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ON

DEFECTIVE HEARING:

ITS

CURABLE FORMS AND RATIONAL TREATMENT.

BY

JAMES KEENE, F.R.C.S.,

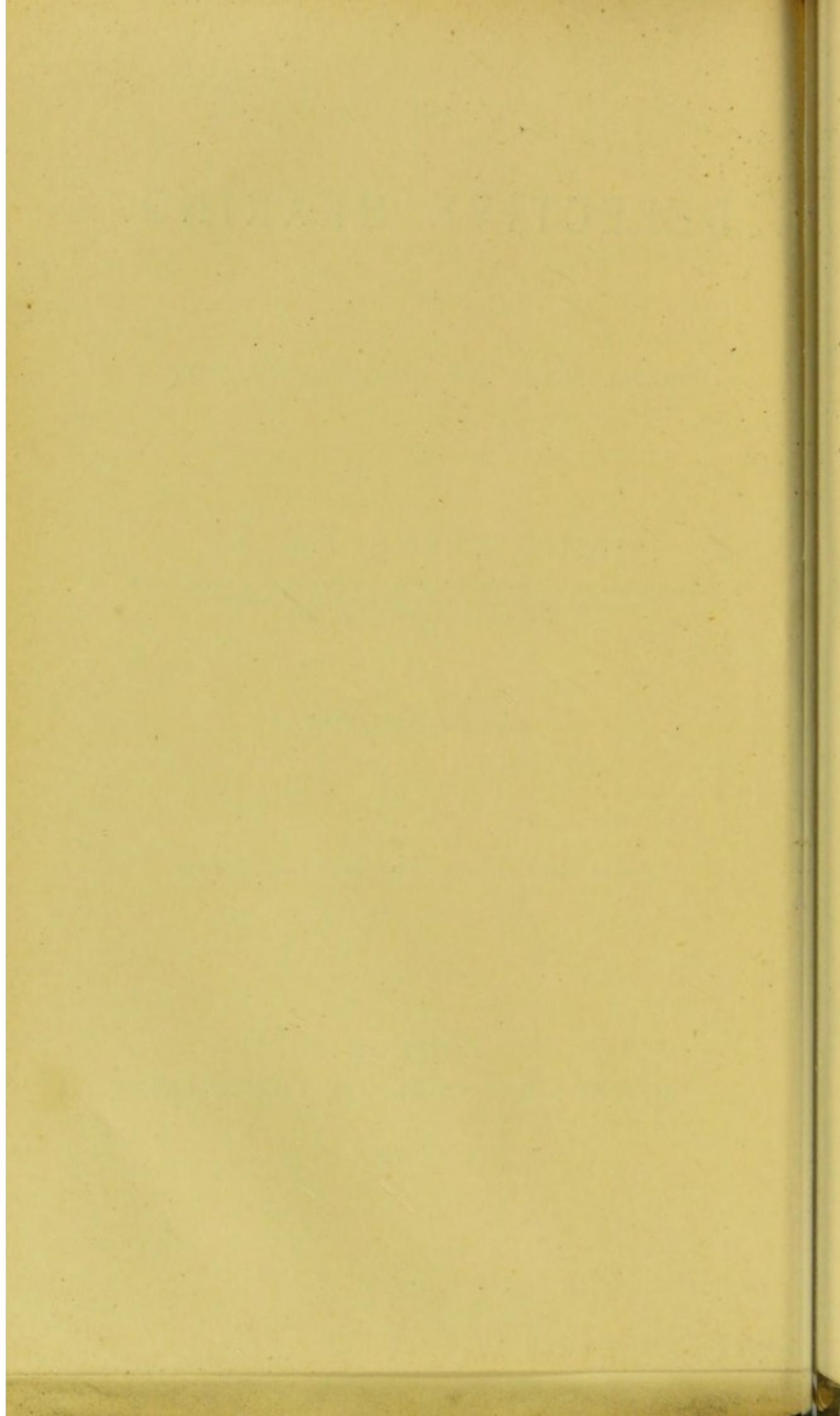
ASSISTANT SURGEON, AND SURGEON TO THE EAR DEPARTMENT AT THE WESTMINSTER
HOSPITAL: LECTURER ON AURAL SURGERY AT THE WESTMINSTER
HOSPITAL MEDICAL SCHOOL, ETC., ETC.

THIRD EDITION.

Paper read before the Harveian Society.

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PREFACE TO THE THIRD EDITION.

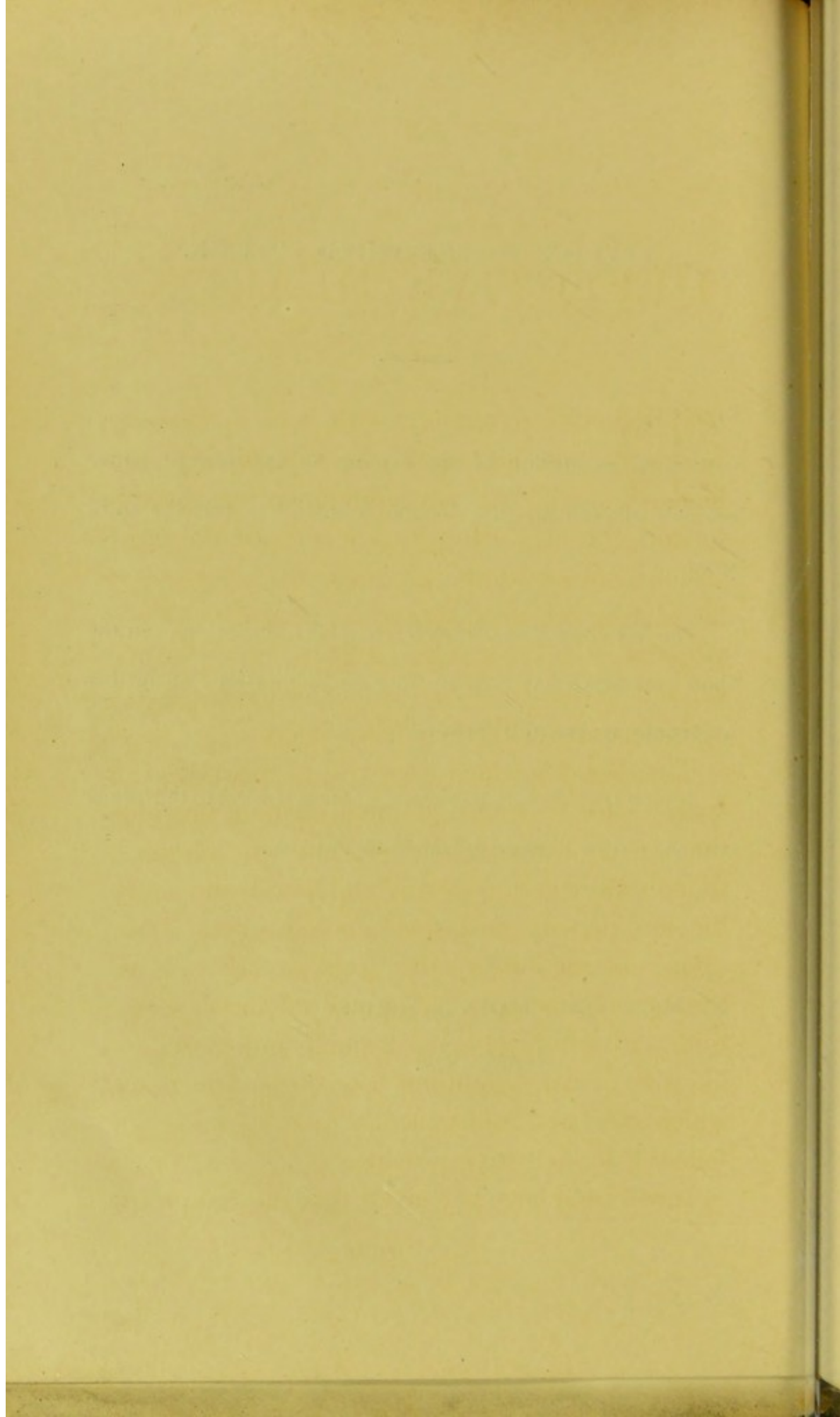
THE rapid exhaustion of two editions of the present paper has only allowed me time to give a reprint in this the third issue.

The last edition was, however, carefully revised, and in the short time which has elapsed since its publication, no further alterations appear to be needed.

I hope that the favourable reception accorded to the former editions will be likewise extended to this one.

33. MADDOX ST., HANOVER SQUARE,

August, 1875.



DEFECTIVE HEARING.

—→8963←—

THE frequency with which persons are met with who talk thickly, and who do not pronounce nasal consonants correctly, cannot have escaped the most ordinary observation. Indeed, so common is the defect of which I speak, that when once attention has been directed to it, few persons will fail to notice many cases during each day of intercourse with their fellow-men.

The diseases which give rise to this defect of speech—for we must at once dismiss the idea that it is a mere habit—occur at all ages, though more commonly in childhood and early life, and depend, as I shall endeavour to show, upon obstruction to the free passage of air through the nostrils. Augmented nasal secretion, with snoring, loss of smell and taste, are likewise usual symptoms of these affections, which are not unfrequently accompanied or followed by defective hearing.

It will be at once perceived that the symptoms

I have just mentioned are those which are usually present in ordinary "*colds in the head*," to which they are generally attributed, and on this account neglected. To the aural surgeon, the persistence of indications such as these are of considerable importance, because he knows that the catarrhal and inflammatory affections upon which they depend are very liable to extend from the nose to the throat, and thence to the Eustachian tubes and middle ear, where they constitute the commonest causes of defective hearing.

A person who has the peculiarity of pronunciation to which I have alluded is, in common parlance, said "to speak through the nose," though, in point of fact, as I have already mentioned, he is unable to do so by reason of obstruction of the nasal passages. I do not wish to be understood that absolute closure of the nose is always, or even usually, present in these cases, but that a certain resistance to the free passage of air occurs, which the feeble expiratory effort accompanying pronunciation of nasal consonants is insufficient to overcome.

Our alphabet contains two nasal consonants, the M and the N. When these are deprived of the nasal expiration which should accompany

their articulation, they become B and D respectively. This will be readily perceived by endeavouring to pronounce a word or monosyllable containing a nasal consonant, while the nose is closed. *Me* will then become *be*, *no do*, *moon bood*, *sun sud*, and so forth.

By placing a cold mirror below the apertures of the nostrils, in such a manner that its polished surface is directed upwards, and out of reach of the breath issuing from the mouth, we may readily satisfy ourselves that nasal expiration actually takes place during the pronunciation of syllables containing M and N, and with these only. In this manner we may repeat each of the consonants, in combination with each of the vowels, without any deposition of vapour taking place on the mirror, unless the syllable contains *m* or *n*, which will at once become manifest by the appearance of a spot of dimness on the glass.

If we take into consideration the relative positions assumed by the organs of articulation—the tongue, lips, teeth, and palate—we shall perceive that they are the same for the pronunciation of *me* and *be*, *no* and *do*, and consequently we may infer that the difference between the sounds produced depends upon

the passage or non-passage of air through the nostrils.

Having thus arrived at the conclusion that nasal consonants can only be properly pronounced when air passes through the nose, it will be evident that any cause which gives rise to nasal obstruction will also give rise to the form of thickness of speech which is commonly, though improperly, termed "speaking through the nose."

The defect may vary in degree from an amount scarcely perceptible in some cases to the most aggravated and unpleasant extent in others; but, wherever present, it may be considered to be a symptom of obstruction to the nasal air-passages which indicates a diseased condition in some part of their course. Impairment of taste and smell, as well as heavy breathing and snoring, have a similar import, and some one of these indications will be found to have preceded most cases of deafness.

This is in no way surprising when we remember that at least four-fifths of all cases of defective hearing are due to disease of the middle ear, and that of this number, in by far the largest proportion, the affection spreads to the Eustachian tubes from the naso-pharynx. The

continuity of surface between the parts readily explains this, and at the same time points out that, if we wish to attain success in aural practice, we must first acquire a thorough knowledge of nose and throat affections. For these reasons it has been deemed advisable to say a few words concerning the structure and functions of the nasal air-passages, as an introduction to the study of their pathology.

I have employed the term *nasal air-passages* so as to comprise the whole tract through which air passes in its way between the external apertures of the nostrils and the glottis. By this arrangement we shall include the whole of the interior of the nose, the upper portion of the gullet as far as on a level with the opening of the larynx, the upper surface of the soft palate, and the tonsils.

The mucous membrane which lines this tract is continuous with the general mucous surface of the body, and varies considerably in thickness in different parts. Near the exterior orifices of the nose and along the floor of the nostrils, where glandular tissue is absent or nearly so, the mucous membrane is thin and even. In the remaining portions mucous glands form an almost continuous layer, and

the membrane is in consequence much thicker. Glands are most conspicuous at the upper part of the naso-pharynx, more particularly in the neighbourhood of the Eustachian tubes, where they form aggregations, called the pharyngeal tonsils. The mucous membrane covering the inferior turbinated bones is corrugated and irregular, thick, and very vascular. Indeed the capillaries are so abundant in this situation that the part may be considered as almost cavernous or erectile. On this account the mucous membrane is very liable to swell, and becomes the principal cause of obstruction in acute nasal catarrh.

The olfactory portion of the nasal tract, or that part to which is distributed the nerve of smell, is limited to the superior and middle turbinated bones, and the upper part of the septum narium. For the proper exercise of the sense of smell it is necessary that odorous particles suspended in the air should be brought into contact with the upper portions of the nasal cavity, which must itself be in an efficient condition. Whenever, therefore, the nose becomes obstructed from any cause, these conditions are not fulfilled, and, consequently, smell is lost or impaired.

The same may also occur even when in-

spiration can be performed through the nose, if the direction of the current of air be directed from the part in which resides the olfactory sense. Of this an interesting instance was lately brought before the Medical Society of London. A man who had lost the whole of his nose and palate, as well as the anterior portion of his upper jaw, was, in consequence of this wholesale destruction of parts, deprived of the sense of smell. When he was fitted with an artificial nose, teeth, and palate, however, the sense returned, to disappear again immediately the gutta-percha nose was removed. In this case it was clear that the artificial nose directed the current of air to the olfactory region, instead of permitting it to take the more direct course to the respiratory organs. More simple and frequent cases are of daily occurrence during and following colds in the head, when swelling of the mucous membrane covering the inferior turbinated bones suffices to cause loss of smell, by diverting the current of air from the superior fossæ of the nose. We must bear in mind, therefore, that loss of smell does not always indicate an affection of the olfactory region, but that its cause is often seated in other portions of the nasal air passages,

To a certain extent the sense of taste is influenced by that of smell, and requires for its efficient exercise clearness of the nasal air-passages. Thus we know how, from early infancy, we are taught to hold our noses when taking physic. Much of the delicacy of taste resides in the soft palate, which is very liable to suffer from affections of a catarrhal character coexistent with those of the nose and throat. Hence it is that defective taste is a common symptom in some throat affections.

After what has been said concerning the important influence exercised by the nasal air-passages in causing disease of the ear, I need hardly dwell upon the necessity of making a thorough examination of these structures. By the aid of the nasal speculum we are enabled to examine the lower fossæ of the nose to a considerable depth, as well as the inferior turbinated bones. The soft palate, fauces, tonsils, and a portion of the posterior pharyngeal wall may be seen by looking into the mouth. The parts situated above the soft palate can only be viewed with the aid of the rhinoscope—an examination which is attended with considerable difficulty in many patients, and in some cases cannot be performed successfully. Occa-

sionally, therefore, we are compelled to form our conclusions concerning the state of these parts from the appearances presented by those below. In such cases, if the throat is diseased, we conclude that a similar condition prevails above; but when the throat appears healthy, the posterior nares, the superior portion of the pharynx and orifices of the Eustachian tubes, remain as a closed book. Judging from the description of rhinoscopy given in some works we should imagine nothing more simple; but, as a matter of fact, in not more than one out of every ten cases, taken indiscriminately, can we make a satisfactory examination of the nasopharynx with the rhinoscopic mirror. This may depend upon various causes. Thus, too great proximity of the soft palate to the vertebral column, enlargement of the tonsils, not unfrequently seen in catarrh, and irritability of the parts, may each or all contribute to cause failure. It is true that in most instances, when the disease is advanced, the space becomes large enough to enable us to use the mirror, but in the earlier stages of the affection, to which I wish more particularly to direct attention, this is frequently not the case.

These difficulties are so commonly met with

that a variety of hooks and retractors have been devised to overcome them by drawing forward the soft palate. I have tried many contrivances, but confess that I have been disappointed in them all. Patience and constant practice will do more than any apparatus ; but, in spite of all, occasional failure will occur.

I will now proceed to describe some of the affections of the nasal air-passages which produce disease of the auditory apparatus and defective hearing. Of these, catarrh—commencing in the nose and naso-pharynx, whence it spreads to the Eustachian tube and tympanum—is certainly the one most frequently met with in practice ; and if we take into consideration the acute and chronic forms of the disease, as well as the consequences to which it gives rise, this will be found to constitute a common, if not the commonest cause of defective hearing.

The symptoms which indicate acute nasal catarrh, or a common *cold in the head*, are too familiar to need much description. First comes the dry or sneezing stage, succeeded by the moist stage, characterised by a constant flow of thin transparent mucus. After a time this is followed by the third stage, in which the secretion becomes thicker and more tenacious, and assumes

a yellow or greenish colour. The affection often commences in one nostril, and is sometimes limited to this; more frequently, however, both are affected simultaneously or in rapid succession. When the disease does not extend beyond the nasal fossæ, altered secretion, thickness of speech, and breathing through the open mouth are the chief local symptoms observable. Most cases will likewise be accompanied by some general malaise, which will be greater when the sinuses are involved.

Post-nasal catarrh commonly results from extension backwards of the nasal affection, but may have its starting point in the throat or soft palate. When present, a feeling of discomfort or stiffness about the fauces and uvula will be complained of. This does not amount to actual pain, though it is decidedly uncomfortable, and leads to an inclination to swallow, hem, sniff, or perform some analogous action, in order to get rid of a sensation as of something adhering to the soft palate.

If we make an examination of the throat in a case of this kind, we shall probably find the uvula and pillars of the fauces presenting a reddened semi-transparent appearance, the redness being due to enlarged veins immediately

beneath the mucous membrane. The parts appear to be infiltrated, and, as it were, œdematous, and a drop of mucus not unfrequently dips down below the point of the uvula. A very similar condition may be seen to exist on the posterior and upper portions of the pharynx; and when it extends to the Eustachian tubes, hearing will be considerably impaired. In the first instance this usually depends upon swelling of the mucous membrane around the orifices of the tubes. By extension further along the canal the cavity of the drum becomes involved and we have simple catarrh of the tympanum. This, as it is met with in the course of an ordinary cold in the head, is what I believe to be simple acute catarrh of the middle ear, and distinct from acute inflammation of this part, which is a most severe and sometimes dangerous disease.

Time will not permit me to discuss the question whether catarrh be an early stage of inflammation, as is generally taught, or whether it be a distinct affection. Whichever theory we may think proper to adopt, certain it is that the symptoms, appearances, and treatment of catarrh are altogether different from those of established inflammation, whether seated in the tympanum or elsewhere. If catarrh be but a stage of in-

flammation in many, I may say in most cases, it does not go further, but proceeds to resolution, or assumes the chronic form without, inflammatory exudation taking place.

In acute catarrh of the nasal air-passages the symptoms are usually transient, and disappear of themselves. The affection of the Eustachian tubes frequently extends no further than the guttural orifices, and, like the nasal affection in which it originated, will, in general, spontaneously subside. Often, however, the mucous membrane which has been affected does not return to its normal condition and function for some time, and not unfrequently the third stage, such as I have described, persists, constituting chronic catarrh. The thick secretion and the tumefied mucous membrane continue, with occasional exacerbations and remissions, for an almost indefinite period of time, unless checked by appropriate treatment.

Chronic catarrh is often accompanied by enlargement of the glandular structures so abundant in these parts, which may be observed on the under surface of the soft palate as minute semi-transparent swellings, of the size of pins' heads. These bear a resemblance to small vesicles, and for this reason the disease is

called by French writers herpetic. On the uvula and posterior wall of the pharynx these glandular enlargements attain greater proportions, and in these situations swellings may often be seen of the size of a split pea, or even larger. Whether colds in the head act as causes in setting a latent condition into activity, or whether the first symptoms of incipient disease show themselves by nasal catarrh in its acute or chronic form, certain it is that we generally meet with them associated together. Weakly scrofulous children are very liable to discharge of mucus from the nose, enlargement of the glands, including the tonsils, and also to more or less deafness. They are very frequent attendants at the aural departments of our hospitals, and have such a peculiarly characteristic appearance that they can be recognised directly they enter the room. The nasal obstruction from which these patients suffer causes them to open their mouths, and this, together with the deafness, gives them a vacant stupid appearance.

From the condition of glandular enlargement which I have described, to that of adenoid vegetations, is to my mind but a question of degree. The latter affection, stated by Dr.

Meyer to be so common in Copenhagen, appears to be but the further development of a disease not uncommon in this country, in which the glands of the posterior walls of the pharynx attain the dimensions of a pea. I have no doubt that if we more frequently made examinations of the naso-pharynx, we should more frequently discover cases of adenoid vegetation, though perhaps not quite so extensive as those met with by Dr. Meyer.

In some cases abnormal growths of glandular structure fill the naso-pharyngeal cavity, and may be felt by the finger introduced under the border of the soft palate. To the touch they resemble a bundle of worms, are of different consistence and form according to the situation from which they spring, and very readily bleed on being handled. We need not stop to consider the varieties which these assume; it is, however, important to remember that some of the glands affected by the disease are in close proximity to, and in fact surround, the orifices of the Eustachian tubes. It is very common also to find deafness associated with adenoid vegetations, and thus the disease is one of interest in our present enquiry.

The signs which serve to indicate the presence

of these morbid growths naturally vary in degree with their extent, and are sometimes altogether absent even when the affection is so situated as to be most dangerous to hearing. Foremost among the symptoms I will mention *deadness* of voice and inability to pronounce nasal consonants. It will be found, however, on examining the nose, that there is no unnatural redness within, and that the nostrils are generally contracted and pinched. The quality and quantity of secretion is also liable to considerable variation. In some cases the nose is almost dry, in others there is a greenish, red or brown thick secretion, which may either be discharged by the nostrils or run down the posterior wall of the pharynx. Not unfrequently blood appears in the mouth at times, and occasionally assumes the appearance of rusty pneumonic sputa. When the growths have attained certain proportions, a sensation of fulness, as from the pressure of a foreign body in the upper part of the throat, behind the posterior nares, may likewise be experienced.

These diseases which affect the secreting structures of the mucous membrane, we may consider to be in their nature catarrhal, and they are by far the most common affections met with in these parts.

Swelling of the mucous membrane covering the nasal air-passages, and consequent deafness, may likewise result from inflammation. The cases differ, however, from those just described in many important particulars. The throat is the most frequent part affected, and it is rare for the disease to commence in the nose. The appearance of the mucous membrane is much redder and more angry looking. The parts are tender to the touch, and painful on movement, so that the muscles contract spasmodically on attempting to make an examination.

In the presence of this hypersensitive condition, in which depressing the tongue is often immediately followed by involuntary movement of the parts, it will be readily understood that rhinoscopy is most difficult, if not altogether impossible, and therefore we can rarely hope to obtain a view of the orifices of the Eustachian tubes. If, however, the symptoms indicate tubal obstruction, we may presume that the general tumefaction of the part has extended to the Eustachian tube. When secretion is present on the surface of the mucous membrane, it is generally more glary and transparent than the mucus of catarrh, and it is also less abundant.

Inflammation seems to attack the submucous areolar tissue rather than the secreting surface. It is, therefore, more deeply seated, and surrounds the muscles and nerves, which are situated here immediately beneath the surface. For this reason the disease is generally attended with pain, more particularly when the parts are moved.

Inflamed sore throat will not unfrequently proceed to ulceration or suppuration, whilst the thickening of the parts is much greater and more difficult to disappear. In early life the commonest form of inflammation met with in the throat is the scarlatinal, which is sometimes followed by suppuration in the middle ear and total loss of hearing. To this affliction will be added that of dumbness if the child has not learnt to speak thoroughly before it became deaf.

During adolescence and early manhood, inflammation usually attacks the tonsils or the tissues which surround them, and thus quinsy is the most usual form met with during middle life. The syphilitic sore throat likewise belongs to this age, and, like other inflammatory affections of these parts, causes deafness both by obstructing the Eustachian tubes and by extension

of the affection to the cavity of the tympanum. The proportion of cases of disease of the middle ear, and consequent defects of hearing resulting from them, is small when compared with those due to catarrh, and the effects produced are also different.

Thus far I have confined my observations almost exclusively to the nasal air-passages, and have only incidentally alluded to affections of the middle ear. I have done this from a conviction that disease of these parts is really the commonest cause of defective hearing. I will now say a few words concerning the mechanism by which sounds are conveyed to the brain, in order to explain how the function of hearing becomes disturbed by disease of the nasal air-passages.

Sonorous vibrations communicated to the air are collected by the external ear, and received by the membrane of the drum, which forms the outer wall of the tympanum. For the transmission of these vibrations to the brain, and consequently for the correct appreciation of sound, the tympanic membrane must possess a certain degree of tension. This is maintained and regulated by two opposing forces, namely, atmospheric pressure and muscular action.

The middle ear may be considered as a box containing air, the density and tension of which is regulated by a safety valve—the Eustachian tube. Normally this is closed by its own elasticity, but opens readily when the pressure of air exceeds a definite amount. The perviousness of the tube can also be increased by the action of a muscle, which removes the elastic pressure of its walls. This function is performed by the salpingo-pharyngeus, a portion of the palato-pharyngeus, and is set in action during swallowing.

The whole of the middle ear is lined with mucous membrane, continuous with that of the pharynx. Now, one of the properties of mucous membranes is to absorb the air which they enclose, and consequently that within the tympanum requires frequent renewal. This is effected during the act of swallowing; the quantity admitted being regulated by the demand.

In addition to the regular tension of the membrana tympani produced by air within the drum, certain variations are produced, so as to adapt the membrane for the reception of different sounds. The regulation of tension under these circumstances is called

accommodation, and is performed by muscular action.

The chief muscle concerned in accommodation is the tensor tympani. This is inserted into the malleus, which is itself firmly attached to the membrane of the drum. The action of this muscle is to draw the membrane inwards, and, therefore, to increase its tension. When obstruction of the Eustachian tube prevents the renewal of air to the tympanum, the absorption which I have mentioned as taking place reduces the quantity of air below its normal standard. From this results augmented concavity of the membrana tympani, and therefore drawing inwards of the malleus handle. The consequence of this is diminution of the force opposed to the tensor tympani, which contracts so as to maintain a certain amount of pressure on the cushion of air within the drum.

The pressing inward of the malleus involves the other ossicles of the ear, and as the base of the stapes communicates, through the oval fenestra, with the labyrinth, the nervous elements are compressed. This produces tinnitus, as well as diminution of nerve power, and hence arise the noises in the head and defective hearing of which patients complain.

In the first instance these symptoms can be readily relieved by supplying air to the tympanum, and a permanent cure may be effected by removing the cause which obstructs the Eustachian tube. If, however, the tube has continued impervious for a considerable time, the difficulty will increase in proportion to the time it has endured. The reason of this is obvious. The parts within the tympanum—muscles, bones, and ligaments—gradually accommodate themselves to the altered condition in which they have been placed, and will no longer return to their normal positions unless some force be applied to overcome the morbid contraction. Thus the tensor tympani muscle becomes shortened, just as the muscles of the calf are shortened in a case of club foot. The ligaments of the articulations between the small bones become contracted, and a certain degree of rigidity results. For this reason, we find, even when the Eustachian tube has been rendered pervious, that indrawing of the malleus persists, and as a consequence of this, pressure on the nervous element contained in the labyrinth continues. In such cases we sometimes notice that inflation of the tympanum distends the membrane, but that the manubrium continues

drawn inwards and slightly rotated, showing that the bone is kept in its abnormal position by muscular and ligamentous contraction rather than by atmospheric pressure, which caused it in the first instance.

In this manner, simple tubal catarrh, which, at the onset is so amenable to treatment, ultimately causes severe and obstinate deafness, aggravated by intolerable noises in the head. If these facts were better understood, the number of persons afflicted with chronic deafness would be enormously decreased. We should no longer meet with the cases, now too numerous, of persons who, during the early stages of the affection, were treated by blisters and syringing, until serious and often permanent mischief followed.

The symptoms which indicate the presence of catarrh of the Eustachian tube are due to obstruction. Assuming, as I wish to do, that the disease has not reached the cavity of the tympanum, the symptoms observable in the auditory apparatus will be entirely due to abnormal closure of the tubes. The first consequence of this will naturally be increased concavity of the membrana tympani, indicated by diminution of the light-spot. This no longer appears tri-

angular in form, but becomes more or less rounded and diminished at the periphery. Sometimes it is reduced to a mere point. The short process of the malleus looks more prominent from the tightening of the membrane over it, and the manubrium seems shorter than natural, because its lower extremity recedes from the eye of the observer and approaches the horizontal position. With this altered condition of parts, the membrane of the drum retains its normal transparency, and as its position will be nearer to the long process of the incus and to the stapes, these may sometimes be made out with more than usual distinctness.

The patient will generally complain of stiffness in the ears, with more or less impairment of hearing, and not unfrequently tinnitus. These symptoms are liable to considerable variation in degree, and one may be present without the other. Thus we very frequently see cases in which the deafness is considerable, but no noises in the head are complained of. Occasionally the tinnitus is very troublesome, and yet deafness is scarcely perceptible.

In addition to the defects of hearing, caused by obstruction of the Eustachian tube, catarrh of the nasal air-passages may extend through

the tube to the cavity of the tympanum. When this part of the middle ear becomes affected its functions are considerably interfered with by swelling of the mucous membrane, as well as by the presence of augmented secretion. To these causes is usually added increased concavity of the membrana tympani, due to obstruction of the Eustachian tube, and in this manner the cavity of the drum, which is normally so small, becomes almost obliterated.

Simple catarrh, in its acute form, sometimes spreads from the nose to the tympanum, and though instances rarely come under the notice of aural surgeons, many of my readers have no doubt experienced this in their own persons. When suffering from a severe cold in the head it may sometimes be noticed that, on blowing the nose, a very moist sound is produced in the ear. This sound is not unlike that caused by walking in shoes which contain water. Acuteness of hearing is considerably interfered with, and the presence of thin secretion in the tympanum may sometimes be seen on examination with the speculum.

These symptoms, which are undoubtedly due to acute catarrh of the tympanum, will generally subside of themselves with the affection of the

nose and throat in which they originated. At any rate the moist stage which I have described is very transient, and will have passed away before the patient will think it necessary to seek advice. For this reason, as I have said, catarrh in the acute form rarely comes under our notice, and is not enumerated among diseases of the ear.

When the affection passes into the third stage, the secretion of mucus within the drum becomes thicker and more tenacious, as it does in the nose. It does not readily escape by the Eustachian tube, but adheres to the ossicles or tympanic walls, and the delicate mechanism of the middle ear is still further interfered with. Should this continue for more than a brief period, the disease may be considered to have become chronic, and in this form, with repeated exacerbations and remissions, will not unfrequently accompany the patient through life, unless he adopt proper measures for its cure.

Chronic catarrh, together with the consequences to which it leads, are the most common causes of defective hearing, and constitute a large proportion of the cases which occur in practice. As it is important to be able to recognise this condition, I will give a

brief outline of the symptoms by which it is characterised.

If we make a careful examination of such a case, it is not unusual to find the hearing power so diminished that the watch can only be heard in contact. At the same time the tuning-fork placed on the bridge of the nose will be well heard, and probably better on the side which the patient finds worse for ordinary purposes. The membrana tympani has an opaque appearance in parts, and is generally abnormally concave, with diminution in size and alteration of form of the light-spot. The short process of the malleus is more prominent than natural, and the handle of the bone is drawn towards the promontory, and thus has the appearance of foreshortening. Around the hammer-bone may frequently be observed a yellowish appearance, more particularly at the upper part. Auscultation of the middle ear reveals in the earlier stages a gurgling sound, which gradually merges into a sort of squeaking as the mucous contents of the drum become thicker.

The hearing power of patients suffering from catarrhal affections of the middle ear, whether in the Eustachian tubes alone or in the tympanum, is liable to great variation. It is considerably

affected by temperature and barometric pressure, as well as by stomachic derangements. We generally find that the hearing improves during dry weather, either hot or cold, and that the opposite condition of humidity aggravates the disorder. In like manner irritation of the digestive organs will often extend to the mucous membrane of the nasal air-passages, and from them to the middle ear. For this reason it is not uncommon to find that persons who suffer from catarrh are worse when their stomachs are out of order.

Catarrh of the tympanum may terminate in one of three ways,—1, by resolution, in which the parts return to their normal condition and function without any perceptible detriment; 2, by retention and inspissation of the mucus secreted in the middle ear; 3, by the accumulation of secretion causing perforation of the membrana tympani.

The first of these terminations is, apparently at least, the most common in acute catarrh. The deafness, stuffiness, and noises in the head gradually disappear, and the patient is considered well again. If, however, the hearing power be carefully tested, it will not unfrequently be found to have suffered slight

impairment. This shows that some mischief, however slight, has been left behind. Now we know that catarrh is an affection which is very liable to recur, and on each recurrence further damage may be produced, as evidenced by the hearing power further receding from the normal standard. After a certain number of attacks this becomes manifest to ordinary observation, and the patient reluctantly acknowledges that he has become "slightly hard of hearing."

By gradual and almost imperceptible degrees, a case of chronic catarrh of the tympanum may become one of inspissated mucus. The cohesive properties of the secretion increase, whilst its adhesive ones diminish, and so it happens that the mucus forms tough gelatinous masses in the middle ear. These can often be moved from one part to another by inflating the tympanum, and patients are not unfrequently conscious of something moving in the ear when they shake their heads. Sometimes hearing can be so much improved in this way, that persons acquire a habit of giving a sudden shake of the head. It is not improbable, although of course insusceptible of the proof of actual observation, that hearing is most impaired when a mass of inspissated mucus rests against the

fenestra rotunda. If this supposition be correct, any sudden movement which dislodges the plug from this position will naturally improve hearing. Persons suffering from the affection to which I allude will often tell us that they hear better in the morning—a fact which may on the same principle be explained by gravitation of the mucus during the recumbent position.

In some cases large masses of tough, elastic secretion have been removed from the middle ear, which, from their size, must have extended into the mastoid cells. Continued pressure, caused by this inspissated mucus in the tympanum, will not unfrequently give rise to perforation of the membrane, but the opening is usually of small size, and only admits of partial escape of the secretion, unless the efforts of nature be assisted by art.

Perforation of the tympanic membrane may likewise result from accumulation of non-inspissated mucus. This is the commonest cause of ear-ache among children, and is distinct from the very severe form which accompanies acute inflammation, and which terminates usually in suppuration. The ear-ache of catarrh is mild in comparison with this, and in adults the symp-

toms are usually so inconsiderable as scarcely to deserve the name of pain.

After two or three days slight discharge takes place from the ear, and is due to a perforation having occurred in the membrana tympani. On examination a small circular or oval opening with pale and rounded edges will generally be seen. The pain, when any was present, is immediately relieved, and in a few days later the perforation closes. After this hearing soon returns, if not to its normal state, at least to a very useful degree, and the patient is considered well again. Such is an outline of a case of perforation as it results from catarrh. These attacks do not occur, however, without producing a certain amount of mischief, though it may be imperceptible at the time, and relapses must be expected.

I consider all these affections as purely catarrhal in their nature, and distinct from inflammation. They appear to be seated in the secreting structure of the mucous membrane, and do not give rise to the deposition of organised material in the tissue.

True inflammation, on the other hand, affects the submucous tissue, in which are situated the vessels and nerves. Leucocyths migrate from

the interior to the exterior of the blood-vessels, and there become converted into organised material, or degenerate into pus. Now the sub-mucous tissue of the middle ear is likewise the periosteum or nutrient membrane of the bones, and consequently inflammation attacking this part is a periostitis.

Inflammation of the middle ear, like catarrh, may give rise to defective hearing either by causing obstruction of the Eustachian tube, or by extension of the disease to the tympanic cavity. In whichever of these parts it is situated, the affection may, as I have said, be plastic or suppurative in its nature—that is to say, it may either proceed to the deposition of organised material in the tissues, or it may terminate in the formation of pus. When inflammation is plastic, and attacks the Eustachian tube, we find that the resulting obstruction is firmer, and more resisting than in catarrh. So also, when the cavity of the tympanum is affected, fibrous deposits are formed in the lining membrane, including that of the fenestræ. As a consequence of this thickening, and of progressive condensation of the new material, fixation and rigidity of the parts take place. The periosteal character of the tissue affected sometimes leads to osseous

calcareous material being deposited, and thus thickening of the bone and ankylosis of the ossicles take place.

When inflammation is suppurative, it may proceed to ulceration, caries, or necrosis, and it is in these cases that wholesale destruction of tissue occurs. The *membrana tympani* becomes perforated, the ossicles are loosened and destroyed, and caries of the temporal bone, extending even to the interior of the skull, may be met with.

Inflammation of the middle ear is, as a rule, always accompanied by pain, this is, as we have seen, quite exceptional in catarrh. The suffering which usually accompanies acute inflammation of the tympanum is perhaps the most severe which it is the lot of mortals to endure. In the chronic form there is often very little pain, noticed only at certain times or under certain circumstances. Still most instances are attended with suffering.

A striking exception to this rule occurs in the rapidly destructive form of inflammation which is met with in scarlatina. In these cases it commonly happens that the first indication of the affection is noticed when the accumulation of pus in the middle ear has found vent by

rupturing the membrana tympani, and purulent matter flows from the meatus.

In most instances of acute inflammation of the middle ear, suppuration will take place if the symptoms are severe, and as the Eustachian tube is most frequently obstructed by tumefaction of its walls, the purulent secretion will escape by perforation of the tympanic membrane. The tinnitus accompanying the affection is generally of a pounding throbbing character, and there is usually considerable impairment of hearing. If the disease is limited to the Eustachian portion of the middle ear, the appearances noticeable on inspection are similar to those of catarrh of the tube ; when, however, the tympanic cavity is the seat of inflammation, intense redness of the promontory is reflected through the drum-head, giving to it an appearance as of polished copper ; soon, however, the membrana tympani itself becomes implicated, and ceases to be transparent. The vessels which accompany the malleus handle become injected and turgid. Other minute blood-vessels appear around the periphery of the membrane, and gradually the entire surface becomes red and velvety. As suppuration takes place the membrane becomes of an opaque yellowish grey

colour, and ultimately perforation occurs, followed by relief of the symptoms.

Chronic inflammation is attended with very similar though less marked appearances. It sometimes happens in these cases that the membrana tympani continues unaffected, or nearly so, throughout, and the changes taking place within can be watched. Usually, however, the membrane becomes opaque, but the active redness described when speaking of the acute disease is not present.

After perforation of the membrana tympani, more particularly when it is due to suppurative causes, discharge from the ear may continue for months or years. Often it is accompanied by a most offensive smell, and sometimes by occasional bleeding. This form of otorrhœa, which is called internal, because it proceeds from the parts within the tympanum, requires careful attention. It may depend upon the lining membrane of the middle ear continuing to secrete pus or excess of mucus, or upon ulceration, necrosis, or caries being present. When the discharge is mixed with blood, a polypus will usually be found to occupy the auditory canal, and may at any time prove a source of danger to life by obstructing the flow of matter from the ear. In

this manner suppuration is sometimes made to extend inwards to the bones, and even to the skull cavity, causing death.

When otorrhœa is accompanied by caries or necrosis of the temporal bone, we can never consider the patient to be out of danger, as it is impossible to tell whether the disease will extend to the many vital parts which surround the ear. In this way the brain and its membranes, the petrosal and lateral sinuses of the dura mater, the jugular vein, and internal carotid artery, are all exposed to injury, and a fatal termination may depend upon extension of inflammation to any one of them.

Sudden cessation of discharge from the ear often precedes symptoms of a serious nature, and for this reason many persons, both doctors and patients, are afraid to cure otorrhœa. This fear is only well founded when the cessation is brought about by such means as tend to keep back the discharge, which thus becomes a source of irritation to the important structures around.

Having briefly alluded to the commonest causes of defective hearing, it only remains to point out the methods which appear to be most successful in the management of these cases.

Before doing so, however, I should like to say a few words concerning the reasons why we see so many deaf persons who are reputed incurable.

When a patient suffering from any bodily ailment consults a physician or surgeon, it is the usual custom to enquire whether he has already adopted any treatment for his complaint. If the answer be in the affirmative, the nature and result of this treatment is ascertained in order that it may serve as a guide in the future management of the case. Applying this rule of practice to cases of defective hearing, the answers which we receive commonly resolve themselves into one of two forms. The first is that when ear symptoms made their appearance, the patient consulted the ordinary medical attendant, who syringed the ears without bringing away anything from them, and then applied blisters. When it became manifest that no improvement resulted from this treatment, the patient was told that nothing more could be done, but that in time his hearing would improve. This promised amelioration had not, however, taken place, in spite of anxious expectation during months or years, but on the contrary, the deafness had considerably in-

creased, with the addition perhaps of noises in the head.

The second form of reply, which it is not very uncommon to receive to our question, is that either after having seen the family doctor, or without having done so, the patient consulted some well known specialist. He continued his attendances for two or three weeks or, perhaps, longer, but finding, as he thought, no commensurate benefit, ceased to attend.

Let us stop for a moment to consider what is the import of these replies. The first clearly shows that the family doctor has paid little or no attention to the study of aural disease, and that the fact has not escaped the observation of the patient. This is made further manifest by the frequency with which patients tell us that, for their general health, they are under the treatment of Dr. A. or Mr. B., who is a first-rate man—a capital fellow, and one for whom they entertain the greatest esteem and regard, but that *he knows nothing about ears*. Surely this is a circumstance much to be deplored, and one which we ought to spare no pains to overcome. Unfortunately, however, instead of endeavouring to master this interesting branch of study, it is too much the custom to hold it in derision, and

to assure the patient that if blisters and syringing have failed, no treatment will be of any benefit. By statements such as these, it often happens that valuable time is wasted, and persons are deterred from submitting to treatment in the early stages, when their disease is most curable.

That this branch of surgery should be but little understood cannot be wondered at, when we remember that very few years ago none of our hospitals possessed ear departments, and that aural surgery, untaught in our schools, was almost entirely in the hands of quacks. The labours of the late Joseph Toynbee did much to elevate the study of ear disease, but we find even at the present day that most works on general surgery are sadly behind the times in this particular. Thus it happens that, with very limited opportunities for observation, with little time at his command, and with no assistance, the medical practitioner continues in the belief which was prevalent in his earlier days, that aural surgery was but a delusion and a snare. The only way it seems to me of overcoming these prejudices, for such they undoubtedly are, is for those who occupy the responsible positions of teachers of aural surgery, to make known to

the profession at large the results of their experience acquired in the special departments. In this manner, by avoiding mystery and freely disseminating the knowledge placed within our reach, we shall ultimately raise the practice of this branch of surgery to the position which it has attained in other countries. No doubt we are largely indebted for the knowledge we possess to foreign sources, and that for some years most of the original work has been done in Germany. We must not, however, forget that much of this is the immediate result of the pathological observations of our countryman Toynbee. To his indefatigable zeal must undoubtedly be attributed the fact that aural surgery has been so extensively cultivated during the last thirty years, and that as a consequence very important advances have been made.

This may seem at first sight to be somewhat contra-indicated by the second form of reply to which I have alluded. It cannot be denied that many, even in our own profession, believe that modern research has done little or nothing, and that those who have made aural disease their special study possess no more *practical* knowledge than those who have not worked at the

subject at all. By the dissemination of these opinions want of confidence is engendered, and becomes one of the principal causes of failure which we have to contend against. It is impossible to practice this branch of surgery without being constantly impressed with the fact, and it is important to ascertain the causes which give rise to it.

Without taking into consideration that greedy charlatanism which sacrifices all for the sake of gain, both the profession and the public are too apt to forget that most of the cases of defective hearing which come before us are chronic. Many have been steadily getting worse for years, and we are resorted to as a sort of forlorn hope. It is well to remember that all chronic diseases are more difficult to manage in proportion to the time they have endured, and therefore we should not expect these to be exceptional. In some instances no doubt immediate benefit will follow judicious management, but we cannot shut our eyes to the fact that in many this will not be the case until after a prolonged course of treatment.

The various forms of defective hearing described in this paper, and they are the commonest observed in practice, depend upon disturbed function of the middle ear. These

are all seated in the conducting apparatus, and are consequently all amenable to treatment, provided that treatment be appropriate, and not abandoned too soon. Some cases certainly give much more trouble than others, but I repeat that so long as the tuning fork shows that the nerve remains sensitive, we ought not to despair of being able to restore useful, if not perfect hearing. We may even go further, for it sometimes happens that persons whose hearing is moderately good, do not hear a tuning fork placed on the vertex. For this reason, we are not justified in destroying a patient's hope on the evidence of this test without a very careful examination.

In those instances which require the treatment to be persevered in for many weeks, it is of considerable importance to adopt methods which patients can themselves carry out. This is quite practicable in most cases, and will be found very materially to assist the progress towards cure. It not unfrequently happens that the daily employment of remedies is called for during a considerable period, and it is hardly reasonable to expect that patients will spare the time and money to visit their surgeons, thus often more particularly if the progress they are

making be not very perceptible. For this reason I have dwelt more especially on those forms of treatment which may be safely entrusted to patients themselves.

In considering the management of cases of defective hearing, I have thought it most convenient to commence with that of the nasal air-passages. This arrangement has been adopted, not only because affections of the nose and throat generally precede and act as causes of the ear disease, but also because it is only by way of the naso-pharynx that remedies can be applied to the middle ear.

The treatment of catarrh, whether seated in the nasal, buccal, or pharyngeal mucous membrane, should be stimulating. In the early stage of a cold in the head, it has been long known that smelling ammonia, acetic acid, camphor, chloroform, ether, iodine, carbolic acid, and other stimulating substances which give off vapour, will often effectually arrest the progress of the disease. I have frequently known a pinch or two of snuff to drive away a cold altogether if taken when the first symptoms appeared. It is true that these will sometimes return on the following evening, to be again stopped by the same means, and perhaps return no more. Though less effective

in the second or moist stage, this treatment will often afford considerable temporary relief to the feeling of oppression and fulness in the head.

Dry air, whether hot or cold, will always during the moist stage of the affection relieve nasal obstruction. We all know the alleviation experienced when suffering from a severe cold, on going out during dry, frosty weather. Those who use the Turkish bath will likewise bear testimony to the comfort of the hot room under similar circumstances.

When catarrh has reached the third stage, characterised by the secretion becoming less abundant though thick and tenacious, stimulants and tonics to the mucous membrane are indicated. The management of chronic catarrh should be conducted on the same principles.

Remedial agents may be applied to the nasal air-passages in the form of solid, liquid, or vapour. The first of these comprises powders used as snuffs, or for insufflation. In this manner we may employ various stimulant and astringent preparations, their strength being regulated by admixture with different proportions of inert powder. Powdered camphor and sugar in equal parts forms a useful snuff in some cases, and is generally appreciated by patients suffering from

catarrh.* Alum and sugar sometimes prove advantageous, when blown up behind the soft palate with the apparatus of Rauchfuss. Patients will rarely, however, perform this operation satisfactorily, and I prefer to use remedies in the form of liquid or vapour, to be next described.

One of the best methods for making liquid applications to the nasal air-passages, is by means of a douche which consists essentially of the following parts:—1, a reservoir for which a jug, basin, or other convenient utensil, will answer the purpose; 2, a syphon tube by which the fluid is delivered in a constant stream, the force of which may be regulated by raising or lowering the reservoir; 3, nozzles of various form, so that the liquid may be applied to different portions of the nose and pharynx.

The first nozzle made to fit closely into the nostril will enable the stream to be directed into one side of the nose, whence it will pass round the septum and return by the other nostril; this is called Weber's douche, and will be found

* Messrs. Bullock and Reynolds, of Hanover Street, have made the preparation much more elegant by substituting powdered liquorice root for the sugar. In this form it will not become lumpy.

very useful in the treatment of disease of the nose and naso-pharynx. The patient should bend his head forward over a basin and breathe entirely by the mouth kept widely open for the purpose. It is important when using this form of douche, not to place the reservoir too high, as by so doing, it is possible to cause the liquid to enter the Eustachian tube and inflict injury on the middle ear; of this accident several cases have been recorded. If the water have a fall of six or eight inches it will be quite sufficient, and danger will be avoided. As an additional precaution, the patient should be told not to swallow during the operation, because we know that this opens the Eustachian tube. By adopting these simple precautions, I have never seen any ill effect from the use of Weber's douche, but on the contrary, the greatest advantage. The same nozzle will also serve for directing a gentle stream of warm water into the auditory canal for the relief of inflammatory pain, whether seated in the external or middle ear. When used for this purpose it should not be pushed into the meatus, as it would prevent the return of the water.

Another form of nozzle, which will be found of service when the upper portions of the nose

are affected, consists of a tube slightly curved, and having on its convex side five or six perforations. This is intended for passing along the floor of the nose on either side to the extent of about three inches. The jets should be directed upwards, and will play upon the upper and middle meatus of the nose.

A third nozzle by which liquids may be applied to the naso-pharynx, is formed by a tube terminating in a bulbous extremity perforated in various directions. This is intended to pass along the floor of the nose beyond the posterior nares, where the jets will wash the different portions of the space situated above the soft palate. It is more especially useful in post-nasal catarrh, and reaches the orifices of the Eustachian tubes.

In the "Universal douche"* the reservoir consists of a graduated tin box which also serves to contain the rest of the apparatus. The syphon tube is filled by compressing an india-rubber ball, instead of by suction with the mouth, and a small wire clip serves to arrest the flow of liquid when desired. All these are refinements which, though very desirable, may be

* Manufactured by Mayer and Meltzer, of Great Portland Street.

dispensed with when economy is an object, without in any way sacrificing the efficiency of the apparatus. Thus four or five feet of india-rubber tubing fitted on the end of a piece of curved composition gas pipe will answer every purpose, as well as the most expensive instrument. Indeed, if it is only required for Weber's douche or for the external auditory canal, a foot and a half or two feet of tubing will suffice to give the required pressure. In order to set the apparatus in action, it is only necessary to fill the syphon tube by suction, or by any other means, and raise the reservoir to the required height.

The remedies which I have found most useful for employment with the douche, are common salt, carbonate or phosphate of soda, borax, and carbolic acid. These should be dissolved in water in the proportion of two to three grains to the ounce. Chloride of sodium is tonic and stimulant, and may be used either at a temperature of 90° or cold. The other salts are solvent, and are most effective at a temperature of about 100° . Carbolic acid may be mixed with any of these; it is a most useful application, and appears to have an anæsthetic action as well as being stimulant and antiseptic. It is

well to remember that simple water, particularly if used cold, is not a little irritating to the mucous membrane of the nose. It is less disagreeable, however, if employed at a temperature of 90° , and if the specific gravity is raised by the addition of any of the salts I have mentioned it becomes quite pleasant and refreshing.

Astringent solutions are best used in smaller quantity than could be conveniently done with the douche. Two drachms will generally suffice for each application, and a small syringe or india-rubber bag will constitute a ready method of making the application. When it is deemed advisable to carry the lotion into the nasopharynx, without first coming in contact with the mucous membrane of the nose, a tube of sufficient length to reach the posterior wall of the pharynx should be attached to the syringe. In this manner we may employ a variety of stimulants and astringents, among which may be mentioned alum and iron, sulphate and sulpho-carbolate of zinc, carbolic acid, iodine, iodide of potassium, and many more, either singly or in combination.

Another useful form in which liquid applications can be made to the nasal air-passages is in

the shape of spray. This may be used by the patient himself, and may be introduced by the nose or by the mouth. The various forms of spray-producing apparatus are too well known to need description, and the lotions which they serve to apply are the same as those just enumerated.

When it is considered undesirable to extend the effects of a remedy to the larynx, the current of spray should be stopped during inspiration. This will be most effectually guaranteed, when using the method through the nose, by substituting the lungs of the patient for the inflating bellows. In this way the jet being produced by the expiratory effort, will naturally cease during inspiration. If the tube of the apparatus is long enough to reach beyond the posterior nares, the spray may be directed on the parts contained in the naso-pharynx.

More concentrated solutions should be applied with a brush, which may be fixed on a handle in such a manner as to form with it a right angle. This kind of brush is intended to be passed by the mouth under the velum palati to the naso-pharynx, including the orifices of the Eustachian tube. The solutions which are used in this way are chloride of zinc, 15—30,

grains to the ounce; perchloride of iron, 60—120 grains; carbolic acid, 30 grains; sulphate of copper, 15 grains; tincture of iodine, or a solution of one part each of iodine, iodide of potassium, and carbolic acid in 100 parts of glycerine. Nitrate of silver is a very useful remedy, and may be applied in solution of varying strength from 10—60 grains to the ounce. It may also be employed in the solid form, fused on a stem of wire, bent at a right angle, and fixed into a wooden handle similar to that of the brush just described.

Chronic catarrh affecting the naso-pharynx may sometimes be rapidly cured by first using a nasal douche of salt and water, so as to remove the thick mucous secretion which adheres to the parts, and then applying a strong solution of nitrate of silver with a brush. Occasionally this will cause some cough and spasm, which soon subsides.

The application of vapour to the nasal air-passages is of very great utility in the treatment of disease of these parts, and deserves more extensive development. By this means we are enabled to use any of the gases, as well as a large number of volatile substances, both solid and liquid. Several methods have been

devised for the employment of vapour, the most familiar of which are, perhaps, the ordinary inhalers. In them the volatile substance is mixed with hot water, and may be inhaled either by the mouth or by the nose. This method necessitates the admixture of steam, which has a somewhat relaxing effect on the mucous membrane.

Another plan by which vapour may be employed to the nasal air-passages is by passing a stream of air through some volatile liquid placed in a bottle. The cork of this should be pierced by two tubes—one terminating immediately inside the cork, the other extending nearly to the bottom of the bottle. In using the apparatus air should be propelled through the longer tube to bubble through the liquid, and pass out by the shorter tube charged with vapour.

A third plan is that of placing a few drops of volatile liquid on a sponge enclosed in a box, from each of the two opposite ends of which passes a tube. One of these is for the entrance of air, which becomes charged with vapour by passing through the sponge, and emerges by the second tube. This form possesses the advantage of being applicable to the Politzer

bag, and so enables us to inflate the middle ear with a medicated atmosphere.

The reason why remedies in the form of vapour have not been largely employed in the treatment of disease of the nasal air-passages appears to me to be due to the difficulty experienced in limiting their action to these parts. Many substances which act beneficially on the naso-pharynx produce considerable irritation of the glottis when employed by inhalation. For the purpose of avoiding this evil, I venture to recommend a simple and inexpensive contrivance, which will be found very effectual. It consists of a U-shaped tube made of glass. To each open extremity of this is fitted a cork, through which passes a tube. One of these tubes is bent to an obtuse angle, and is intended for the mouth; the other is straight, and is prolonged by a few inches of india-rubber pipe, to which nose-pieces of various form may be attached if desired. Inside the cork of this side of the instrument is a piece of coarse sponge, intended to prevent any of the solid or liquid, placed in the U-tube, being blown into the nose. When the remedy requires warming in order to disengage its volatile principle, the tube may be dipped in hot water or in a sand-bath.

To use the apparatus, the patient should introduce the nose-piece into one of his nostrils, he should then blow through the glass tube, placed in his mouth, and a stream of air, charged with vapour, will enter his nose. Inspiration should be performed through the open mouth, and thus none of the volatile principle will enter the wind-pipe.

In this manner camphor, chloroform, carbolic acid, kreosote, ammonia, and several essential oils may be employed, and will prove useful stimulants to the mucous membrane. The tendency of catarrhal affections to produce chronic enlargement of the glands contained in the nasal air-passages, points to iodine as the remedy *par excellence* for these diseases. The metalloid, placed in the bottom of the **U**-tube, will, under the influence of slight heat, give off vapour, or we may employ it in the form of tincture. In either way it will often prove of great advantage, and patients may be directed to use the apparatus once or twice daily.

Catarrhal affections of the nasal air-passages are benefited by general as well as by local treatment. Thus sudorifics, stimulants, narcotics and diuretics, if administered within twenty-four hours of the commencement of acute catarrh,

will often cut short the attack. The chronic form, which comes more particularly within the domains of aural surgery, generally demands tonic treatment. By this I do not mean tonic medicine only, but equal, if not greater importance should be attached to hygienic methods. Habitual use of the cold bath is of great service, by promoting action of the skin, and so relieving the mucous membrane. Active exercise in the open air, the avoidance of close crowded rooms, and the proper ventilation of sleeping apartments, are also matters well deserving our attention in the management of these cases. The sympathy which exists between the stomach and nasal air-passages, points out the necessity of regulating the digestive system, both by medicine and dietetics. Tonics and chalybeates will often prove of service, and in the scrofulous delicate children who so commonly suffer from catarrh of the nose and throat associated with deafness, cod-liver oil will likewise be called for.

Acute inflammation of the nasal air-passages is best treated by steam inhalation, or by the hot nasal douche. Vapours reach the nasopharynx and orifices of the Eustachian tubes more readily if inhaled through the nose, which

may be done by stretching an india-rubber teat over the mouthpiece of an ordinary inhaler. A teaspoonful of compound tincture of benzoin, or two teaspoonfuls of succus conii with twenty grains of dry carbonate of soda, form soothing additions to the steam inhalation. A nose douche of hot water, to which may be added a teaspoonful of borax, phosphate of soda, or chlorate of potash to the pint, is likewise very grateful in some cases.

Guaiacum in the form of lozenges* is of very great utility in the treatment of acute or sub-acute inflammation of the fauces, tonsils, and pharynx, and if employed before suppuration has taken place will generally prevent its occurrence. Such is my opinion of the value of this remedy in acute tonsillitis, that I always recommend persons who are subject to recurrent attacks of quinsy to keep the lozenges by them. Immediately the first symptoms appear one lozenge should be taken every two hours, until relief is manifest, when the dose may be taken less frequently. Saline purgatives are likewise of considerable service in these cases, and should

* These formulæ, and many others mentioned in preceding pages, will be found in the Pharmacopœia of the Hospital for Diseases of the Throat.

be administered three or four times during the day at the onset of the attack. Tincture of aconite in frequently-repeated doses also appears to exert a very marked influence over this, as over many other inflammations. If carefully watched it is quite free from danger, though it cannot, like the Guaiacum lozenge, be safely entrusted to patients themselves.

It was at one time supposed that enlarged tonsils exerted direct pressure upon the orifices of the Eustachian tubes; and with this belief it became quite fashionable to remove the glands for the cure of deafness. More accurate observation has taught us the incorrectness of the theory upon which the practice was founded; and in consequence tonsillotomy has fallen into disuse in these cases. If, however, the tonsils have become so enlarged as to impede respiration, if they are so hard as to have lost their glandular structure, or if they are riddled with sinuses full of thick offensive smelling matter, they, undoubtedly, give rise to, and maintain an, unhealthy condition of the naso-pharynx, and so operate injuriously on the mucous membrane of the middle ear. Under such altered conditions the organs no longer serve any useful purpose in the economy, but have become hurtful

and offensive appendages, consequently their removal is desirable as well for the benefit of the general health as for the treatment of defective hearing.

In the scarlatinal form of inflammation of the throat, which I have spoken of as being so insidiously fatal to hearing, acetic acid inhalations are most useful. The inflamed sore throat of syphilis requires general treatment by iodide of potassium, with or without the addition of mercury. Local applications of nitrate of silver or of sulphate of copper to any ulcerated parts, and inhalation of kreosote or carbolic acid, will likewise form useful adjuncts to the constitutional remedies.

It will be observed that I have devoted a considerable space in my paper to diseases of the nasal air-passages. I have done so because this part is so very frequently at fault in cases of ear disease, and because we can only hope to cure defective hearing by restoring the nose and throat to a healthy condition. Having given an outline of the treatment to be adopted for this purpose, let us consider what should be done when the affection extends to the middle ear.

The first portion of this, commencing from

the naso-pharynx, is the Eustachian tube, which, as I have already explained, becomes closed by relaxation or tumefaction of its lining membrane. In these cases impairment of hearing results from the non-admission of air into the tympanic cavity. If the disease be catarrhal, and have not extended further into the middle ear than the Eustachian tube, an occasional inflation of the drum by Valsalva's or Politzer's method will usually suffice, together with applications to the throat, to restore hearing. In recent cases, more particularly with children, the effects of this treatment are very striking. The vacant, stupid appearance commonly observed in these patients will often be made to vanish by a single inflation, as if by magic. The face lights up, and hearing is restored, to the no small surprise and delight of the patient, and of any of his friends who may be present. This improvement, marked as it is at the time, will be but transient, however, unless measures are adopted to maintain the perviousness of the Eustachian tube. For this reason inflation will require to be practised once or twice daily until air is normally admitted into the tympanum by the act of swallowing.

I have pointed out how tubal obstruction

causes displacement of the ossicles and contraction of the tensor tympani muscle; from this results pressure on the contents of the labyrinth, defective hearing, and tinnitus. Before the parts have become fixed in their altered position by long habit, the treatment I have described will suffice to restore them to their normal position and function. Unfortunately, however, in many of the cases which come before us the tubal obstruction has been allowed to continue unchecked for too long a time to be thus readily relieved. As a result of this, the handle of the malleus may often be seen resting on the promontory, where it is firmly held by the contracted tensor muscle, as well as by altered ligamentous structures. Forcible inflation will frequently fail to move the bone from its position, but will sometimes increase the tinnitus, and even cause giddiness.

In some of these cases, when the malleus handle continues drawn inwards towards the promontory after the Eustachian tube has become pervious, I have found improvement result from exhausting the air in the meatus externus. In this manner the membrana tympani is drawn outward, and traction is necessarily made on the manubrium. In many instances, however, no

permanent benefit results, because the membrane has become too much thinned and relaxed by prolonged indrawing. Weber-Liel and Gruber advocate division of the tensor tympani tendon, and have recorded some cases in which the operation proved of service. The results are not sufficiently striking, however, to warrant us in performing the operation, until after other measures have been tried and have failed. Though further evidence of the permanent effects of tenotomy is needed, it seems probable that by its means relief may be afforded to the distressing tinnitus which is so commonly present.

If the Eustachian tube has become closed by plastic inflammatory products within or around it, and we cannot succeed in rendering it pervious by Politzer inflation, or by catheterism, the employment of bougies will be called for. In this manner laminaria introduced through the catheter will sometimes be serviceable in dilating stricture. Bougies are not very frequently required, they should only be introduced for a short distance, and may be allowed to remain for ten minutes at a time. Their employment may be repeated two or three times during the week, and inflation of the

tympanum ought not to be practised for some time afterwards.

The principal points to be remembered in the treatment of tubal obstruction are—1st, to reduce the tumefaction of the throat which induces it, and 2nd, while this is being effected, to inflate the tympanum regularly but effectively. The Valsalvian method being the simplest, should be tried first; if this fail, Politzer's should be employed, and in the event of this also proving unsuccessful, it will be necessary to have recourse to catheterism, and finally to bougies.* This rule, like many others in medical practice, has its exceptions; for instance, if our patient has passed middle life, and we find that Valsalvian inflation causes great congestion of the head and conjunctivæ, it will be well not to advise this method, lest the strain put upon the cerebral vessels should cause their rupture. The extreme simplicity of the method is very liable to lead to its abuse, and it not unfrequently happens that patients produce excessive relaxation of the membrana tympani in this way. The use of Politzer's method is much less liable to objection, because the mere fact of

* These methods are fully described in my "Manual of Aural Surgery."

having to use an apparatus will cause this mode to be less frequently resorted to.

When disease of the throat has spread to the tympanic cavity, we must extend the influence of our remedies to the part. Unless the membrane of the drum be perforated, this can only be done through the Eustachian tube. Having therefore adopted measures for securing the perviousness of this channel, let us see how we should treat affections of the drum cavity.

Acute catarrh of the tympanum, occurring as I have mentioned with the same affection of the nasal air-passages, is little likely to come under special treatment. In fact, unless we chance to observe the disease in our own persons, or in those of our friends, we shall probably never meet with a case until it has arrived at the chronic stage. This form, however, which constitutes one of the most frequent causes of defective hearing, we are constantly called upon to battle with, and as I hope to show, successfully.

Although catarrh of the Eustachian tube is met with without the cavity of the tympanum being implicated, the converse is rarely the case. For this reason the treatment recommended for the tubal affection requires to be continued when the disease has extended to the cavity of

the drum. Repeated inflation affords us the best means of driving mucus from the interior of the tympanum, after which its lining membrane will often return to a healthy state.

In order to illustrate the course and treatment of this most common form of disease of the ear, I venture to introduce two cases from my notebook:—

E. H., aged 18, was sent to consult me on May 30th, 1874, by Dr. Goddard Rogers. She is of strumous diathesis, and her father and one brother are hard of hearing. She speaks very thickly, is unable to pronounce nasal consonants, and does not breathe through the nose, but keeps her mouth partially open for respiration. She states that five weeks ago, in consequence of a cold, she became very deaf, and has continued so ever since, with singing in the head, and a sensation of stuffiness in the ears. She can only hear loud conversation at two feet from the ear, and my watch, which should be audible at five feet, is only heard at three inches on the left side, and when in contact on the right. She hears the tuning-fork placed on the bridge of her nose normally well. On examination of the ears, the membrana tympani on each side was observed to be very concave. The

light-spot was diminished in size and the short process of the malleus was abnormally prominent. The membrane was somewhat opalescent and of a pinkish hue. The throat presented a red semi-transparent appearance, and the tonsils were considerably enlarged. Inflation with Politzer's bag improved the hearing to three inches on the right side and six inches on the left. The treatment consisted in the application of iodine and carbolic acid solution to the throat twice weekly, the daily use of salt and water to the nose and naso-pharynx, followed by Valsalvian inflation three times a-day.

At her next visit, the hearing distance for the watch was four inches on the right, two on the left. Politzer's inflation brought this to eight and four inches respectively. She continued the same treatment for five weeks, during which time she considerably improved, until at her last visit she could hear my watch at four feet on each side. Her hearing power for conversation was so nearly normal, that she was considered perfectly well, and ceased to attend.

The following case is intended to show the progress of catarrh in a young child:—

R. S., a pretty and naturally intelligent-

looking girl of four years of age, was recommended to me by Dr. Begley in January of the present year 1875. Her mother informed me that the child had been deaf since an attack of the mumps in the autumn, but had not suffered from pain in, or discharge from, the ears. The appearance of this little patient was very characteristic; the usually bright expression was changed into one of heaviness and stolidity. She stared about, with open mouth and vacant look, and could only hear my watch one inch from the ear on either side. On examination, the tympanic membranes were abnormally concave on both sides, and were darker than natural. The throat showed evidence of catarrh, and the tonsils were enlarged. Immediately on using the Politzer bag the patient presented a more intelligent expression, and heard much better. After two or three inflations, my watch was audible at least ten inches from the ear on each side, and she heard what was said to her in a low voice. I recommended some steel wine, and requested her mother to practise inflation two or three times daily. I saw the child again at the end of six days; she could then hear my watch at two feet from either ear. This distance was doubled by the use of

Politzer's bag, and a few days later the patient was perfectly well.

If we consider for a moment the narrowness of the Eustachian tube, and the fact that this is the only opening into the cavity of the drum, we shall readily understand the difficulty of clearing the tympanum by inflation. The expulsion by this means of mucus, often thick and tenacious, and adhering to the ossicle, is frequently impracticable, whether by the method of Valsalva or Politzer, or by the catheter. Under these circumstances the secretion should be rendered more fluid by the use of solvent solutions injected into the tympanum. A simple way of doing this, if the Eustachian tube be pervious to Valsalvian or Politzer inflation, is to inject about two drachms of the lotion through the nose into the naso-pharynx, the head being so placed, that the side on which we wish the liquid to enter is downwards. Two or three inflations should now be performed, and the fluid from the pharynx will enter the tympanum. An examination of the ear with the speculum will sometimes afford satisfactory evidence of the fact, by enabling us to observe the fluid at the lower part of drum cavity resting against the membrane. The patient, too, will

generally be conscious of the presence of liquid in the ear, and deafness will be temporarily increased.

When the Eustachian tube is impervious to inflation by the simpler methods, these must be replaced by catheterism. In this manner we shall rarely fail to inflate or inject the tympanum. The solvent best adapted for injection is solution of carbonate of soda, ten to twenty grains to the ounce of *warm* water. From two to four grains of carbolic acid are sometimes added with the object of restoring the mucous membrane to a more healthy condition. This may be advantageously followed in some instances by the use of a two-grain solution of sulphate of zinc, with or without an equal quantity of carbolic acid.

The treatment by solvents is likewise the one most suitable if the mucus accumulation within the tympanum has become inspissated. Should we fail in this manner to soften and remove the secretion, it may become necessary to puncture the membrana tympani, in order to wash out the middle ear by passing the soda solution through it. This operation is a very trivial one, it rarely causes much pain, and I am not aware that it has ever produced permanent injury,

even when it has failed to do good. There can be no doubt, however, that it has been often performed without any benefit resulting, even in cases which seemed to promise best, whilst in others, much less favourable apparently, wonderful improvement has followed.

The operation will not be frequently required, and it will always be well to try the less formidable methods first, only having recourse to paracentesis if these fail. Politzer's method of inflation should be practised immediately after the operation, and will not unfrequently blow masses of mucus into or through the incision. After this, a warm solution of soda should be injected through the middle ear, either by way of the meatus externus, the Eustachian tube, or both, and should be repeated daily until the puncture has closed. As this can rarely be kept open for more than three days, paracentesis sometimes requires to be repeated once, twice, or even oftener, but in favourable cases it will prove of real and permanent advantage.

The treatment of perforation of the membrana tympani, from accumulation of pus or mucus within the drum, should be very similar. By clearing away retained secretion, it is often surprising to find how perforations, even of

large size, will heal. On the other hand, if this is neglected, or imperfectly carried out, the opening in the tympanic membrane will not unfrequently resist all treatment, and may terminate in the formation of polypus, or in disease of the bones. The solution of zinc and carbolic acid already mentioned is very useful after the above indications have been fulfilled, and serves to check excessive secretion. When the lining membrane of the tympanum, seen through the perforation, appears tumid, it may be advantageously touched with solution of nitrate of silver.

In some cases of perforation, striking improvement of hearing as well as diminution of discharge, follows the use of Yearsley's artificial membrane. This simple contrivance consists of moistened cotton-wool, adjusted at the bottom of the auditory canal, and probably acts by affording support to the ossicles, and thus maintaining a proper tension of the labyrinthine fluid. This explanation is confirmed by the fact that the artificial membrane will sometimes improve hearing when no perforation is present. A case lately under my care well illustrates this. After removing a plug of cerumen, the *membrana tympani* was observed to be thinned

and relaxed: finding after two or three weeks, that this condition persisted, and that hearing was not much improved, I adjusted the artificial membrane with the best results. The patient, who could not hear my watch, unless in contact with the ear, was enabled with the cotton-wool to hear it at ten inches, ordinary conversation being audible at several feet.

Some care is often required to adapt the artificial membrane in such a manner as to afford the greatest amount of benefit obtainable. Patients will soon learn to do this better than the surgeon, if the mode of adjustment is properly explained to them. It is often advisable to moisten the wool with an astringent or antiseptic lotion, and the addition of a small quantity of glycerine will prevent too rapid drying.

If, as a consequence of perforation and prolonged suppuration, a polypus has formed, and this is the manner in which they mostly originate, our first object should be to remove the growth. When this is of some size, it should be pulled away with forceps or with the snare. After which, or when the polypus is small, the frequent application of caustic will be necessary. I have found London paste very effectual, and at the same time very manageable for the purpose,

and I generally prefer it to other caustics.* When only small granulations remain, nitrate of silver, fused on the end of a probe, answers very well, though this is not sufficiently potent in the first instance. The patient may render some assistance in destroying the growth by dropping strong liquor plumbi into the ear every morning, after having removed all discharge, and carefully dried the meatus. In this manner running from the ears, even of long standing, may be cured; the perforation closes, and the patient recovers very useful, if not perfect hearing. We must bear in mind, however, that the thorough destruction of polypus requires much patience, and must not be abandoned until perfectly effected, or the growth will most probably return.

The suffering which accompanies acute inflammation of the tympanum demands prompt and decisive treatment. From two to four leeches should be applied in front of the tragus and below the meatus auditorius, and will usually afford considerable relief. Hot water should

* I have lately been using caustic soda fused on metallic wire. In this way the sticks may be obtained as small as required. They must be kept in caustic lime to prevent deliquescence.

be poured into the auditory canal, where it may be allowed to remain for ten minutes at a time, or we may recommend a gentle stream of hot water to be applied with the douche. This treatment should be repeated at short intervals while the pain continues severe, sleep being procured by the aid of narcotics and sedatives. In addition, much benefit will be experienced from steaming the throat, together with the use of a hot nose-douche, as recommended for the naso-pharyngeal affection. Poultices, though often recommended, and undoubtedly grateful to the patient, seem to promote profuse and destructive suppuration, and must consequently be prohibited in these cases. The same objection applies, but in a smaller degree, to fomentations, and still less to hot dry applications, which may, therefore, be employed if they afford relief.

When suppuration has occurred in the middle ear, whether the matter be situated inside the membrana tympani, or point over the mastoid process, it should be evacuated without delay. This was the rule laid down by all writers until the appearance of Mr. Hinton's "Questions of Aural Surgery," published after his retirement from practice. The book to which I refer

expresses a doubt on this, as on many other points of established practice, without suggesting any well tried substitute for the treatment hitherto adopted. In cases of suppuration in the middle ear, I fear that the suggestion of doubts can only conduce to a line of practice which will prove dangerous to life, and detrimental to hearing. Considering the extreme severity of the symptoms in most cases of acute inflammation of the tympanum, it will be gratifying to learn that by judicious management the termination will be satisfactory. Indeed, it is the rule rather than the exception, for patients to recover almost perfect hearing.

In the following case of acute inflammation prompt treatment proved successful in preventing suppuration.

H. S., about thirty years of age, consulted me during the summer of 1873, for severe pain in his right ear. He was very much out of health, and evidently pulled down by acute suffering and a sleepless night. On the previous day, after having taken a bath, he was conscious of an uncomfortable sensation in his ear; this was worse towards evening, and became acute suffering during the night. He

had dropped laudanum into the ear, and had applied roasted onions, warm oil and fomentations with only temporary relief. When he presented himself to me he complained of sharp pain of a shooting character, which extended from the ear to the side of the head and neck. There was a constant throbbing sound, and the suffering was aggravated on swallowing or moving the jaw. The pulse was rapid, the skin dry and feverish, and the tongue coated.

On making an examination the auditory canal was found swollen and reddened towards the attachment of the membrana tympani. The membrane itself was considerably congested, and a network of enlarged vessels covered the entire surface. Inflation of the tympanum did not take place by the Valsalvian method, though a short time before his visit eructation caused a painful sensation of distension in the ear. The throat was red and irritable. My watch, which should be heard at five feet, was only audible when in contact.

The treatment consisted in the application of four leeches immediately in front and below the meatus, followed by hot fomentations for two hours. After this the patient was directed to

employ a douche of hot water for ten minutes at a time, every hour, until the pain subsided, when the intervals might be longer. On the following day the symptoms had much abated. The pain had diminished immediately after the leeches had been applied, and had not returned with great severity since. The congestion of the tympanic membrane was less active, but the throat was still sensitive, and inflation by Valsalva's method could not yet be performed. Two days later the congestion of the membrana tympani was limited to the circumference and the vessels of the manubrium. The membrane was devoid of lustre and abnormally concave. The pain on swallowing was almost gone, though the patient could not inflate the drum. Hearing continued as at first, in spite of the general improvement. On his fourth visit, three days later, finding that the watch could only be heard in contact with the ear, and that the membrana tympani continued drawn inwards, I inflated the tympanum with Politzer's bag. The air penetrated without difficulty or pain, and hearing increased immediately, the watch being heard at two feet. Good food, with the assistance of iron and tonics, and a repetition of Politzer inflation every other

day, completed the cure in thirteen days, hearing being perfect.

It will be remembered that one of the principal points of distinction which I have drawn between catarrh and inflammation of the tympanum, in a pathological sense, is that in the latter disease a periosteal tissue is implicated. We must bear this in mind in the treatment of the sub-acute and chronic forms of the affection. The objects which we should have in view are to limit, as far as possible, the effusion and organisation of plastic material, which tends to lessen the capacity of the tympanum, diminish the mobility of the ossicles, and produce rigidity of the fenestral membranes. These consequences will be best prevented by the administration of iodide of potassium, as well as by the injection of a solution of the salt into the cavity of the drum. At the same time it will be necessary, by frequent inflation with Politzer's bag, to maintain the mobility of the ossicles. I need hardly state that the results of treatment will depend upon the extent to which the disease has attained. If seen early, much may be done to restore the ears to their normal condition ; if however the disease have already progressed to such a degree that the ossicula

are firmly fixed by dense fibrous tissue, or by true bony ankylosis, we cannot expect by any treatment to bring back normal hearing.

It will hardly be deemed orthodox to conclude a paper on ear disease without alluding to blisters and the syringe among curative agents. These must undoubtedly be regarded as the sheet-anchors of routine practice, and consequently a word or two concerning their use and abuse will not be out of place.

Though almost discarded by the modern school of aural surgery, it cannot be denied that blisters sometimes have the credit of doing considerable good. The discomfort and annoyance of this plan of treatment are palpable enough, though it is often difficult to satisfy ourselves of its real advantages. The indiscriminate use of blisters must undoubtedly be condemned, but we ought not to set them down as altogether useless, because we are unable to explain their *modus operandi*. In some cases of chronic catarrh of the tympanum counter-irritation behind the ear is beneficial, probably by stimulating the sluggish circulation within the drum. The effects are so uncertain, however, that it will be impossible to say in any particular instance

whether or not advantage will result, consequently the practice is purely empirical.

Of syringing I will remark that it is only justifiable for the purpose of removing something from the ear; therefore it should never be resorted to until we have ascertained that there is something which requires removal. If the meatus contain impacted cerumen, or any other foreign substance, or if abnormal secretion be present in the ear, judicious syringing is called for, but as a matter of routine it has repeatedly injured the delicate organs of hearing, and must be unhesitatingly condemned.

I have attempted in this paper to give a brief résumé of the principal affections of the middle ear, which constitute the most frequent causes, as well as the most curable forms of defective hearing. Within limits like the present it is of course impossible to do more than indicate the most salient points of this important subject. I hope, however, to have succeeded in showing that the study of ear disease is not only one of considerable interest, but one which, with a little pains, may be readily mastered.

Such are the aims of this little book for which I now ask the indulgence of the reader.

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