. In the first place, the patient is greatly annoyed, during their introduction, by the reflux of the water through the mouth and nose; and it is only by great care on the part of the patient, in expiring during the injection, that he prevents the water from being carried downwards into the larynx, and giving rise to very troublesome coughing. Secondly, It is difficult for the patient to hold his head so steady during the injection, as to prevent the catheter from being thrust deeper into the nose by the pressure of the syringe, during

\* Phil. Trans. vol. xli. p. 848. 1731.



the injection of the water. This is not only productive of pain, but renders it necessary for the operator to interrupt the injection, in order to restore the catheter to its right position, and the operation is, consequently, very much protracted. Thirdly, The syringe cannot exceed a certain size, nor the water be injected with more than a certain degree of force, with which, it will often be impossible to succeed in completely overcoming the opposition presented by the accumulations in the Eustachian tube. Fourthly, These injections prove very annoying, when they lodge in the cavity of the tympanum; and, if they be only used as a means of diagnosis, they must, as such, be very doubtful. Fifthly, These injections are very uncleanly for the patient and every thing about him; and it will be difficult to persuade him, after a first trial, to subject himself again to the inconvenience.

From all these important objections, Deleau was led to the idea of substituting condensed air in the investigation and treatment of the diseases of the middle ear and Eustachian tube. *And in certain cases, as a mean of diagnosis, and in others as a mode of treatment, it is certainly the best which we at present possess.*

For the purpose of introducing this air in a forcible and uninterrupted manner, different modes have been proposed by different authors. Deleau, the original proposer, kept his invention for a long time unknown to the public, and indeed he never gave an explicit description of his apparatus.

M. Gairal, a French army surgeon, recommends for this purpose an elastic caoutchouc bag, having a tube attached to it, of a size capable of being fitted into the large or free extremity of the catheter; and the walls of the bag being compressed by the one hand, while the other holds the nozzle of the instrument steady, a sufficient force, as he supposes, may thus be given to the column of air, to overcome any obstruction in the Eustachian tube. The inconveniences, however, which attend the use of this instru-



ment are many; and the objections which are brought against it, apply with equal force to the common syringe, which has also been recommended.

The use of the latter instrument was proposed by Mr Pilcher, who speaks very highly in its favour. "From the daily experience," says he, "of the great facility with which air and even fluids may be introduced into the tympanum, and regulated both as to force and quantity by means of a common syringe, accurately fitted to the catheter, I do not hesitate to declare my conviction that the ceremony and inconvenience of the air-press may be entirely dispensed with." "It is of course requisite," continues he, "that the operator should steady the catheter with his left hand, while using the syringe with his right."

This mode of procedure, however, I do not think at all to be compared with the air-douche, *which he so unceremoniously condemns*. For, in the first place, to say nothing of the pain unnecessarily inflicted on the patient by this method, how could it be possible for the operator to listen to the sounds, supposing any could be produced from so feeble a stream of air, passing into the cavity of the tympanum? For, as I shall point out more particularly in the latter part of this essay, the principal use of the air-douche, no matter whether the air come from an elastic bag, a common syringe, or an air-press, is, *in the generality of cases, more as a means of diagnosis, than as a mode of treatment*. This result, of course, could never be obtained by the use of the common syringe. In the second place, though much harm need not be dreaded from so feeble a stream of air, as that projected from the syringe, whilst its nozzle is accurately fitted to the catheter, still there is considerable danger to be apprehended when forcing in the air, that the end of the catheter which is engaged in the Eustachian tube, be not pushed too far along it, and its mucous lining be thereby considerably injured; and if the injection of the air be afterwards continued, it will, in all probability, be forced through this artificial aperture in the



tube; produce emphysema of the cellular tissue around, and then extend itself to the parts beneath the jaw and along the anterior part of the neck.

Lastly, it should be an invariable and fixed rule with all those who undertake the treatment of acoustic diseases by the means here proposed, that, when the air is introduced along the catheter into the middle ear, a space should always be left for its regurgitation, both by the sides of that end of the catheter which is engaged in the Eustachian tube, and between the nozzle of the syringe, or that of the air-press and the dilated extremity of the catheter into which it is inserted, and thus unpleasant consequences may sometimes be avoided.

By far the best mode, therefore, of compressing and forcing along a column of air, of sufficient power, which can be regulated at will and kept up without interruption for a considerable time, is by the use of the air-press.

This apparatus may be variously constructed, but its essential parts consist of a pump for the purpose of condensing the air, and a cylinder for its reception. The apparatus which I always use, consists of a small condensing pump, screwed tightly into a large cylinder, the interior area of the latter being capable of containing one hundred cubic inches of air, exclusive of the space occupied by the barrel of the pump. In the plug of the piston-rod of the pump, there is placed a small flap-valve which opens only downwards, by the pressure of the atmospheric air, when the piston is elevated in the barrel. In the lower end of the pump, there is placed a similar valve, opening in the same direction, which always acts when the piston is thrust downwards, carrying before it the air which is placed between its plug and the lower part of the barrel, during its ascent, and which becomes forced, through the second valve, into the larger cylinder, whence it is prevented from returning, by the replacement of the valve in its natural situation. The area of the barrel of the pump should also be known, as the operator will then be able to



tell the quantity of air which has been condensed, and the probable force with which it can be discharged from the instrument.

For the purpose of indicating this, an instrument, called a manometer, has been attached to the side of some of the instruments ; but a single day's practice, and a knowledge of the area of the condensing cylinder, as well as of the barrel of the pump, will at once teach the operator the number of cubic inches of air which require to be introduced into it, in order to produce a proper degree of condensation. Attached to the upper part of the side of the external cylinder, there is a small stopcock, on the extremity of which is fitted, when required, the brass ferule of an elastic tube, the opposite end of which has an adapting nozzle, fitted to the dilated extremity of the catheter, which is to be used.

When used, the air-press should be placed on a table, of a sufficient height to enable the operator to have perfect command of the stopcock, in order to regulate the quantity and force of the stream of air ; and previously to the introduction of the catheter into the Eustachian tube of the patient, the cylinder should be charged with air, so that no delay may take place after the former instrument has been properly fixed.

The number of cubic inches of air which should be condensed, will vary according to circumstances. If it be the first time the patient has undergone the operation, the operator should be very careful as to the quantity used ; for if he were to condense a great quantity and allow it to rush rapidly into the ear of the patient, the suddenness of its introduction, and the peculiarity of the sensations which it produces, might overcome him, and syncope supervene, which would tend to alarm the surgeon, unless accustomed to the performance of the operation. The extent to which I generally condense the air at first, as an exploratory mode of investigation, is about half an atmosphere, or fifty cubic inches, as measured by the apparatus, and this I gra-



dually and carefully increase, according as its immediate consequences may require.

When the air-douchè is used, the surgeon should always remember to superintend the introduction of the air, and retain the entire management of it in his own hands, and never trust it into that of the patient; otherwise it may be his lot to witness such unpleasant consequences, as were produced by it last year, in that unfortunate case, which has rendered this operation notorious over the whole kingdom.

The inflexible catheter of Wathen was afterwards improved by Saissy and Itard, and in every respect it nearly corresponds to that which is in use at present. It consists of a cylinder of silver, six inches long, of a caliber varying from the size of a small crow to that of a large goose quill. Its extremity is well-rounded, and curved only to the extent of six lines (or half an inch) from the further extremity, at an angle of  $144^{\circ}$ , so as to correspond with the lateral situation of the mouth of the Eustachian tube. It is of the same caliber throughout its whole length, and provided with a funnel-shaped dilatation at the proximal extremity, six lines in length, to admit the ivory point of the flexible tube which comes from the air-press. To this dilatation is attached a ring, on a line with the curve of the beak of the catheter, by means of which, the situation of the latter may be ascertained, when it is introduced into the nose, and thus out of sight. In addition to this, the catheter may be graduated by fourths of an inch, which will be found of the greatest convenience in repeated introductions.

Saissy gave to his instrument a triple curve and a button-shaped protuberance at its farther extremity. The additional curves he supposed to be better adapted to the structure of the nasal fossa; and that the knot-shaped protuberance, would prevent the infliction of pain upon the lining membrane of the mouth of the Eustachian tube. But these fears are groundless, if the instrument be well rounded off; and as to the curves, they are, in my opinion,



decidedly injurious; for, on using them so made, on the dead subject, I have found that the greatest caution was required, in placing them securely in the opening of the Eustachian tube, lest the convexity of the middle curve should completely break in pieces the septum nasi.

Pilcher has recently recommended a double curved catheter, but this I have also tried and found liable to the same objections; so that I consider the single curved catheter as being the best adapted to the size and form of the inferior meatus.

All practitioners, with the exception of Itard and Deleau, held the catheter firmly in their hand, in the direction given to it, after having introduced it into the Eustachian tube. This, however, is not only inconvenient to the patient, and troublesome to the operator, but is also very uncertain; for the least motion of the hand removes the instrument from its proper situation, and renders replacement necessary, which is often more difficult than the first introduction.

Itard has remedied this evil, by the invention of a frontal vice or bandage, the construction of which, however, is rather inconvenient. The modification of Kramer is much better, and is that which I have generally used. It consists of a middle piece made of metal, bent so as to fit the forehead, and slightly padded inside; and to this are attached two straps, which fasten with a buckle. To the centre of this a pair of strong forceps are attached, which move in a ball and socket joint, and the blades of which are brought together by means of a screw; the head of the forceps being also capable of being fixed in its socket, in any position, by means of another screw.

Before commencing the catheterism, the frontal vice must be placed across the forehead, and the straps buckled behind the head; and the forceps being fixed in the ball and socket joint, are turned upwards and screwed in that position, for the convenience of the operator.

The patient sits on a chair with a high back, the opera-



tor standing before him, who, having oiled the instrument, lays hold of it by the funnel-shaped dilatation, with the thumb and two forefingers of either hand, according to the side on which the operation is to be performed, and with the concavity of the instrument turned downwards. The beak of the catheter is then to be introduced upon the floor of the nose, and pushed *quickly* but *carefully* along the inferior meatus, gliding over the bottom of the nasal fossa into the bottom of the pharynx. This part of the operation must be executed with a delicate steady hand, to spare the patient pain, and to overcome successfully the impediments to the progress of the instrument, arising from the lateral inclination of the septum narium. For the avoiding of these, no definite rule can be laid down, but it should always be remembered to hold the instrument loosely between the fingers, while it is being introduced, by which means, if any opposition be offered, it will more easily be overcome, than when the catheter is held rigidly between the fingers. In this latter case, if any obstruction occur, in the form of dilated inferior spongy bone, or obliquity of vomer, they will undoubtedly be much injured.

The catheter having been passed into the upper part of the pharynx, the posterior wall of which it is made to touch (up to which time the ring, and consequently the beak of the instrument, remain directed downwards), the external extremity of the instrument is to be elevated, by which its beak is depressed and glides over the posterior edge of the mouth of the Eustachian tube. The operator then withdrawing the instrument towards himself, about half an inch, or until it is prevented from being further withdrawn by the posterior surface of the velum palati, rotates the catheter on its own axis about a quarter of an inch, turning it upwards and outwards; when, with a slight degree of force, it is conducted into the mouth of the tube, the situation of the beak of the catheter being all this time indicated by the ring on the large extremity of it. By careful traction it is found that it is here held fast, by the an-



terior cartilaginous edge of the mouth of the canal, which, in conjunction with the perfectly easy situation of the catheter for the patient, affords the surest indication that it has been lodged in the proper situation. The ring then stands turned a little upwards, pointing to the external canthus of the eye, and in the direction which the Eustachian tube takes from the pharynx to the ear. For the purpose of facilitating the operation in any case which might present itself, the operator should always have beside him a series of catheters of different calibers, so that he may be able to adapt the size of the instrument to the width of the nasal fossa.

Having thus introduced the instrument into the Eustachian tube, the external extremity of it is then to be embraced by the blades of the forceps attached to the frontal bandage, by the screwing of which tightly together, as well as the head of the forceps in its ball and socket joint, the whole instrument is comfortably and securely maintained in its position. And the apparatus being thus adjusted, the patient may not only move his head, but may even speak or cough without experiencing any inconvenience or pain.

M. Gairal recommends, that, before introducing the catheter, the distance of the upper incisor teeth from the base of the Velum Palati, should be measured, in order to ascertain with more certainty when the beak of the catheter has arrived at the posterior orifice of the nasal fossa, and thus the precise moment when it should be rotated outwards. For this purpose, he uses a thin, silver blade, which he terms a "Palatometre," and which is graduated to correspond with the catheter; but the employment of this instrument is useless and takes up a great deal of time, and if the operator chooses, or is obliged from circumstances, to perform the introduction of the instrument, on arithmetical principles, he will find by experimenting on the section of a head, having all the parts, over which the instrument passes, in their natural positions;



*that the point of the catheter, when three inches from the attachment of the ala nasi to the cheek, will be placed in the axis of the pharyngeal extremity of the Eustachian tube.*

Having properly introduced the catheter into the Eustachian tube, and fixed it securely into the frontlet, the patient is then made to sit close to the table on which the air-press is placed, and on which he leans the elbow of the affected side, and with the hand of the same side lays hold of the flexible tube of the air-press, which must have been previously charged. The operator then introduces the ivory or metallic tip of the tube into the funnel-shaped extremity of the catheter, places his own ear close to that of the patient which is to be examined, and having slowly opened the stopcock of the machine, listens to the noise which the condensed air makes in rushing into the ear. When the Eustachian tube and cavity of the tympanum are perfectly free and open, the air flowing in, strikes without interruption, and with an audible shock, against the membrana tympani. When the first shock of so strong a current of air is over, or if it have not been very violent, the operator hears during the streaming in of the air, a blowing and rustling in the ear of the patient, which appears to issue out of the auditory passage, and to fill the ear in its whole extent. To this sound Deleau has given the name of "*bruit de pluie*," and even when it is produced by a moderate douche, it is sometimes accompanied or followed by a slight pain and momentary deafness, indicating an exaltation of sensibility, or a commencement of inflammation. All variations from this sound, the peculiarities of which can only become perceptible by often repeated observation, are morbid, and lead to very certain conclusions, as to the particular diseased changes which have taken place in the structure and functions of the middle ear and Eustachian tube.

When, however, the tumefaction of the lining membrane and the accumulation of mucus in the tube are such, that opposition is made to the free transit of the air, it is ac-



accompanied by an audible gurgling noise, during the first part of its passage to the membrana tympani, and followed by an agreeable sensation of relief to the ear, a diminution of the tinnitus, and a material improvement in the power of hearing.

Sometimes the stream of air does not at first enter the ear at all, and in spite of the greatest attention, no noise is heard in the ear, and no alleviation or alteration in the symptoms perceived, till after repeated sittings. Small bubbles of air are at length heard to enter the tympanum, then a fine shrill sounding stream of air, which gradually becomes larger and fuller; and exactly in proportion as it does so, it is accompanied by increased alleviation of all the complaints, including the dulness of hearing. Kramer is of opinion, and I think rightly, that the number of unsuccessful sittings should be limited to four, for, says he, "if, after the fourth sitting, no distinctly audible stream of air makes its way to the membrana tympani, and no perceptible improvement in the hearing takes place, there exists a structure or obliteration of the Eustachian tube, which requires another mode of treatment."

When such a state of parts exists, so that no air can be made to pass up to the membrani tympani, it has been proposed to dilate the canal by the use of sponge-tents and bougies, either of catgut or silver.

The use of sponge-tents was first proposed by Deleau; and the reporters on his work to the French Academy, viz. Majendie, Percy, Pelletan, and Savart, *state confidentially, that they had no doubt of Deleau being able to introduce these, along the Eustachian tube, though they had never seen it done.* Yet, however high the authority of these respected names are, when the extreme narrowness of the canal, its hidden situation, its distance from the surface of the body, and the comparatively incompressible nature of its walls are considered, this mode of procedure appears to me extremely difficult, *if not almost impossible.* The catgut bougie, or a silver wire with a bulbous extremity,



will much more readily succeed in overcoming the obstruction.

In attempting to introduce either of these along the Eustachian tube, the practitioner will succeed best, if, in the first place, the smallest sized catheter be selected, so that the catgut or wire cannot take a different direction from that of the curved end of the catheter, and that on making its exit from the end of the instrument, it will be prevented from slipping down into the Pharynx, or the top of the Larynx, and thus exciting a disagreeable coughing or even vomiting. And, secondly, that, if the beak of the catheter be directed well upwards, it may be, in a manner, hooked on to the superior angle of the mouth of the Eustachian tube.

If catgut be used, the first or E string of the violin should be selected, on which should be marked with ink the length of the catheter, and farther back, that of the Eustachian tube ( $1\frac{3}{4}$  inches). It must be pushed carefully forward, in order that any opposition in the tube may be carefully noted; and, before being introduced and passed into the Eustachian tube, its extremity should be softened a little by biting it. If it can be made to pass an inch and a quarter along the tube, the patient begins to feel as if it approached the middle of the external meatus, whereas before, he could not tell where it was. If the bougie be thrust still farther forward, so as to pass between the Malleus and Incus, and to the membrana tympani beyond; the acuteness of the sensation increases up to the moment when the membrane is touched, and then he supposes he is able to lay hold of it in the outer ear.

In every instance where the stricture is considerable, but has been overcome, the bougie should be allowed to remain for three or four hours in the Eustachian tube. For this purpose, it should be held fast with one hand, after having been drawn about half an inch from the catheter, in order to fix it so that it will neither slip farther forwards and come against the membrana tympani, nor follow the



course of the catheter which is to be removed. With the other hand, the catheter should be carefully and gradually drawn out in the direction in which its beak meets with the least opposition ; at the same time holding the bougie more firmly until the catheter be entirely removed from the nostril. The bougie should then be cut short, and fastened by means of a slip of adhesive plaster, to the ala nasi. In a few hours it softens and swells, so that it fills the entire Eustachian tube ; but by the repeated movements of the Pharynx in endeavouring to sneeze (as the result of the irritation produced by its presence in the back part of the nose), it is ultimately discharged by the force of the expired air, and slips down into the throat, when it should be removed altogether.

By some authors this mode of treatment is very much condemned, and in one of the latest works on Acoustic Pathology (Williams on the Anat. and Pathol. of the Ear, Lond. 1840), I find it stated, that " it is difficult to conceive how such a practice could be persisted in, without doing considerable damage to the membrana tympani, and also to the ossicula, considering their delicate connexions, and the brittle material of which they are composed." But this I look upon as a mere assertion, without the support of any proof on the part of the author in its favour, as it is evident from his book that he never performed the operation on the living body. If he had ever done so, he would never have made such a statement. I have myself performed it very often on the living body, and repeatedly on the same individual, with the most decided benefit, and without its having been attended by any of those imaginary evils, which he so much dreads.

The accidents which may be the result of catheterism of the Eustachian tube, with the introduction of air into the middle ear, are, inflammation of the throat and Eustachian tube from violence used in the introduction of the instrument ; emphysema of the cellular tissue beneath the angle of the jaw, and along the tracheal margin of the sterno-



mastoid muscle,—consequent on laceration of the mucous and fibrous membranes, connecting the two margins of the cartilage of the tube—the condensed air being thereby forced into the cellular tissue ; rupture of the membrana tympani from the too rapid introduction of the air into the middle ear, when the Eustachian tube is natural ; and, lastly, death may be the result of the incautious introduction of a too powerfully condensed current.

In regard to the first of these, I may state that it is an accident which may occur to any operator, however dexterous he may be in introducing the instrument, if his patient be at all restless during the passage of the instrument along the floor of the nose. But when it does occur, it is very speedily removed by those remedies which are useful in removal of simple catarrh.

In regard to the second of these accidents, viz., emphysema of the neck, it has been seen by Deleau six or seven times, by Pilcher once, and by myself twice in my own practice. When it does occur, its appearance is rather startling, causing the patient's neck to look like that of a pouting pigeon. The voice becomes considerably changed for the time, appearing as if it were produced from a resonant cavity, in connection with the back of the throat. Little or no pain was complained of in either of those instances which came under my notice, and in both, it was overcome immediately by a very simple process. This consisted in rubbing the surface of the emphysematous swelling, very gently with the palm of the hand from above downwards, and continuing thus for a few times, the swelling was seen to extend itself slowly over the clavicle, and be gradually dispersed in the loose fascia covering the Pectoralis Major muscle, and surrounding the mammary gland. Having dispersed the tumour entirely from the region of the lower jaw and ear, an ammoniated liniment may be used and rubbed all over the surface of the tumour four or six times a-day. When the rubefacient properties of the application, and the friction which accompanies



it, will, in the space of twenty-four hours, remove all irritation, as well as the air effused in the cellular tissue. In neither of my cases did it interfere with the after treatment by means of the catheter, and in both it had this good effect, that the patients became, through dread of it, quiescent during the introduction of the instrument, whereas before, they were extremely restless and turbulent.

I have never seen the third accident, viz. rupture of the *membrana tympani*. It has occurred in the practice of Deleau several times, who says, that it takes place exactly in the middle of the lower half of the membrane; the opening being round and almost always a line in diameter. "It is to be wished," he adds, "that in many cases of deafness, we could produce, at will, such effects. The patient feels no pain, he does not even know what has happened, and is often agreeably surprised at hearing perfectly well afterwards." This mode, however, of making a perforation in the membrane, is rather a round-about way, and the reasoning of Deleau on the subject, is very like "making a virtue of necessity." It should, in every instance in which condensed air is introduced into the middle ear, be carefully avoided, by endeavouring never to push the catheter far into the Eustachian tube, or thrusting home the nozzle of the pipe of the air-press into the dilated end of the catheter; by attending to which rules all danger from the air-douche entering the cavity of the tympanum with excessive force, will be obviated.

In regard to the last of the accidents, which may occur from the careless introduction of condensed air into the cavity of the middle ear; it will be remembered, that two melancholy examples took place last year in London, in the house of one medical man there, which has thereby brought the proper and judicious use of a strictly scientific and useful mode of diagnosis and treatment, into very great discredit with a great number of professional men, as well as of the community at large,—who being themselves, or their friends, afflicted with dulness of hearing, have, in



consequence, been deterred from subjecting themselves to *any* mode of relief; choosing rather to endure their afflictions, than expose their lives to what they consider a hazardous experiment.

The *cause* of death, in these individuals, has been variously explained;—the sedative influence of the highly condensed air,—the powerful stimulus on the auditory nerve,—rupture of the superior wall of the tympanic cavity, and consequent injury of the brain,—and, lastly, apoplexy, have all been represented as the immediate cause or causes of death. These hypotheses, however, I do not think at all proved by the morbid appearances and the suddenness of death in both instances; and of all the explanations which have been offered regarding them, it is unfortunate that none of them have been deduced from actual experiments on the lower animals, which, if properly planned and executed, would perfectly demonstrate the real cause of death. I trust, however, that some properly educated members of our profession, who are prosecuting this branch of pathology, will come forward and state their candid and honest opinion, with the results of this mode of treatment as adopted by them; and that a valuable surgical remedy will not be allowed to sink into oblivion, or become mere matter of history, through the reckless abuse, and indiscriminate use, which, unfortunately, has always followed the discovery of a new remedy, either surgical or therapeutic. For myself, I look upon it as a very useful means of diagnosis as well as prognosis, in a great variety of cases of deafness,—although, in regard to many others, it is of no avail as respects their treatment.

In concluding this part of my subject, I may enumerate what appears to be the only purposes for which catheterism of the Eustachian tube appears to be useful. (1.) As a mode of investigating its condition in health or disease, and that of the cavity of the tympanum; (2.) to remove fluids (mucus or blood) from it; (3.) to dilate a stricture



of the tube ; and (4.) as a medium of introducing ethereal vapour into the tympanic cavity, in order to stimulate directly the tympanic plexus of nerves and lining membrane of its cavity, in cases of purely torpid nervous deafness. The first and third, however, are by far the most important ; but, as the consideration of the last does not come within the limits of the present essay, I am prevented from taking farther notice of it in this place.

If all these remedies fail in overcoming the morbid change in the Eustachian tube, we have only one resource left, *i. e.*, perforation of the membrana tympani. This, as already stated, has been strongly objected to by Kramer, on the ground, that he considered himself capable in every instance of overcoming the diminished caliber of the canal by the air-douche and bougie ; and that, where this proved impossible, the state of the tympanic cavity would, most probably, be such as to render any operation abortive.

This opinion, however, will neither stand the test of physiological reasoning, nor of practical experience ; for, in the first place, if clear in our diagnosis, the principal indication is the introduction of air into the cavity of the tympanum, so that an equal degree of pressure be kept up on both sides of its membrane, when the difficulty of hearing will at once be got rid of ; and, in the second place, although Sir A. Cooper had not the advantage of what we now know to be the only means of forming a diagnosis of those diseased states of the organ for which the operation may be required, yet the beautiful results of his bold practice, at once, and incontestibly proved, that the operation is positively demanded in cases of insurmountable closure of the Eustachian tube.

I have thus endeavoured to describe, as concisely as possible, the various branches of the subject which I allotted to myself for a Probationary Essay, and I am only afraid that it has extended itself beyond the usual limits. The only apology I can offer is the extreme importance of



the subject, an importance which those of us who possess this sense can by no means sufficiently value.

The advantages and pleasures of hearing can only be appreciated by those who once enjoyed, but have now lost, this inestimable blessing. The benefits it confers upon us in society in enabling us to exchange mutual ideas, the pleasing recollections we enjoy of long past conversations, the delight we experience from the harmony of sweet sounds when the mind is depressed by anxious cares, or the enchantment we receive from overpowering eloquence, all convince us that half our happiness is dependent upon the possession of this valuable faculty. This, indeed, is not ideal ; for who has not observed the individual, once happy and cheerful in the bosom of his family or friends, who, from the loss of hearing, has lapsed into a state of the most deplorable melancholy from being shut out from the soothing influence of society, the circle of his mental powers becoming narrower and narrower as his malady increases ; and, although the light-heartedness of youth may for a long time have warded off its gloomy influence, yet it will ultimately have induced an almost intellectual death, ere the bloom or usefulness of his life have passed, or the lines of age begun to trace their impress on his brow.











