

**On deafness, giddiness, and noises in the head / by Edward Woakes  
assisted by Claud Woakes.**

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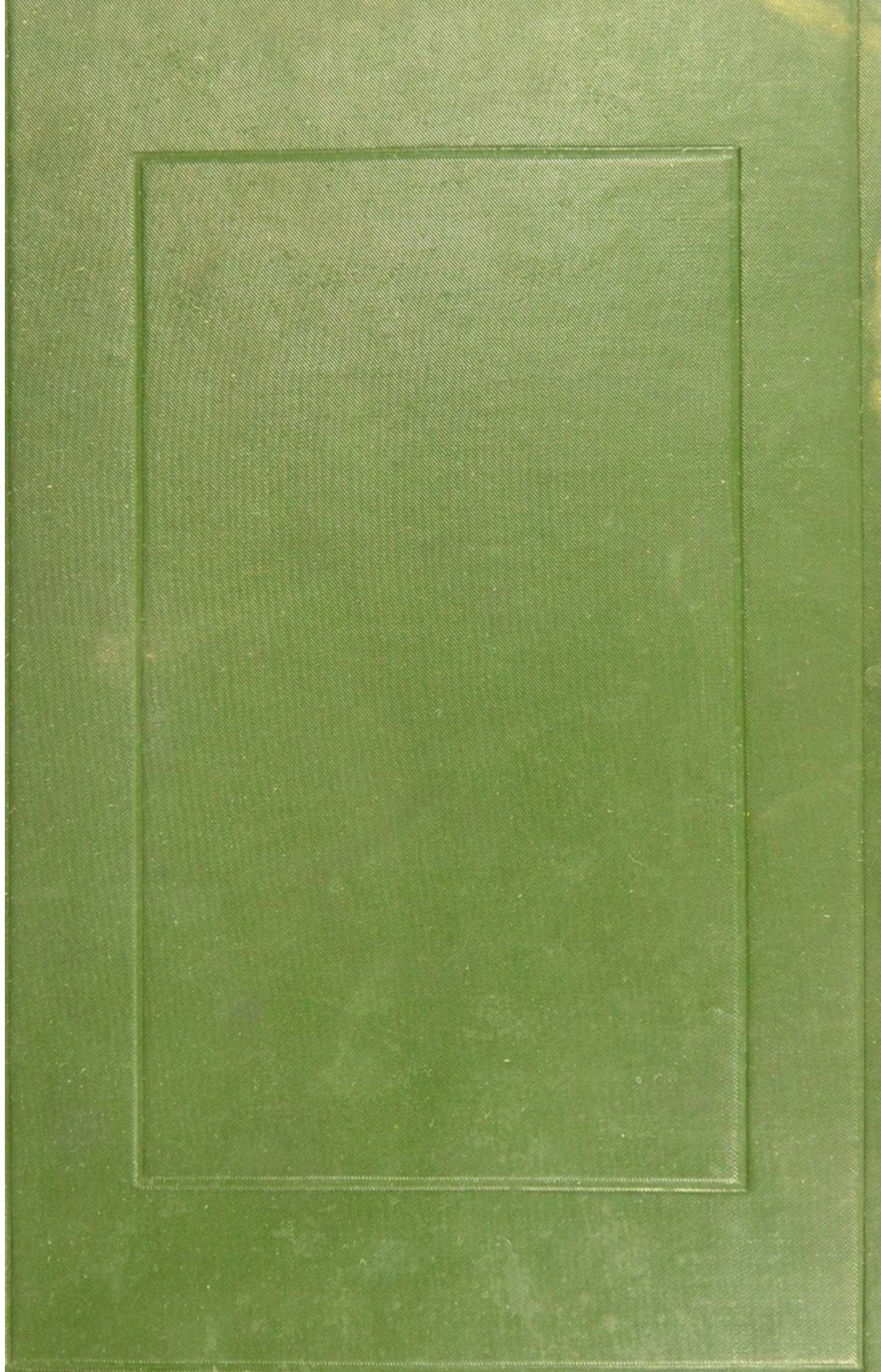
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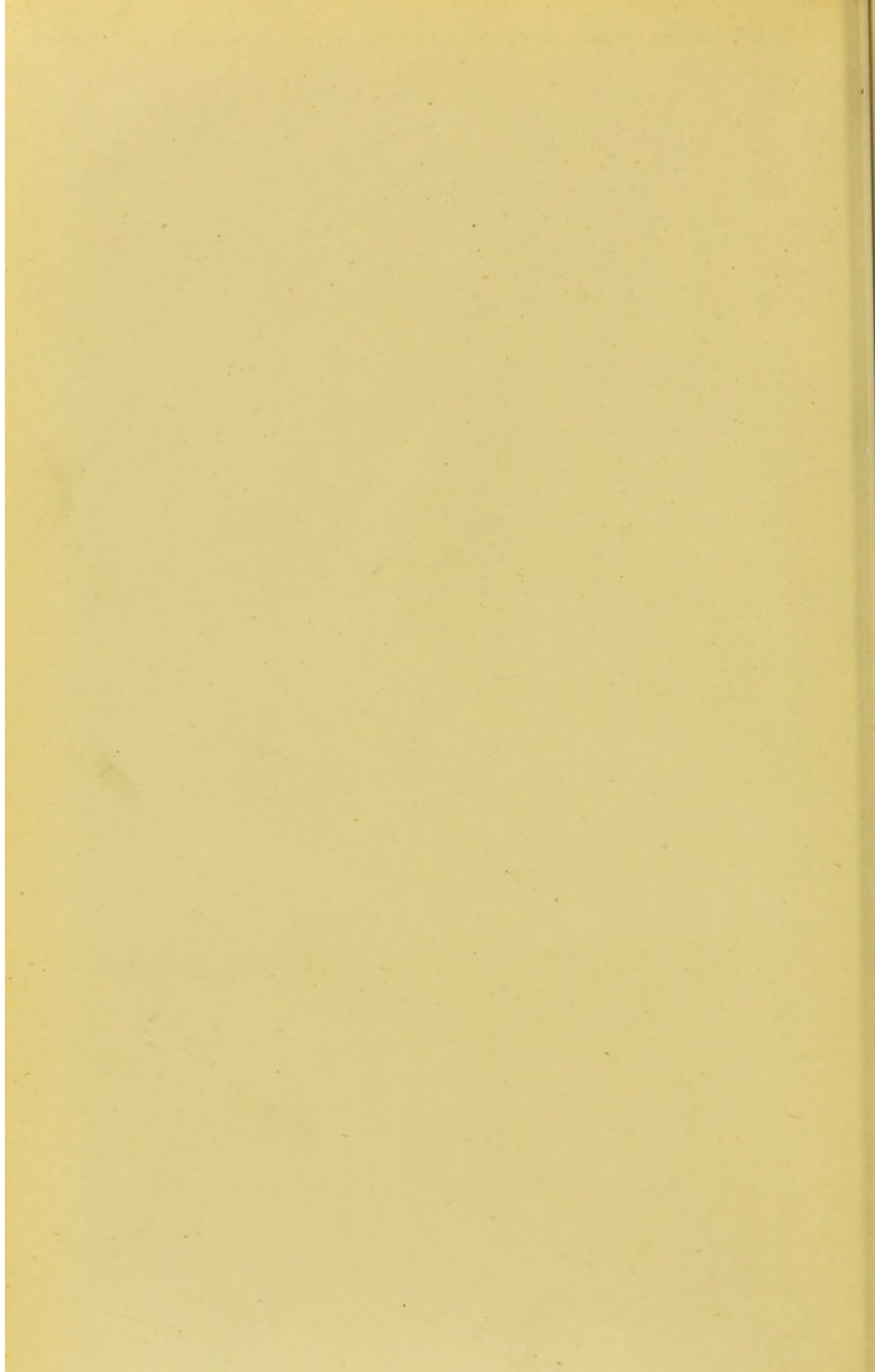
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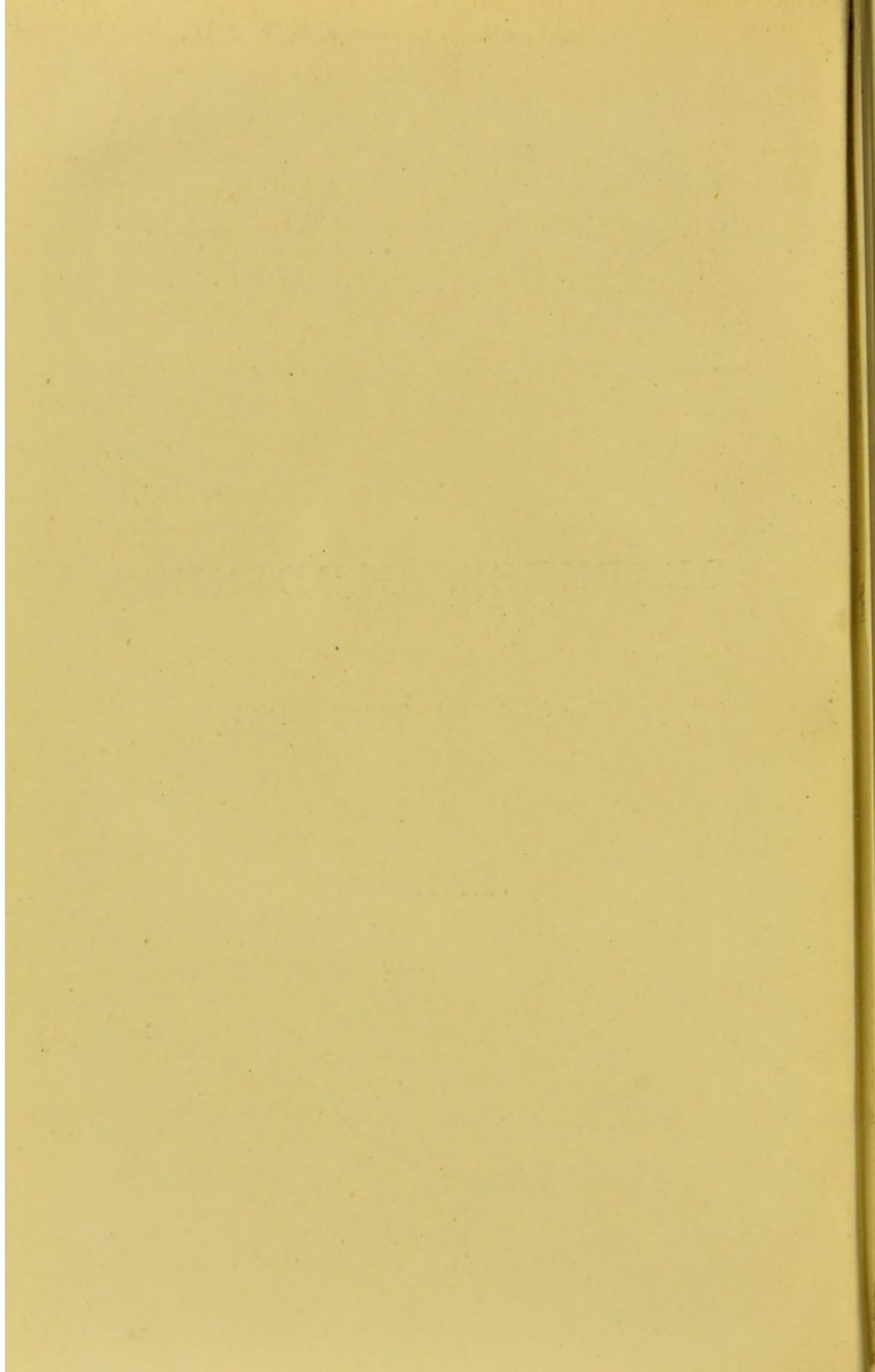
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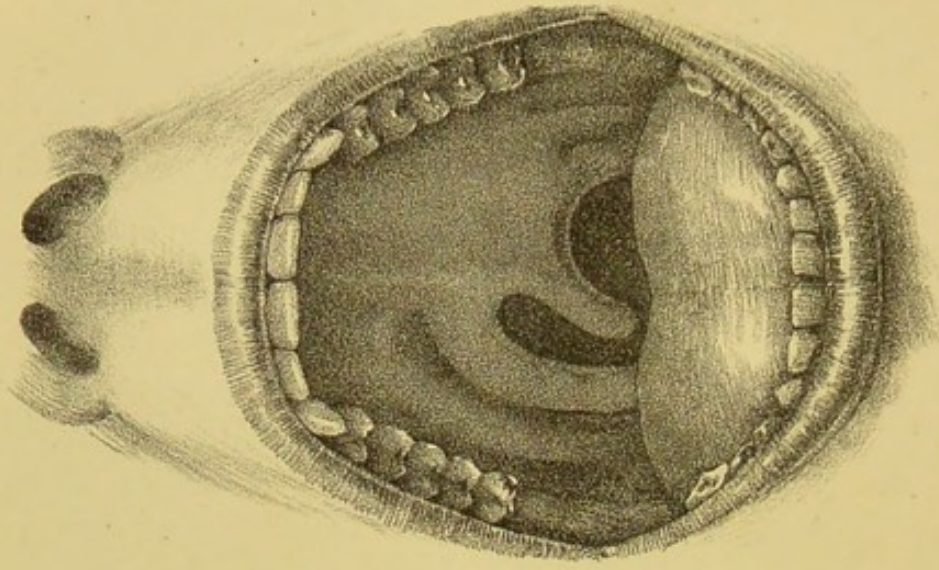
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DEAFNESS, GIDDINESS,  
AND  
NOISES IN THE HEAD.

PART I.

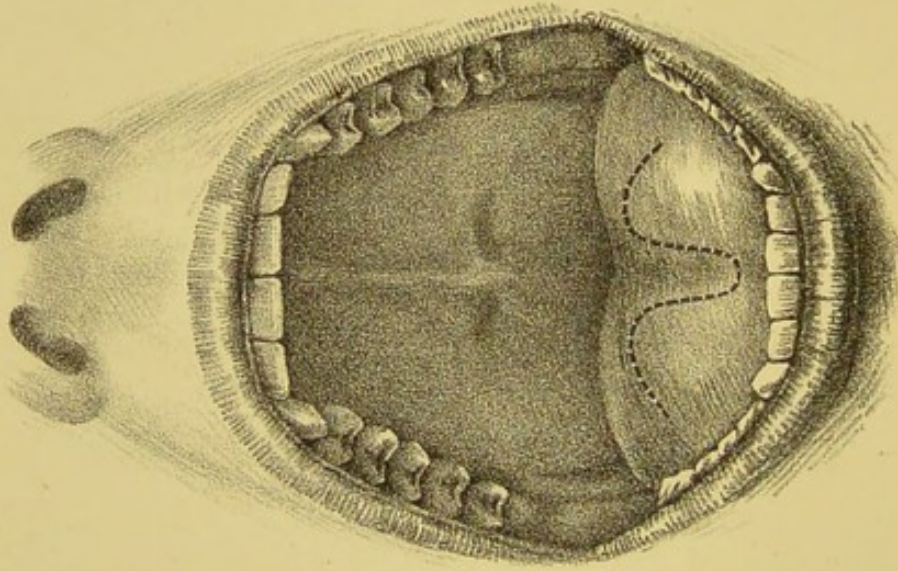




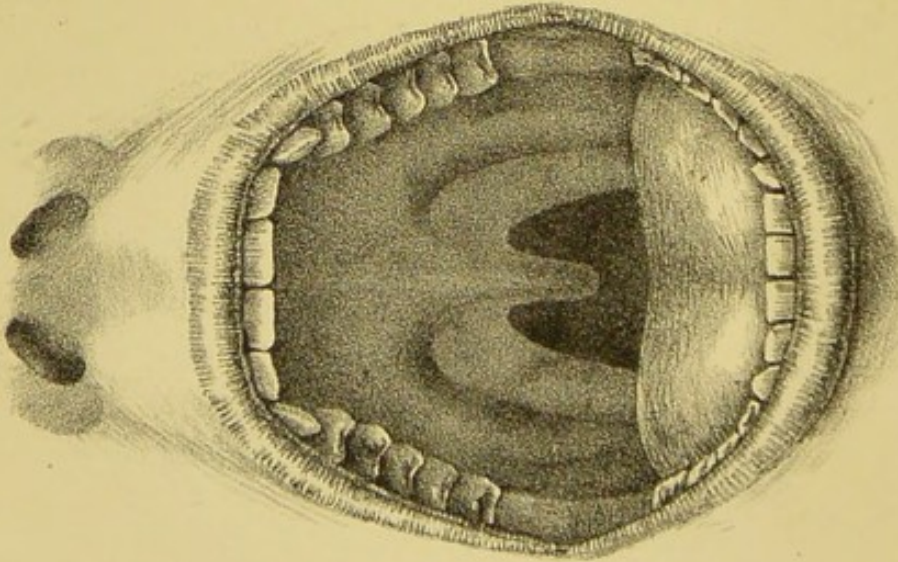
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Unilateral palsy of palate—left.



Bilateral palsy of palate.



Normal palate.

ON  
DEAFNESS, GIDDINESS,  
AND  
NOISES IN THE HEAD

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*FOURTH EDITION.*

LONDON  
H. K. LEWIS, 136, GOWER STREET

1896

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DEPARTMENT OF MEDICINE

LECTURE NOTES



BY DR. J. H. B. ...

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## PREFACE TO FIRST EDITION.

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IN collecting for the following pages these studies of certain phenomena attending disease of the ear and its allied organs, two principal objects have been kept in view by the author. The first of these has been to examine the various conditions, competent to give rise to the symptoms in question, in order to assign each to its respective causes.

At the outset of this undertaking it was evident that very scant assistance was to be obtained from aural text-books, because in confronting every obscure problem associated with the etiology of Giddiness and Noises in the Head, one explanation was invariably made to do duty for all, that, viz., of referring them to some *subjective* state of the auditory nerve.

To attempt to recover the subject from this ambiguous position, it became necessary on theoretical, but especially on practical grounds, to examine it from a point of view unoccupied by previous observers.

About ten years ago, while considering the association of neuralgia with herpes, and the analogous phenomena attending wounds of nerves, the author became aware that in numerous instances in the economy, the local connexions of vaso-motor innervation are such, that given tracts of tissue, not otherwise connected, are thereby habitually kept in nutritive correlation one with another. Between any two areas thus correlated so intimate is the relation that any departure of one of them from its ordinary state is immediately appreciated by a corresponding set of nutritive changes in the other. The explanation of this mutual interdependence between the respective, often widely separate, regions, is found in the association of their afferent and efferent nerves with a given sympathetic ganglion. Thus, these organs were seen to assume co-ordinating functions not usually attributed to them.

The tentative application of this theory to elucidate certain natural physiological processes, as also others occurring in disease, appearing to afford satisfactory results, it remained to make use of it for the purpose of explaining the origin and method of production of Tinnitus and Vertigo. The endeavour to do this constitutes the second object prominently before the author in the work now published.

A considerable portion of the material of this treatise has appeared at different times in the pages of the medical journals; in collating it for its present purpose diagrams have been added to illustrate the text. The author is indebted to the artistic skill of his friend Mr. Edward Bellamy for those illustrating the more obscure anatomical references. It will be understood, however, that these diagrams are intended to indicate existing anatomical relations, rather than accurately to define them.

Undertaken as these studies originally were for the author's own instruction, he has aimed at imparting to

their publication in the present form such a practical value as may render them of service to others interested in the subject of which they treat.

Harley Street, W.,

*January, 1879.*

## PREFACE TO FOURTH EDITION.

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THE Fourth Edition of this work, now offered to the profession, follows at an interval of twelve years from the last issue.\* Needless to say the present volume has been almost entirely re-written, the necessity for which arose from the fact that the intervening period has been prolific in scientific research, biological and pathological, in subjects cognate with those dealt with in this work.

Since the fundamental principles upon which the former treatise was based have not been impugned by these researches, it will not surprise the reader to find the principle of *correlated tissue areas*, so largely

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\* "Post-nasal Catarrh, and Diseases of the Nose causing Deafness," being Vol. I. of the Third Edition of "Deafness, Giddiness, and Noises in the Head." London: H. K. Lewis. 1884.

insisted upon in the first edition,\* still relied upon to explain certain phases of Vertigo and Tinnitus.

Having survived the criticism of twenty years, this principle not only retains its former place, but is found equally useful to account for complications of a trophic kind which are met with in each new region that the developments of the subject compel us to explore.

Without doubt the most important departure in connection with EAR work of late years has been the prominence given to morbid states of the nose in relation to affections of the ear.

That the author had long realised the truth of this association and devoted his energies to its development is clear from the contents of the last edition, written as long ago as 1884.†

In this connection it appears desirable to append an

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\* See Preface to the First Edition, reprinted on the preceding pages.

† "Post-nasal Catarrh, and Diseases of the Nose causing Deafness," being Vol. I. of the Third Edition of "Deafness, Giddiness, and Noises in the Head." London: H. K. Lewis. 1884.

extract from the Preface to his work on "Nasal Polypus"\* as follows:—

EXTRACT FROM PREFACE TO "NASAL POLYPUS," PUBLISHED  
JULY, 1887.

"The facts set forth in the following pages came primarily under the author's observation whilst studying the *states of the nose and adjacent organs associated with, or provocative of, affections of the ear.*

"These studies had of late been prosecuted with a view to the completion of a treatise on the latter subject, one half only of which has yet been issued; but for many reasons the author decided to interpolate the present volume before concluding his unfinished work.

"A chief reason for the adoption of this course is that some of the reflex nasal symptoms which form part of the subjects herein discussed occur in regions which can be inspected by the unaided sight, or by the assistance of simple scientific appliances, so that no

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\* "Nasal Polypus, with Neuralgia, Hay Fever, and Asthma in Relation to Ethmoiditis." Preface. London: H. K. Lewis. 1887.

doubt can exist as to the nature of the changes thus brought about in them. From these definite observations it may be inferred that corresponding changes take place in organs similarly irritated, but which, owing to their anatomical situation, are more difficult of investigation.

“Thus it seems reasonable to expect that when this evidence has been duly considered it may serve to *throw light upon some affections of the auditory apparatus concerning which comparatively little is at the present time with certainty known.*”

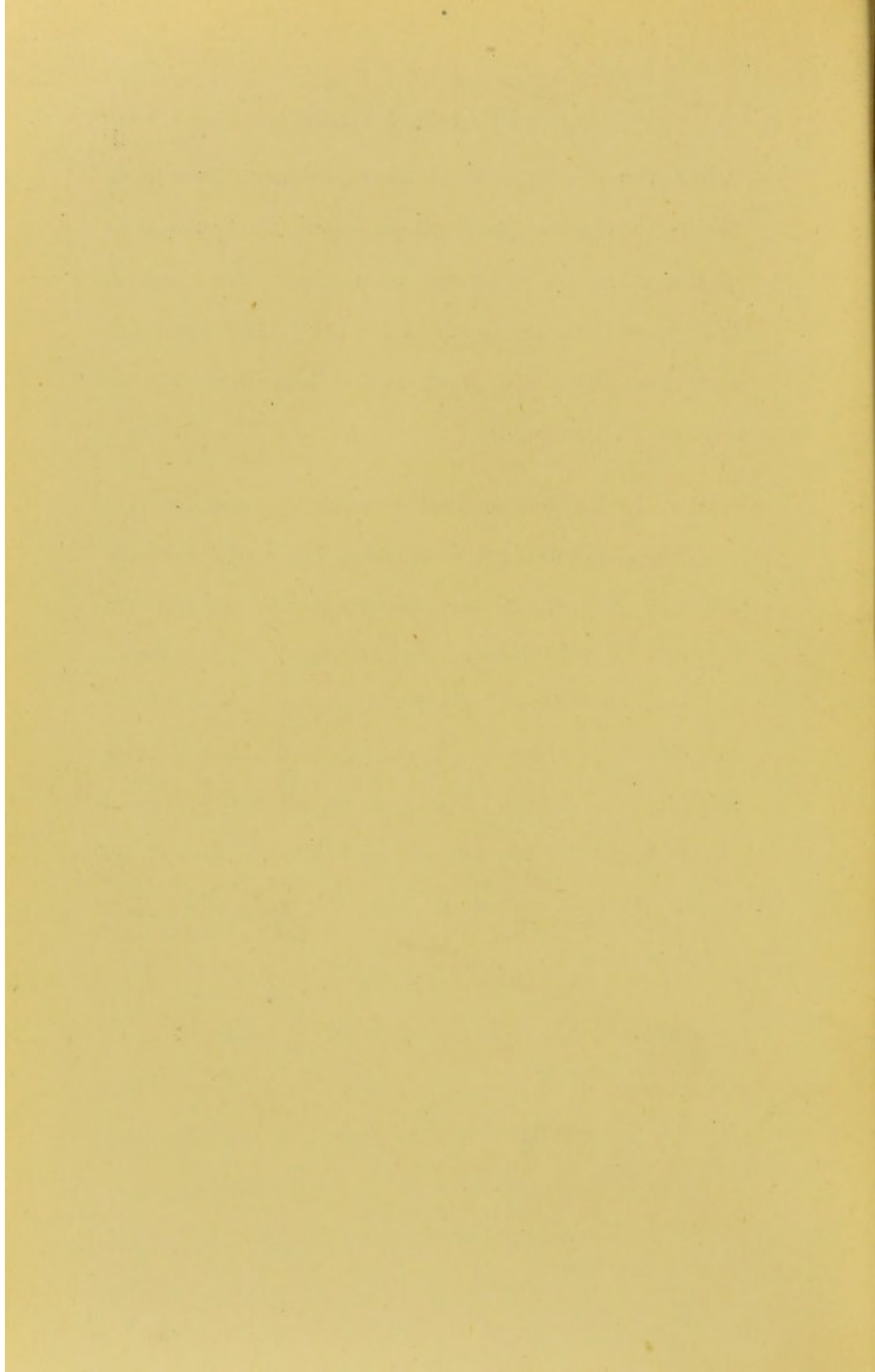
The author ventures to express the hope that the circumstances detailed in the foregoing extract will be held to extenuate his responsibility for the delay which has occurred in the publication of the present volume. A further cause of postponement arose—viz., that, whilst the accumulation of observations and facts bearing on the association of ear disease with that of the nose was effected with abundant facility, the true difficulty was to connect them as cause and effect in such wise as to satisfy the requirements of a scientific explanation.

Nor was this capable of accomplishment, as regards the more obscure relationships, until the publication of the researches of Ewald on the one hand, and of Landois and Stirling on the other. Of their admirable work the author has freely availed himself, as will be apparent in the context.

How far he has succeeded, with the aid of the knowledge thus derived, in making the subjects herein discussed clear to his readers, they must remain the judges. Of this, however, he is assured, that no one will be so conscious of his inadequacy to deal with the complicated problems in question as he is himself. One object he may claim to have kept prominently in view—viz., to render his remarks of real utility to those of his readers who may elect to carry his suggestions into actual practice.

Harley Street, W.,

*December, 1896.*



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ON  
DEAFNESS, GIDDINESS,  
AND  
NOISES IN THE HEAD.

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CHAPTER I.  
VERTIGO.

PRELIMINARY OBSERVATIONS, CHIEFLY PHYSIOLOGICAL.

THE complex of symptoms apprehended in the term Vertigo are both numerous and diversified in character. Moreover, they affect many and distant regions of the economy. As the author adheres to his former thesis, that any and every phase of the disease requires for its manifestation the implication of certain organs situated in the labyrinth—*i.e.*, that all Vertigo is essentially auditory in its location—it becomes a primary duty on his part to establish this position upon a securely scientific basis. It is the effort to accomplish this object which will occupy the present chapter. The author is conscious that the sequence of facts is not perfect. There are links wanting in the chain which he would fain have supplied, but which investigators have as yet failed to discover, though every year is happily lessening their number, and the attentive consideration of such as are already known will, it is believed, carry conviction with it of the truth of the position.

The earliest reliable investigations bearing upon the subject date from the year 1817, when Flourens demonstrated that injuries of the semi-circular canals in pigeons

produced movements of the head, rotations of the body, &c.\* Since this date there has been an increasing stream of observers, including Goltz, Loewenberg, Gellé, Spamer, Baginsky, Gruber, Ewald, and others, who have added greatly to the sum of knowledge of the functions and location of these organs. Speaking broadly, the conclusions arrived at by these observers, with the exceptions to be referred to, go to prove that the semi-circular canals, with the utricle and saccule, are the end organs for the maintenance of the equilibrium of the body; that through the medium of these parts of the labyrinth the required degree of *precision* of muscular action is effected, so as to maintain the erect attitude in man, and the normal position in the case of other animals. Furthermore, it is due to the function of these organs that we recognise our relations to other bodies and our position in space generally.

The use of the term *precision* of muscular action has a wider range of meaning, however, inasmuch as it is constantly exercised in those muscles which act in pairs, and tends to bring about the efficiency of each member of the pair, so that the combined effect shall exactly answer the end designed. The muscles of the head and neck require this precision in a marked degree; hence it is in their movements that the labyrinth function is in constant evidence, though it is by no means limited to these regions, as the sequel will show.

In opposition to this view, Baginsky, of Berlin, maintained, 1881, that the results arrived at by his predecessors in this field of research are referable to concomitant injuries inflicted during the experiments on adjacent tracts of brain tissue. Spamer subsequently traversed these objections by showing "that the disturbances of equilibrium vary with

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\* FLOURENS: "Expérim. sur les canaux semicirculaires de l'oreille." Mém. de l'Acad. R. des Sciences de l'Institut de France. T. ix., 1828.

the canal injured. There is no relation between the amount of disturbance and the amount of cerebro-spinal fluid which escapes when a canal is cut. The disturbances vary with the kind of injury inflicted, being more marked on transverse than longitudinal section. Apart altogether from section of the canals, irritation by different chemical solutions causes marked results; and the effect of touching the canals with a heated point cannot be explained away by any hypothesis of direct injury to the brain, such as Baginsky assumes.\* In his (Spamer's) experiments the most careful examination failed to detect any lesion of the brain, or, if such lesions were accidentally produced, the cases were considered unsuccessful experiments." ("Brain," January, 1882.)

Another class of objectors is represented by Professor Gruber, from whom any contribution towards the solution of this question demands respectful consideration. Gruber summarises his position thus:—Phenomena referable to disturbances of equilibration can only be evoked through the medium of the semi-circular canals "in virtue of their relations with the central nervous system; and upon slighter or stronger irritation in accordance as it were with the individual peculiarities of construction of the auditory organ and its adnexæ." Amongst the latter he specially notes the *sacculæ*. Furthermore, he lays stress upon the safety-valve function of the *aquæductus endolymphatici*, "which, in spite of their diminutive size, play a part similar to that conjectured by Weber-Liel in regard to the *aquæductus cochleæ*, under conditions in which phenomena of augmented pressure are present." Weber-Liel's theory is that pressure on the perilymph is relieved by the *aquæductus cochleæ* admitting of the passage of this fluid,

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\* SPAMER: "Exper. und krit. Beitr. zur Physiol. der halbkreisförmigen Kanäle." Pflüger's Archiv, Bd. xxi.

under tension into the subarachnoid cerebro-spinal fluid with which this aqueduct communicates.

Gruber continues: "Still more worthy of consideration are the relations of the *ductus endolymphaticus* and its termination, the *recessus Cotugnii*." This author (Gruber) is inclined to believe that a greater significance attaches to this than to the aquæductus cochleæ, and that in the remarkable individual peculiarities of the recessus Cotugnii a foundation "may be sought for the severe subjective auditory symptoms with Vertigo, &c., which are provoked in many persons upon even slight increase in the intra-labyrinthine pressure, whilst in others the latter may become greatly augmented without the evolution of any such symptom. The most noteworthy fact would appear to be the variability in the size of the *recessus*, with a permeable aquæductus vestibuli."

Here it may be permitted to recall the anatomical fact that the *ductus endolymphaticus* is a membranous tube communicating, on the one hand, with the endolymph in the vestibule, where it connects with the saccule as well as with the utricule; it then enters the ductus vestibuli of the pars petrosa, through which it passes into the cavity of the cranium. Here the ductus endolymphaticus ends in a pouch-like dilatation between two layers of the dura mater, called the *recessus Cotugnii*, or *saccus endolymphaticus*, which rests on a more or less marked depression on the inner surface of the petrous part of the temporal bone. (Gruber op. cit., p. 88, et seq.) By means of these tubes, the *perilymph*, on the one hand, is seen to have an outlet into the subarachnoid space, by way of the aquæductus cochleæ; whilst the endolymph, on the other hand, through the ductus endolymphaticus, can obtain relief into the recessus Cotugnii. While, however, relief through the former is

of comparatively unlimited extent, the latter is confined to the dimensions of the sacculus, which, as Gruber points out, is always limited to narrow bounds, varying in different individuals—so much that in some it “can scarcely be recognised, whilst in others it may be as large as a small hazel nut.”

Gruber continues his argument, *ut seq.*:—“It is certain that an exaggerated intralabyrinthine pressure first of all takes effect upon the perilymph, and is then transmitted through the aquæductus cochleæ to the subarachnoid space, thereby inducing the results under discussion (Vertiginous symptoms), if the action take place with sufficient rapidity. The pressure may always be moderated to a certain degree, since the direction in which the aquæductus cochleæ opens into the subarachnoid space is not the most favourable. It is, however, quite otherwise with the aquæductus vestibuli; for if the pressure on the saccule become excessive the endolymph can give way directly through this channel towards the cranial cavity, and if the recessus Cotugnii be largely developed it will become distended to a corresponding extent, and thus exercise a more considerable pressure upon the centre of statical equilibrium, the cerebellum; evoking symptoms of Vertigo, &c. If the recessus Cotugnii be, on the other hand, but slightly developed, the phenomena in question may then be quite absent.”

Obviously, Gruber's explanation applies to such cases of Vertigo as are due to pressure upon the intralabyrinthine fluid. It can have no bearing upon the much larger number of cases, as the author regards them, which are referable to reflex irritation of the ampullar nerves, or of those of the maculæ acusticæ of the sacculus and utricle.

It is a chief point of Gruber's argument that the symptoms may be occasioned by the pressure of a distended

recessus Cotugnii "upon the centre of statical equilibrium, the cerebellum." But if the researches of Lange, accepted by Ewald, be correct, it would seem that the cerebellum is not the centre of equilibration, and probably is not in any way concerned in the production of phenomena arising from its disturbance.\*

Further, as regards the overflow of perilymph through the aquæductus cochleæ into the subarachnoid space, it is improbable that this can exert any influence whatever, otherwise than as affording relief to increased tension within the labyrinth. For, apart from the fact that the perilymph in its total bulk is very small in quantity, while the conduit for its escape is almost infinitesimally minute, the dynamic properties of the cerebro-spinal fluid—as of any liquid similarly confined—would compel any tension transmitted to it at a given spot to take equal effect throughout its entire volume; in consequence of this provision the result of such tension would be lost in the extent of area over which it would necessarily operate—viz., the whole of the cerebro-spinal fluid.

It is improbable, therefore, that either of these causes can be held responsible for the occurrence of Vertigo, or for the *irregularity* with which its phenomena are displayed, in cases where the recognised objective conditions suggest no clue to the inconsistency in question. This irregularity in the evolution of Vertiginous symptoms remains to be accounted for. Its true explanation will probably be found in the presence, or absence, in a given case of more than one of the many factors that are severally capable of leading up to the Vertiginous state. These will be separately examined, and their potential value estimated, in the following pages.

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\* See page 18.

Keeping these facts in mind, we come next to examine Professor Gruber's second position. This is the more important, inasmuch as it leads up to the central question of the relationship of an *end-organ* to its associated nerve supply : a relationship which is equally applicable to any other special-sense apparatus as it is to that of equilibration. Respecting this relationship much confusion of thought prevails, at least so it appears to the author. The Professor's view of the situation, it must be admitted, is the more generally accepted one. It is that the function of the semi-circular canals, &c., is only exercised "in virtue of their relations with the central nervous system." That is to say, the function of the end-organ is dictated by the endowment of the nerve supplying it.

Hence, also, the logical sequence that Vertigo can be produced by pressure upon the supposititious centre of equilibration in the cerebellum independent of the end-organ.

This position the author is unable to accept. In fact, his view of the question amounts to an exact reversal of that just stated. It implies that the labyrinthine nerves, with their nucleus and centre, possess no special function beyond what they derive from the endowment of their end-organ in the labyrinth. This is equivalent to saying that the nerve supply of an end-organ—whether visual, auditory, equilibrating, or other—is simply the medium for furnishing it with vital energy, or force, essential to elicit its peculiar activity. The specific work, as the author conceives, does not reside in the nerve trunk, nor its nucleus, nor its centre, but in the end-organ itself. The former are generators and conductors of force, which is translated in the latter into specific work. Separate completely the one from the other, and no specific work will be done. Obliterate the end-organ absolutely, and no possible dis-

turbance of the nerve, or its centre, will produce phenomena which it is the peculiar endowment of the end-organ to accomplish.

Perhaps the best known example of a nerve apparatus with its associated end-organ is supplied in that for vision. While, of course, injury to the sight may arise from interference with the optic sensory nerve, and total blindness be caused, according to Ferrier and Yeo, by destruction of the occipital lobes and angular gyri, yet such local lesions are very few in comparison with those which originate in the end-organ itself. Moreover, if the end-organ itself be destroyed, no effect of vision can be produced by any influence operating on the optic centre. In other words, the end-organ must exist and be in working order for any of its specific manifestations to be induced by any impression on its associated nerve apparatus. So, it is argued, is it with the equilibrating organ. Therefore, Vertigo, which is defective equilibration, cannot occur if the semi-circular canals, &c., be absent, however much the central distribution of its nerve may be involved in disease.

Furthermore, it follows that, whensoever or howsoever Vertigo occurs, it does so only in response to some influence operating within, or directly or reflexly transmitted to, the organ of equilibration located in the labyrinth. This position meets with strong confirmation from those cases of genuine congenital deaf mutes in whom the labyrinth is abortive, and in whom it is impossible to produce the sensation of giddiness.

Following upon these preliminary observations and generalisations, the next step in this inquiry is to ascertain the latest established *facts* respecting the function of equilibration, and the anatomical arrangements which mediate this function. For this purpose it appears to

the author that he cannot place the entire question before his readers in a more satisfactory way than by presenting them with the conclusions arrived at in the latest and most reliable treatises on the subject—viz., those of Ewald.\* This is the more likely to be acceptable to the student of the subject, as the work summarised has not, at the time of writing, been translated into English.

Before, however, giving a summary of Ewald's experiments and conclusions, reference must be made to an article of a very interesting nature, by Howard Ayers, in the *Journal of Morphology* for May, 1892: Boston, U.S.A.

The author takes up the position (page 318, Vol. VI. loc. cit.) that the semi-circular canals do not now and never have possessed any special relations to the equilibrating function.

He appears to rest this conclusion upon the following grounds:—

(1) That the history of the growth of these canals shows them to have arisen as sheaths for the sensory organs.

(2) That there is no evidence that a different kind of function (pp. 317-32) has been added to or substituted for the ancestral function of the ampullar sense-organs, and their connected canals.

(3) That the amphioxus and other lower forms of vertebrates may be deprived of their ears without destroying or even disturbing the powers of equilibration.

(4) That the lower vertebrates, which have a most complete surface system of canal-organs in all three planes of space and obliquely to them, are the very ones which have the best developed ear canals.

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\* EWALD: Physiologische Untersuchungen über das End-Organ des Nervus Octavus.—Wiesbaden, 1892.

(5) He further states that ear canals are degenerating, and less perfect, in the highest developed vertebrates.

(6) He relegates the semi-circular canals to the class of such structures as the vermiform appendix, the coccygeal bones, &c.—viz., such as continue “to appear in ontogeny,” after the need for which they were originated has passed away.

(7) He is of opinion that the equilibration of the body is the product of the total activities of the nervous system acting over the whole periphery of the body, and is not the result of any special organ, or group of organs, such as the semi-circular canals.

The reader will notice that the arguments adduced are purely those of the physicist, and that these are chiefly of a negative character, and where not negative are mainly theoretical.

The experiments on birds, narrated by Ewald in the treatise published about the same time as this article by Ayers, and of which, as has already been stated, a summary will now be given, completely traverse the line of argument adopted.

It is not even from a physicist's point of view sufficient for the argument to establish that certain low forms of vertebrates are not dependent on the internal ear for equilibration, when the higher forms are found to lose, more or less, the power of equilibration if any lesion take place in these organs.

The *clinical* arguments in support of equilibration as a function of the internal ear are, of course, untouched in the article referred to. The obvious teachings of observed clinical facts appear so strongly confirmatory of the equilibrating function of the labyrinth as to quite outweigh speculations based upon purely physical research. The due discussion of the case, however, demanded that the

theories of so careful an observer as Ayers should not be left unmentioned.

*Summary of Ewald's Physiological Investigations on the End-organs of the Eighth Nerve.*

1. The first point is the distinct recognition of the fact that the eighth nerve (octavus) has so many and such important functions unconnected with hearing that it appears no longer justifiable to designate it as the "acoustic nerve," nor indeed is the doing so convenient for the purposes of description.

2. The *labyrinth* consists of two apparatuses, each of which has different functions—

(a) The organ which is impressed or excited by sound waves, and stimulations of which are conducted along the trunk of the octavus to the sound-recognising regions—*i.e.*, the hearing organ proper, which Ewald calls the "acoustic labyrinth" (Hör-labyrinth).

(b) The organ which exercises an influence on the muscular movements, and—from considerations adduced further on—may be called the "tonus labyrinth." The changes or disturbances emanating therefrom are described as tonus disturbances, or tonus changes (Tonusstörungen).

These latter manifest themselves as motor disturbances of a peculiar and hitherto not sufficiently defined kind, which it would be misleading to describe as simple motor derangements. When even the obvious result of such disturbances is an impairment in the use of the muscles, the actual seat of the abnormality is not necessarily in the musculature itself.

Ewald next particularises respecting the function and seat of these two organs, as follows:—

#### I.—THE ACOUSTIC LABYRINTH.

Its function is known. While, however, the doctrine has been hitherto accepted that this sense-organ is necessary for the transmutation of sound waves into nerve stimuli, which is brought about in a unique and hitherto imperfectly understood manner, Ewald's researches concerning the excitability of the octavus by sound have familiarised the notion that the acoustic labyrinth has for its function simply the distribution of sound waves, according to their quality, through the different fibres of the nerve, but not necessarily through certain particular fibres.

On this view the acoustic labyrinth would be an organ corresponding merely to the dioptric system of the eye. Just as a given retinal image excites always a definite particular combination of the retinal structures, so in a similar way—probably, as Helmholtz supposes, by association of vibrations—a certain definite region of the labyrinth is excited by a given sound; and if one could objectively recognise this excitation, we should probably find in the acoustic labyrinth a sound image analogous to the visual image. But the analogy between eye and ear goes no further. Light does not excite the optic fibres direct. One may illuminate the trunk of the optic nerve as brilliantly as possible (according to Ewald) without ever evoking a response to the stimulus. The "sound image," however, may act directly upon the octavus fibres.

In the higher mammalia the "acoustic labyrinth" is situated essentially in that part of the labyrinth known as the cochlea. After extensive destruction of the rest of the labyrinth, the animal may again come to hear quite well,

while the "tonus derangements" remain very marked. On the other hand, when the cochlea only has been removed, it sometimes happens that recovery from the "tonus disturbances" becomes almost complete, while at the same time the hearing capacity always remains at a minimum.

It appears, however, that the octavus fibres situated in the "tonus labyrinth" may be to a certain extent excited by a loud sound; though, of course, they transmit no sound perception.

The following experiment is cited (among others) in support of this. In a pigeon the whole of the left labyrinth was removed, but only the cochlea on the right side. The bare cut surface of the cochlear nerve was seen exposed on each side in the empty cochlear cavity. Suspended by the feet the pigeon let the right wing hang, while the left was drawn up close to the body. The condition was thus like that of a bird deprived only of the left labyrinth. Every time now that the hands were clapped, or a table struck with a wooden hammer, the right wing was drawn up a little, until, like the left, it came to be placed close to the body.

As the animal had no longer any cochlea on either side, and remained quiet—manifesting no more perception of the noises made than an animal without any labyrinth at all—it is conjectured that we are here dealing, not with a sound sensation, but with an excitation of the "tonus labyrinth" produced by the sounds.

## II.—THE "TONUS LABYRINTH."

When both labyrinths are removed from an animal peculiar derangements appear in the action of the striated muscles. In regard to the results manifested, these may be summed up as a "want of precision." Such a condition

may be due to various causes. The *muscular contraction may begin too late, or it may last too long, or it may be deficient in strength.* Which of these, however, is in question in any case under discussion cannot yet be affirmed with certainty, nor can it yet be decided whether the particular disturbance has its seat in the muscles or in the central regions.

In relation to this subject, the various muscles may be classified with reference to the greater or less precision needful for the perfect performance of the bodily movements. *Those the perfect fulfilment of the function of which demands most precision suffer most by removal of the labyrinth.* No muscular system works with such precision as that of the eyeball, which is capable of keeping the retinal image of a moving object always upon the same small part of the retina—viz., the yellow spot (Fovea centralis). Accordingly the eye muscles are found to suffer more by the operations mentioned than any others; on the other hand, they exhibit exceptionally active contractions upon excitation of the labyrinth.

A similar precision is observed in the action of the neck muscles, by means of which the head is placed in the direction necessary for vision, and which in many birds enable a minute seed to be picked up by the point of the beak, &c.

These muscles are thus analogous to those of the eye muscles upon the eyeball. A smaller, but still a considerable, degree of precision is essential for the movements of the wing, and a yet smaller degree again for those of the leg.

It is worthy of note that the same order is observable in regard to the amount of motor impairment which results from the removal of the labyrinth. In different birds, too, a given operation performed in each in exactly the same

way—*e.g.*, section of the external canals on both sides—was followed by disturbances which were more marked the greater the precision demanded for the movements of the animal. For example, the impairment was most marked in the swallow, and scarcely appreciable in the goose.

So also a pigeon, minus its labyrinth, shows no imperfect action of the legs in walking; while a cockatoo, with a like lesion, exhibits very distinct impairment of function of the muscles of its lower extremities, which are in its case used also for seizing its food, and for the support of the body in climbing.

The question arises as to which are the muscles associated with each labyrinth. The labyrinth is associated, not exclusively with particular muscles, or with those of one or the other side of the body, but each organ is in relation with every muscle. The influence of the labyrinth, however, upon certain groups of muscles is stronger than upon others—at least it is so in pigeons. What is as yet known on this matter may be stated as follows:—

(*a*) Each labyrinth is by preference and more particularly associated with those muscles of the opposite side of the body which move the vertebral column and the head—*viz.*, the muscles of the neck and throat, and those especially going from the bodies of the lower to the transverse processes of the upper vertebræ.

(*b*) In regard to the muscles of the extremities, a distinction exists between the extensors and abductors on the one hand, and the flexors and adductors on the other hand. Each labyrinth is connected with the former group on the same side of the body, and with the latter group on the opposite side of the body.

(*c*) All the eye-muscles, with the exception of the

external rectus, appear mainly dependent upon the adjacent labyrinth.

As a consequence of this distinction between the muscles in relation with each labyrinth, it is found—after removal of one labyrinth—that the entire vertebral column is turned towards the injured side in a spiral fashion; the head and throat are bent towards this side; the extremities of the same side are flexed and adducted; while those of the opposite side are extended and abducted; the eyes (especially the adjacent one) are averted from the side of the lesion.

Though the nature of the disturbances seen after removal of the labyrinth cannot as yet be defined with accuracy, nevertheless a most important statement may be made on the subject, especially as to the resultant phenomena—viz. :—

*Firstly.*—The modifications in the motor derangements occurring from the time of removal of the labyrinth up till the death of the animal are always and simply quantitative, never qualitative.

*Secondly.*—These derangements may be made to disappear by irritation of the trunk of the octavus.

Derangements of muscular action also occur after disintegrative changes in the labyrinth, and the conclusion appears unavoidable that the *labyrinth must exercise a constant activity which makes possible the normal precision of muscular action.*

Further, this view renders comprehensible the familiar observation as to the two-sided influence of labyrinthine excitation. This excitation may act either in increasing or diminishing the activity of the organ.

The derangement in muscular action being designated as a want of "ear-tonus," the labyrinth has the function of constant maintenance of this tonus, and the part of the

organ concerned in this function is the "tonus labyrinth." If this part cannot at present be quite accurately limited off from the acoustic labyrinth, it may yet be broadly asserted that the cristæ acusticæ of the ampullæ, and the maculæ acusticæ of the sacculus and utriculus, belong to the tonus labyrinth. On the other hand, the endings of the octavus nerve in the cochlea belong to the acoustic labyrinth.

The disturbances arising from removal of the labyrinth necessitate the inference of a constant activity of the labyrinth, as already intimated; which activity may naturally be lessened or enhanced by certain influences. The same conclusion, however, appears essential to explain the double influence of *stimulation*. Two different, indeed opposite, movements of the animal are always observed, according as the electric current, the passive rotation, or the artificially produced endolymph current has one or the other (contrary) direction. Apart from the supposition, therefore, of a constant activity of the labyrinth, it would be very difficult to understand how opposite actions could arise by altered directions of the same stimulus.

The mode in which stimulation of the nerve fibres (octavus) acts upon the muscles cannot at present be explained. One may imagine the labyrinthine excitations to act directly upon the centres concerned in ordinary motor innervation. On the other hand, they may be supposed to be conducted to other special centres sending their proper nerve fibres to the muscles for the end in view. Ewald considers the latter the more probable hypothesis.

A marked increase of "labyrinthine tonus" causes contraction of the muscles; a deficiency brings about no paralysis it is true, but it *renders contraction difficult and impairs precision of action*. (This latter statement, the author suggests, demands special attention. It will

probably be found to have a distinct bearing on the phenomena of "paresis of the palate," and other collateral pareses, the significance of which common condition in the affections treated of in this work has been insisted upon in former editions, and which significance receives a large accession of import from these researches of Ewald now under review.)

With regard to the *situations of the central regions* to which the excitations of the "tonus labyrinth" are conveyed, a negative statement, at least, may be made. According to the researches of B. Lange, they do not lie in the cerebellum; or, if so, but to a very limited extent. Lange, it is true, removed only the upper two-thirds of the cerebellum. Since, however, the typical cerebellar symptoms occurred after the operation, and these were uncomplicated by any labyrinthine disturbances; while, on the other hand, these derangements referable to the cerebellar lesion were not materially different after the removal of the remaining third of the cerebellum, it appears justifiable to extend Lange's inferences to the entire cerebellum.

The question arises as to the nature of the *excitations of the tonus nerve*. Since the nerve endings are in connection with cells, from which hairs project into the endolymph, it would seem that we are called upon to explain by what means these "tonus hairs" may be set in movement. The assumption of a constant active current of the endolymph, though plausible, will not suit the facts. The lymph stream would, it is true, move the tonus hairs, just as aquatic plants are kept in constant motion by river currents; besides which an increase in the strength of such a hypothetical endolymph current would necessarily act more strongly upon the tonus hairs, the movement of which would, on the other hand, be diminished by a weaker or obstructed

lymph current. But no obvious reason is to be conceived why such endolymph stream should follow a definite course through the semi-circular canals—an essential supposition for the support of this theory. Further, even if such a constant current did exist, *plugging a canal* would completely annul the function of the corresponding ampulla—*which is not the case*. Lastly it is difficult to understand how the considerable commotions incidental to the lymph current could be either prevented or counteracted in respect of their effect upon the ear tonus.

The similarity of the hair-bearing cells to the ciliated epithelium makes another hypothesis very probable—viz., that the tonus-hairs possess active movements. These movements may very well be so slight as to escape even microscopic investigation. A muscle in tetanic contraction is certainly in movement, since it produces a sound, and yet this movement cannot be made visible.

Again, the finest vibrations of a telephone plate must be diminutive almost to the vanishing point in comparison with the smallest movements which the microscope can make evident. Moreover, we assume vibration in the acoustic labyrinth without necessarily expecting the possibility of observing these under the microscope.

*Movement of the "tonus hairs,"* like that of ciliated epithelium, would carry the surrounding endolymph forward in a definite direction: movements of the endolymph in the same direction, brought about by other influences, would have the effect of easing the work of the hairs, by lessening the resistance they encounter in producing motion of the liquids. *Per contra*, the work of the hairs would be increased by extraneous movement of the endolymph in a contrary direction.

Ewald states he made direct observations of endolymph

currents under the microscope. In one experiment he found the endolymph current in the external canal advanced about one millimetre towards the ampulla in twenty minutes.

If, from any cause—*e.g.*, rapid rotation, fluctuating passive movement, unusual position of the head, injury to the Goltzian sense-organ, &c.—these well-ascertained but unconscious relations should be disturbed, then do we experience *giddiness*. Ewald agrees essentially with Hitzig when the latter affirms that Vertigo depends upon the disturbances of the muscular sense. He adds, however, that he is persuaded it is not by disturbance of the muscular sense *as such* that the sensation of giddiness is called forth; but that it is caused by a disturbance of the ordinary relations between the labyrinthine excitation and the muscular sense, and that *the existence of the labyrinth is therefore necessary for its genesis*. A complete absence of these relations, or a merely quantitative lowering of the labyrinthine functions, produces no Vertigo. After partial destruction of the labyrinth Vertigo always arises, and continues to manifest itself until the animal has become accustomed to the new relations established between the head movements and the muscular sense.

In conclusion, it may be remarked that Ewald's work contains material of value to the student, beyond that contained in the foregoing summary. Enough, however, has been abstracted to corroborate the soundness of the basis on which the explanation of the symptoms about to be discussed is founded. The nature of the clinical facts adduced, in its turn, supplies evidence confirmatory of the correctness of Ewald's conclusions derived from experiment.

## CHAPTER 11.

### VERTIGO.—SYMPTOMATOLOGY.

HAVING, with the assistance of the facts recorded in the previous chapter, arrived at a definite view of the location and functions of the organ of equilibration, or labyrinth tonus, as Ewald teaches us to call it, we are in a better position to understand the phenomena resulting from its disturbance—in other words, to comprehend fully the symptoms of Vertigo. These, from their number and diversity, have been described as a *complex* of symptoms, which Trousseau, empiricist as he was of necessity, though unequalled for accuracy of observation, thus epitomises:—"Sometimes when the individual is standing, everything about him seems to be whirling around; he is obliged to shut his eyes and remain absolutely motionless, for he feels his legs tottering and bending under him, and sometimes he does fall. If he be lying down, he thinks he sees his bed revolving on an axis, passing through his head and feet; or, it may be, the patient sees himself involved in the rotatory movement. Sometimes the earth seems to open at the sufferer's feet, and he feels himself irresistibly drawn into the chasm. At the same time he is oppressed with an overwhelming terror and sense of dread which, though fully conscious that his sensations are more subjective than real, he is unable to dispel." There are other contingent symptoms omitted in this, in the main accurate, synopsis of Trousseau. Both those recorded, as well as those omitted by him, the author proposes now to submit to examination.

The most emphatic phenomenon attending the Verti-

ginous state is, the act of *falling*. It usually occurs suddenly, though there are occasions when the subject, taught by previous experience, has time to save himself either by sitting or lying down. The same patient always falls in the same direction, and this is generally to the side of the most affected ear. It may happen that up to this point neither ear has exhibited any sign of local disturbance. The patient may then fall backwards or forwards—the particular direction depending upon whether the posterior or anterior perpendicular canal is the more implicated. The labyrinthine disturbance in the latter condition, in which no prior local ear lesion existed, is due to reflex impressions. These may be vaso-motor reflexes, inducing a statical hyperæmia of a part or whole of the tonus labyrinth—the mechanism and determining causes of which will be discussed later on; or it may be due to sensori-motor impressions reaching the octavus nerve, usually from irritation of the trigeminous branches, which are thus transmitted to the labyrinth. This most important factor in the production of Vertigo, as also of tinnitus, will likewise receive due attention in its proper place.

*Consciousness* is never lost, unless fainting complicate the Vertigo, a fact which will assist the differentiation of the falling in Vertigo from the corresponding symptom in Epilepsy. It is a question worthy of consideration whether the so-called *petit mal* be not often a Vertiginous, rather than Epileptic, state. But no doubt the two conditions, Epilepsy and Vertigo, occupy approximate regions, whose boundaries overlap, whose causation is at times the same; and, what is more to the purpose, the treatment of the one is efficient in that of the other.

Whenever the author has had the opportunity of witnessing an attack of Vertigo—a rare occurrence, from

the suddenness and transitory character of most of these—the pulse has been rather quickened than otherwise; the face and lips have retained their natural colour, or, if this be changed, it is in the direction of injection of the superficial vessels. Should, however, *fainting* occur at the same time, there will be pallor as well as loss of consciousness.

As regards the act of *falling*, some patients describe their consciousness of it as if “the pavement flew up and struck them on the head,” thus using the language of the conventional inebriate. This feature is one of sudden and absolute powerlessness, a crumpling up, as it were, of the body, arising from the withdrawal of the faculty of maintaining its equilibrium. As a rule the attack passes off as quickly as it comes on, and beyond the slight mental confusion consequent upon such a total collapse, the patient is able to resume his former occupation in the course of a few minutes. There are, however, many instances in which he remains in a dazed condition, tottering in his gait, and clinging to the nearest objects for support.

The author submits that no explanation of this unique phenomenon approaches in sufficiency to that which implies the suspension of the labyrinth tonus of Ewald, the withdrawal of which influence makes impossible the normal precision of muscular action. The ways and means by which this suspension may be brought about will be fully considered later on.

A remarkable circumstance about this symptom, falling is, that the patient will experience a single attack, or even two at short intervals, and subsequently be entirely free from any recurrence of it for many years.

After such an interval it may be difficult to extract from the patient any very clear account of the original

attack. Thus a lady who was recently detailing to the author a series of Vertiginous symptoms of more than a year's duration, added, "But I have not been really well since my first '*nervous breakdown*' ten years ago." It was only after considerable questioning that it became apparent that this "nervous breakdown" was in reality a first attack of Vertigo, in which she would have fallen but for the support of her husband, with whom she was walking at the time. Needless to say the true nature of this seizure was not recognised, nor was any effort made to discover its source. This proved to be disease in the ethmoid region of the nose, the long existence of which was demonstrable at the interview, and to the progress of which was due the patient's subsequent continuous ill health. Nor would this patient readily admit that her present symptoms of giddiness had any relation to the long-passed attack. She clearly derived much satisfaction from having undergone such a momentous experience as a "nervous breakdown."

The following example, the subject of which was a medical man personally known to the author, illustrates this long break between the first occurrence of vertigo and its development into a persistent condition. The doctor whose case is referred to, when about thirty years of age, was one evening summoned to a patient. He was already tired with an arduous day's work. On reaching the house he became giddy, and as the door was opened fell into the hall, a proceeding which, though perfectly conscious, he was powerless to prevent. He rapidly recovered, and, beyond the fright of the incident and apprehension as to what it might portend, was not otherwise affected by it. In the course of the following year a second seizure occurred, exactly corresponding in character to the former. For considerably more than

twenty years there was no repetition of the attack. Notwithstanding, he was for a lengthened period the subject of intense headaches with tinnitus, for which he submitted to the ordinary method of depletion then in vogue. Moreover, he became deaf in the right ear.

The subsequent history of this patient was instructive. When he had passed the age of sixty he became the subject of chronic Vertigo, losing first his memory, and then one faculty after another, finally sinking into a state of hebetude, from which, after a further interval of ten years, he was released by an attack of Apoplexy. This chain of symptoms will become intelligible as we proceed.

It is an interesting commentary upon the foregoing case to note that medical men furnish in their own persons some of the most marked examples of Vertigo, and of these examples the majority, in the author's experience, have been found amongst general practitioners in the provinces. Nor need this circumstance excite surprise when the arduous life of toil, exposure, and worry involved in their noble work is considered. Perhaps, too, the irregularity of meals, and the rapidity with which food is often taken by them, constitute factors of even greater moment than those already named.

One medical man, the subject of Vertigo, described his attacks of falling with graphic accuracy. He would be standing upright against, perhaps, the mantel-piece, when suddenly, without the slightest warning, he would find himself in a heap on the hearth-rug—literally, as he said, "sinking into his boots." He did not lose consciousness, and after a very brief interval was able to stand upright again.

It is essential to bear in mind that the *gait* of Vertiginous patients is apt to become chronically affected, apart altogether from the supreme catastrophe above described.

Such individuals are frequently uncertain in their walking powers, often lurching and reeling to one side, and are fain to avail themselves of the support of a lamp-post or railing. They are, in fact, unable to walk in any other way than to the lay mind, at least, suggests a condition of alcoholic excess. The author therefore emphatically commends the study of this picture to the consideration of those who may be called upon to determine, in a given case, whether the subject be drunk or ill.

Some modification of gait is occasionally witnessed in syphilitic invasions of the labyrinth. One such patient complained of the left foot feeling always as if compressed by a tight bandage. In one instance intense itching of the inside of the foot, and, in another, severe pain in this region, have been noted. None of these cases have any true relationship to Ataxy. Besides the absence of collateral symptoms common to the latter disease, they differentiate themselves entirely by the rapidity with which they yield to specific treatment.

*Nausea, Vomiting, and Dyspepsia*, generally, are apt to be associated with any form of Vertigo, howsoever arising. That vomiting can be caused by a plus tension of the intralabyrinthine contents is definitely established by Weber Liel's experiment. The fuller consideration of these symptoms, as of those of *Heart* complications, are referred to the particular phase of Vertigo under which they are most likely to be witnessed.

Another phase of the Vertiginous state occasionally met with is that which has been somewhat fancifully denominated *Agoraphobia*. Literally translated, this implies "dread of the market-place." It is applied to a form of Vertigo induced by the patient finding himself unexpectedly in any open space. Dr. Grainger Stewart, in a clinical lecture on "Giddiness," published in 1884, says:

“Benedict described it in 1870, Westphal in 1872.” In its typical form it is, the author imagines, comparatively rare, as he has met with only one well-marked instance, though it is very usual for all Vertiginous persons to experience an aggravation of their symptoms when placed in situations destitute of any means of support, or even where there are no trees or buildings to break the void.

The case of Agoraphobia just referred to as coming under the author's cognisance occurred in the person of a middle-aged gentleman, whose intelligent account of his condition cannot be better described than in his own words. He says:—“I am able to walk along a street with rows of houses on one, or either side, without discomfort. Crossing a square or field alone, without trees or houses or any near object of support, creates immediate and overwhelming sensations of dread, accompanied by palpitation and tremor, and perspiring at finger ends. This sensation would at times become so distressing, that a standing, sitting, or recumbent posture were equally well-nigh unbearable. Climbing a steep hill or looking down from a height would produce the same symptoms. If, however, *with a companion*, none of the above symptoms would be manifested under any of the conditions above mentioned, except only the last named—viz., the ascent of a mountain or steep hill.”

One symptom about this patient's Agoraphobia was that he must always have the wall or building or hedge on his left side, otherwise the Vertigo came on; the condition was then rather a sense of dread, and tendency to collapse, than one of giddiness, so much so that if he sat down he would still feel very unhappy and miserable.

It is to be noted that this patient afforded no indication of ear disease: he was not deaf, and had no tinnitus; also, that he suffered from intermittent dimness of vision,

and occasional sharp attacks of conjunctivitis. All these symptoms disappeared on treatment of disease well marked in the ethmoidal region of the nose, the only objective morbid condition discoverable. So that this case comes under the head of Vertigo due to ethmoiditis; to which attention will be directed later on.

Another instructive symptom, usually accompanying any well-established case of Vertigo, is *Mottling*, or *superficial congestion of the hands and forearms*. It is a very positive condition, the blush disappearing on pressure to reappear when this is withdrawn. It denotes a loss of tonus in the peripheral vessels of the brachial circulation, the association of which with the labyrinth will be more appropriately discussed under the head of *Stomachic Vertigo*.

Owing a similar anatomical relationship are certain *Auræ*, which, in many instances, presage an attack of Vertigo. Sometimes the sensation appertaining to this category commences in the arm corresponding to the affected ear, passes up the side of the neck to the ear, upon reaching which the patient becomes giddy; or it may commence in the stomach and follow the same upward course. Occasionally it assumes the guise of a stifling sensation in the throat, or a fancied or actual dysphagia. These latter occurrences would lead the initiated at once to search the nose for the primary seat of irritation. All the foregoing symptoms, which are quoted from observed cases, preceded the attack in the subjects manifesting them.

The concluding group of symptoms, though witnessed in their most pronounced and persistent forms in confirmed cases of Vertigo occurring in advanced life, are yet met with as occasional phenomena in the very young, and in quite curable stages of the disease.

Allusion has already been made to the *Sense of Dread*,

the apprehension of impending evil, exhibited by the subjects of Vertigo. This unhappy state of mind is quite unwarranted by the surroundings of the patient, nevertheless it is impossible to soothe or reason him out of it. This symptom was early manifested in the medical man whose condition has been already described as having experienced two attacks of falling almost at the outset of his career; he was subsequently haunted with the fear of becoming epileptic, and frequently pondered over the course he should pursue should he be attacked when riding over the country roads of his district. To some extent this undefined terror may be the effect produced upon the mind of the sufferer by the uncertainty of his relationship to space and the objects about him, which is the direct consequence of his Vertigo. If he be also the subject of the tumultuous noises of tinnitus, while deaf to the sounds about him, it will be difficult to imagine a state of things more calculated to fill his mind with the expectation of evil. Perhaps only he who has felt the ground heaving beneath him in the throes of an earthquake can fully sympathise with this mental distress of the Vertiginous subject.

Closely allied to the foregoing is an uncontrollable tendency to *Sobbing and Weeping* without provocation—a symptom which naturally proves very distressing to friends and onlookers. Though prevalent in aged subjects of Vertigo, it is occasionally witnessed in young persons suffering from advanced and neglected ear disease. In evidence of the latter statement the author recalls two instances: one, that of quite a child, the other a lady of twenty-seven years, both of whom frequently exhibited this proneness to a copious shedding of tears, in the absence, moreover, of any corresponding extraneous reason. In both these patients there existed a long-standing otorrhœa,

with granulations in the tympanic cavity. In another patient, abundant weeping would attend every attempt to read out loud.

There is, moreover, in nearly all cases of any duration, a great and growing *Impairment of the Memory*. Such patients voluntarily complain of forgetfulness in the trivial concerns of every-day life. In senile subjects, where the disease advances *pari passu* with extensive changes in the blood vessels, this forgetfulness expresses itself in inability to talk correctly. This is not aphasia proper, at least not in the earlier stage, when, from sheer forgetting of the word required, some other quite irrelevant word is substituted. The speech becomes increasingly incoherent, and at length unintelligible.

It is in these aged subjects, and in the later aspects of the disease, that the habit of *picking and fidgeting* with the fingers is exhibited. This symptom is curiously alike in every case sufficiently advanced to exhibit it. It takes the form of tapping with the finger nails on any hard surface; twirling and twisting any small object in the hands; carefully exploring the lappels of the coat or other wearing apparel; as also a disposition to touch and finger any small object which may be at hand. It will not have escaped the observation of the reader that these phenomena are not uncommon in people whose equilibrating function is in normal condition when wishing to concentrate their attention on a particular subject. In each case, the action, though so greatly differing in degree, may be traced to the same cause. The further elaboration, however, of the matter would lead us too far from the subject in hand.

Although this symptom is probably a part of the general restlessness of the body, which advances step by step with the growing mental vacuity of the patient, the author cannot but regard the particular localisation of this habitual

restlessness in the fingers as a later manifestation of impaired nerve nutrition of the upper extremities, consequent upon the loss of vaso-motor power to which the mottling of the skin in this region, above quoted, may be traced, and of which this latter is an early indication. In one case this symptom disappeared under treatment of the affected ear, with the cessation of other Vertiginous conditions, and also of the associated tinnitus.

Finally, *Oscillation of the Eyeballs*, called also *Nystagmus* (*νυσταγμὸς*, nodding, slumber) has been described by some authors as an accompaniment of Vertigo. It must however, be a rare complication, the author never having met with any noticeable degree of oscillation of the eyeballs in the entire category of his cases.

Respecting the many other symptoms associated with Vertigo, these are due in the main to the implications of adjacent structures by the lesion which is the *fons et origo* of this symptom. Thus, *Headache*, *Neuralgia*, and *Hypochondriasis* are more closely allied to the ethmoiditis which occasions the Vertigo than to the Vertigo itself. *Tinnitus* and *Deafness* will be duly considered in the section devoted to the former of these; while *Vomiting*, which may belong to any aspect of the attack, whatever its origin, will be considered under the head of *Stomachic Vertigo*.

Having enumerated, and to some extent described, the phenomena attendant upon an attack of Vertigo, we shall be the better prepared to undertake the study of the particular morbid lesions to which the Vertiginous state may be primarily traced.

Stating these in the order in which it is proposed to discuss them, they are, first, *Stomachic Vertigo*, in which vaso-motor disturbances of the circulation of the labyrinth originate in the stomach and primæ viæ; *Menière's Disease*,

or apoplexy of the labyrinth; *Nasal Disease*, chiefly *Ethmoiditis*, giving rise to reflex irritation of the octavus nerve; *Ear Disease*, producing direct pressure upon, or reflex irritation of, the labyrinthine nerves.

Usually more than one of these causes co-exist; so that while one, *e.g.*, ear disease, is a persistent factor of altered labyrinthine equilibrium, the other, *e.g.*, the stomach lesion, may come suddenly into action, and so determine the incidence of an attack of Vertigo.

### CHAPTER III.

#### VERTIGO ORIGINATING AS A VASO-MOTOR REFLEX.— STOMACHIC VERTIGO.

THE association between "swimming in the head" and a "bilious attack" is so common, that both professional and lay observers are apt to speak of them as effect and cause, the organ to whose disturbance the giddiness is due being comparatively rarely recognised as implicated in the attack.

It may be stated at the outset that Vertigo originating in disturbance of the *primæ viæ* is rare except in aged and edentulous persons; the lesion of the digestive apparatus must, to induce an attack, be complicated by nasal or ear mischief—*i.e.*, in persons not thus advanced in life.

In fact it cannot be too strongly insisted upon that diseases, both of the nose and ear, are capable of establishing and maintaining an irritable state of the digestive apparatus. This may be brought about in two ways: first, by the stream of septic muco-purulent discharge which, in many of these cases, finds its way down the pharynx and esophagus into the patient's stomach; second, by reflex irritation of the pneumogastric nerve, through the medium of the trigemenuis, consequent upon the ulcerating and granulating processes in the respective organs in which the primary disease involving the latter nerve is located. Both of which causes will be accentuated when, as often happens, the primary disease has gone on to the production of necrosis of bone.

Such patients are subject to loss of appetite, frequent

nausea, and irregularity of the bowels. Their complexions are dull and leaden; they are the subjects of frequent headache and to attacks of facial neuralgia. They are "nervous," depressed, hypochondriacal. One may freely grant that the physician, not alive to the special lesions present, who should encounter such a condition would be justified in writing it down Dyspepsia. For such truly it is, only it is a great deal more.

Oxaluria is frequently present in this class of patients, and should always be looked for, especially in students and sedentary subjects of Vertiginous Dyspepsia. In order to detect the oxalate of lime it is necessary to allow the urine to stand for twenty-four hours to precipitate the crystals. Their presence is usually attributed to the maldigestion of sugar and the glycogen derivatives.

The author has insisted somewhat on this point because the detection of oxaluria affords important indications for successful treatment. It is, moreover, of consequence from another aspect, which is, that it is within the range of probability, though perhaps not yet absolutely proven, that giddiness may be induced reflexly from irritation of the kidneys, set up in them by the elimination of excessive quantities of oxalates; the order of events in such circumstances being the same, *mutatis mutandis*, as that about to be described as taking place when the morbid impression originates in the stomach.

Whether, then, the hypersensitiveness of the nerves of the stomach be induced by the causes above enumerated, or whether it be a senile stomach simply, the fact remains that such subjects are liable to become giddy upon very slight provocation in the direction of errors of diet.

What, then, is the association between the stomach and the labyrinth by means of which the phenomena in question are brought about? The answer to this question will be

found in the *source, and vaso-motor relations, of the blood vessels of the labyrinth.*

It is, in short, the same explanation as the author first promulgated fifteen years ago, and which, being incapable of disproof, has been more or less generally accepted. Some of his readers may be, nevertheless, unacquainted with it, so that he would solicit the forbearance of those who are already familiar with his views on the subject while he briefly states his case for the sake of those who are not.

The facts to be borne in mind are these: the perceptive portion of the auditory apparatus comprised in the labyrinth receives its vascular supply from a totally distinct source—the vertebral artery—from that which is furnished to the conductive mechanism of the ear. This in itself should constitute a suggestive fact, as the internal carotid in its bony canal passes so close to the internal ear that one might naturally look to this vessel as the source whence its blood supply would be derived. As a matter of fact, however, neither the internal nor external carotid is in any way concerned with the circulation of the labyrinth. (It is quite needless to take into account certain minute vascular twigs described by Politzer, though long previously noted by English anatomists, as passing from the tympanic cavity chiefly through its inner wall to the labyrinth. For whatever purposes of bone nutrition they may subserve, they can exert no influence upon the functional changes in the circulation of the labyrinth with which we are at present concerned.)

It is the vertebral artery and its relations we have to consider in this connection. The origin of this vessel, from the subclavian deep down in the neck, and its prolonged course upwards, guarded by the bony sheath formed by the vertebral foramina, acquire additional

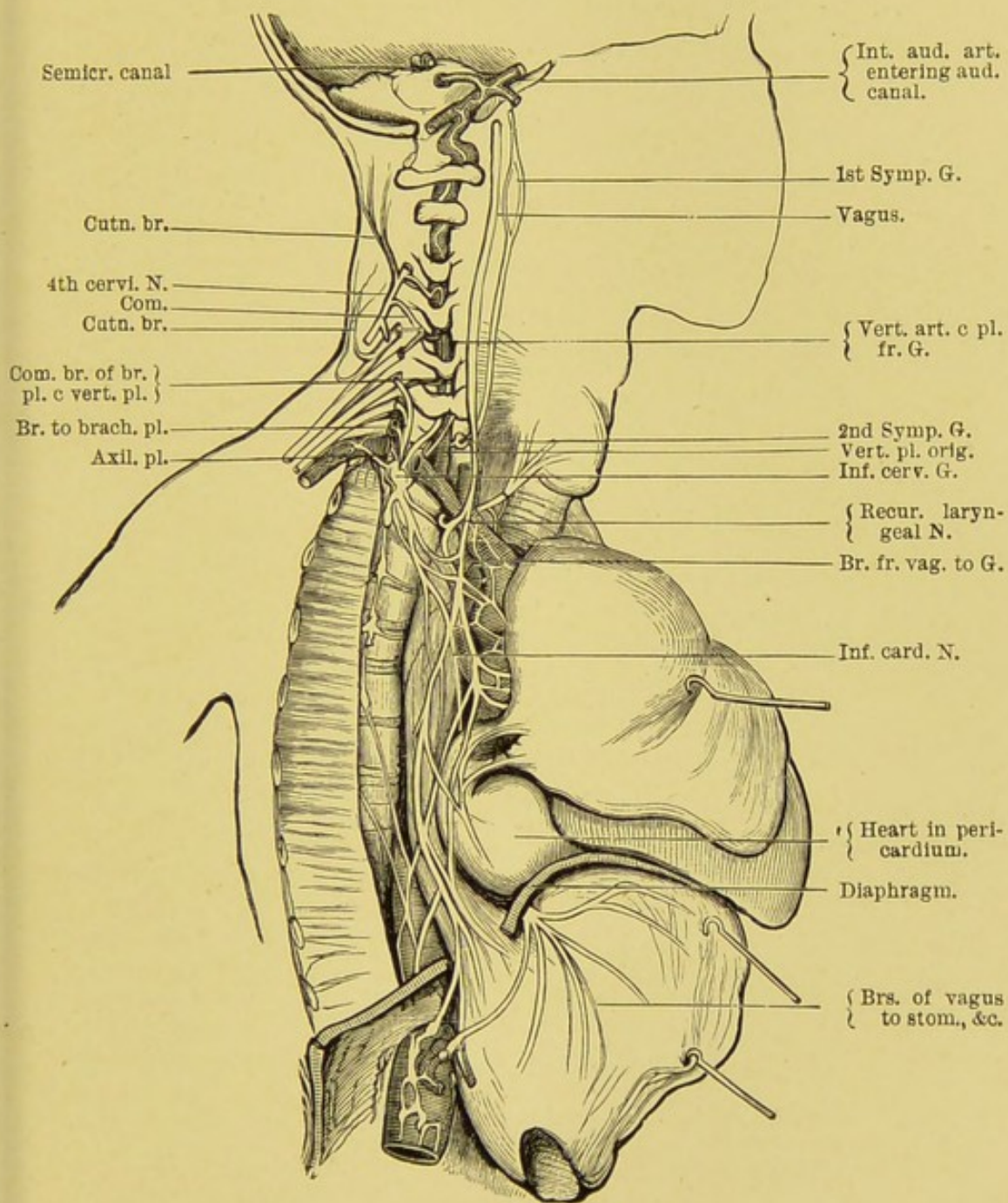
importance when its relations to certain nerves are considered.

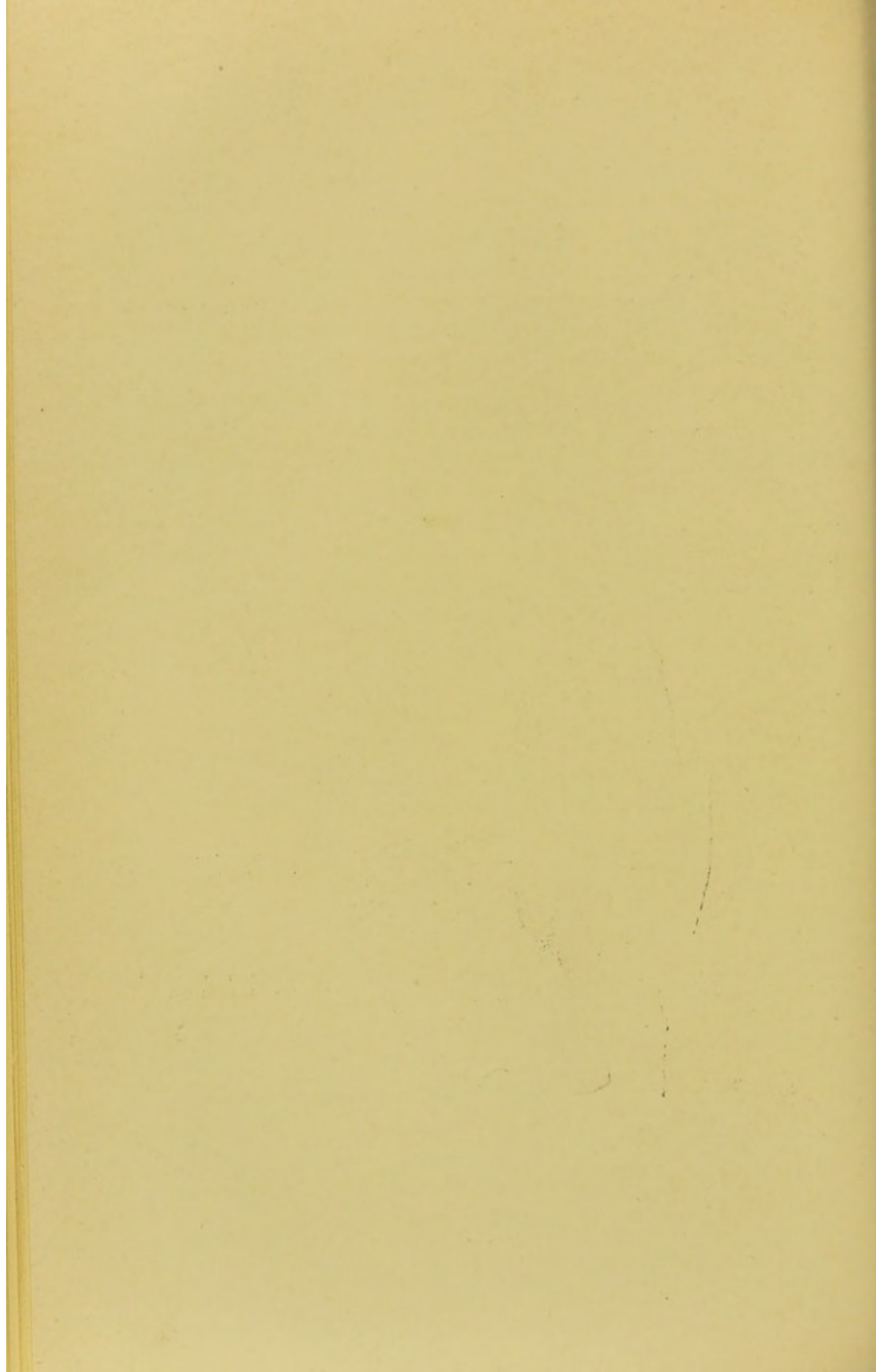
In the first place, this position brings it, near its origin, into close proximity with the inferior cervical ganglion (Fig. 1, inf. cerv. G.), from which it derives a rich plexus of nerves, the vertebral plexus (Fig. 1, vert. pl. orig.) communicating in its upward course with the several cords which form the brachial plexus (Fig. 1, com. brs. of br. pl. with vert. pl.). It is important to note also that this inferior cervical ganglion furnishes one of the regulatory nerves of the heart—viz., the inferior cardiac nerve (Fig. 1, inf. card. N.). The experiments of Cyon and others show that this nerve is capable of exerting very important effects upon the heart's action; it "renders the individual contractions feeble and less effectual."\* It is desired to point out the close relationship of this nerve (inf. card.) with those regulating the supply of blood to the labyrinth, both passing into the same ganglion of the sympathetic chain. Nor is it without advantage that such an arrangement exists.

By way of parenthesis it may be permissible to record one consequence of this association. Bearing in mind that under the circumstances of altered tension in the semi-circular canals, the subject loses his equilibrium and falls to the ground, we gain some insight into the purpose of associating the nerves which regulate this tension (vert. plexus) with that which tends to check the heart's action. The connection is such that an impression influencing the heart through this inferior cervical nerve will be likely to extend to the labyrinth also. Thus a strong mental emotion originating centrally, and reaching the heart through this channel, and which tends to enfeeble its action, will probably be deflected in the ganglion common

\* *Vide* "Handbook for the Physiological Laboratory," p. 280.

FIGURE 1.





to both, to the nerves regulating the supply of blood to the labyrinth, and, by suddenly changing the tension in this organ, will cause the subject to fall to the ground, so removing the mechanical impediment to the circulation which the upright posture implies. In this way time is allowed for the depressor influence of the heart to subside, while the subject of it is placed perforce in the recumbent posture.

Returning to the study of the inferior cervical ganglion and its connections. Besides those already noticed as proceeding from the vertebral plexus to the brachial plexus, there are others which proceed directly from the ganglion to the brachial nerves. (Fig. 1., br. to br. pl.) It is this arrangement, doubtless, which explains an occurrence noticed in gunshot wounds of this plexus, first pointed out by Drs. Moorhouse, Weir Mitchell, and Keen, in a treatise on gunshot wounds of nerves, published after the late American War. These observers record most succinctly that the subject of such a wound, whether received in the arm, axilla, or neck, immediately falls to the ground without losing consciousness. This circumstance is quite unique; it has not been observed in connection with wounds of any other correspondingly non-vital part of the economy. A certain amount of collapse sometimes attends these cases, from which it may be legitimately inferred that the shock is conveyed, not only in the direction of the labyrinth through the vertebral plexus, but also through the inferior cervical nerve to the heart.

Anyone who is conscious of the possession of what is popularly called the "funny bone" may, if he choose, verify these statements, at least to a certain extent, by giving it a blow considerably in excess of that sufficient to induce the well-known tingling sensations in the fingers.

It once happened to the author to witness such an experiment in the person of a lad who was struck on this exposed situation of the ulnar nerve by a hard tennis ball, thrown with considerable violence. Immediately he became giddy and confused in his head, and would have fallen but for the support of some railings; altogether the extreme distress which he manifested appeared out of all proportion to the slightness of the cause. At the time of the occurrence the symptoms were quite inexplicable by any known relation of the injured part.

The explanation of this occurrence, as well as of that of *falling* in gunshot wounds of the brachial plexus of nerves—related by the American surgeons just quoted—is one and the same. It is an application to the particular circumstances of the following general physiological principle:—“The *afferent fibrillæ* of a sympathetic ganglion, which are, for the most part, associated with sensori-motor nerves, are in *reflex relationship* with the *efferent vaso-motor nerves*, furnished to the arteries from the same ganglion which receives the efferent fasciculi. In other words, an excito-vaso-motor function is established between the afferent and efferent elements of a given sympathetic ganglion. It is in this sense that these organs are said to exercise a *correlating function* in regard to such operations as belong to them, between tissue areas often widely separated.” \*

Perhaps the inferior cervical ganglion illustrates this principle more easily than any other of the sympathetic chain, both because its anatomical associations are clearly definable, and because it is the controlling centre of the circulation of the labyrinth (through the vertebral plexus).

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\* *Vide* “Correlating Function of the Sympathetic Ganglion,” a Paper read at the International Medical Congress, London, 1881. Vol. ii. Transactions, p. 75.

## VERTIGO.

which organ exhibits such pronounced phenomena in response to any change in the tension of its contents that such changes of tension in all their bearings admit of tolerably accurate observation and study.

The nerves associated with this ganglion divide into two groups:—(a) Those already noted, which join cerebral or spinal nerves, and are *afferent*—*i.e.*, they convey impressions from the tissues to the ganglion. Of these there are, first, numerous fasciculi which enter the vagus, and accompany it to the lungs, stomach, liver, &c.; secondly, a set of fibres which join the brachial plexus of nerves, and are distributed with them to the upper extremity. (b) The second group are efferent as regards the ganglion, and vaso-motor in respect of their function. This group comprises fibres which supply the vertebral and brachial arteries, with their respective plexuses. Hence it follows that tissue impressions reaching the ganglion through the former group will be reflected in the ganglion through the medium of the latter group to the vertebral and brachial arteries, as vaso-motor impulses, producing either dilatation of the peripheral branches of these arteries—equivalent to hyperæmia of the parts supplied by their peripheral vessels—or contraction of the arterioles, with corresponding anæmia of these regions.

Now, the internal auditory branch of the vertebral artery, being the chief source of blood supply of the labyrinth, is beyond all others most likely to give rise to marked indications of such changes in its calibre, because it alone is distributed to an organ capable of proclaiming the disturbed state of the circulation by so pronounced a symptom as giddiness. When it is considered how largely the vertebral artery is concerned in the blood supply of the brain, and what important centres depend upon it for nutrition, the advantage of this arrangement, by which the very earliest

departure from a state of equilibrium shall be thus prominently notified, will become evident.

Turning now to the question of Stomach Vertigo, the following case, which came under the author's observation more than twenty years ago, still appears to him fraught with instruction. The patient, a member of the Society of Friends, aged about seventy-three years, complained of giddiness brought on by exertion of any kind. Walking in the streets induced a tendency to fall forwards. His appetite was good, although the tongue was coated; he had no teeth, not even artificial ones, but it was ascertained that he ate meat with a relish—a habit very usual in persons of advancing years. The treatment consisted in the entire prohibition of butcher's meat in the solid form, with, as medicine, small doses of bromide of potassium. Under this *régime* he rapidly recovered. After an interval of nearly a year he returned to a mixed diet, with the result that his old symptoms reappeared, but to a less extent than formerly. The above treatment was reverted to, with a like result—cessation of giddiness. Subsequently this *rôle of sequences* was enacted on several occasions, because of the difficulty of keeping the patient from solid food.

Recalling the severe attacks of Vertigo induced by the gunshot wounds just detailed, it would be impossible not to observe the analogy existing between the shock propagated in them from a contused brachial nerve to the vertebral artery, with *its* concomitant Vertigo, and the lesser shock caused to the nerves of the stomach by the masses of unchewed meat swallowed by the toothless patient, and attended with the same symptom—viz., giddiness. *Mutatis mutandis*, the cause, the method, and the result are one and the same in each; the experiment is the same, the conditions only are varied.

It is possible that an adverse critic of this hypothesis of "Vertigo e læso stomacho" might object that it is quite unnecessary to call in the aid of the vaso-motor system to explain it, inasmuch as the result might be accomplished through the medium of the vagus fibres themselves, whose nuclei are in anatomical approximation to those of the octavus nerves. Such criticism, however, takes for granted the anatomical continuity of these nuclei, which does not appear as yet to be established, in the sense with which the nuclei of the fifth and of the octavus are associated. For it must be remembered that mere proximity of nuclei is by no means the same thing as intercommunication of their elements, which, as just stated, is not proven.

If we look at the Vertigo witnessed in gunshot wounds of the brachial nerves, such a connection on the part of the latter with the nucleus of the octavus cannot be urged to explain the symptom. In these cases there is no alternative hypothesis to that given in the text capable of explaining the sequence of events witnessed in them. So that we are warranted in concluding that Vertigo of the severest type can be brought about by shock transferred in the ganglion through vaso-motor nerves to the circulation of the labyrinth through the vertebral plexus.

There is one phenomenon, however, common alike to Vertigo following shock to the brachial nerves and of that accompanying shock to the nerves of the stomach and other viscera, which, to the view of the author—and it may be of the unbiased reader also—settles the argument in favour of the vaso-motor hypothesis.

This phenomenon is the *mottling of the hands and fore-arms* already described. It denotes that the original impression, whether originating in one or the other of the above situations, has been transferred in the ganglion to the brachial artery; its effect upon the peripheral circulation of

the artery—viz., the loss of vessel tonus—can be observed in the hyperæmic state of the skin thereby occasioned.

The mottling of the hands then possesses this crucial significance. By actually demonstrating the state of the circulation in one area of the vascular system regulated by the inferior cervical ganglion—viz., that of the brachial artery—it compels the inference that a corresponding condition of dilatation may, and probably does, obtain in other vascular areas similarly correlated by this ganglion, even where these are removed from direct observation. The vertebral artery is anatomically in this category; the dilated peripheral arterioles of which imply, so far as they concern the labyrinth, an increased tension of its contents. The concomitant Vertigo, which is the direct result of superadded intralabyrinthine tension, leaves no room for doubt that the series of events which induces it, when the exciting cause resides in the stomach, is exactly as herein described.

Should the reader be sceptical as to the competency of even slight degrees of increase of tension within the labyrinth to induce the phenomena claimed for it, he may test the correctness of the statements in the context by repeating the experiment originally conducted by the late Professor Weber-Liel. Selecting cases of bygone ear disease, in which the ossicles were exposed through gaps previously formed in the drum membrane—the Professor proceeded to make slight pressure upon the head of the stapes with a blunt probe, thus gently pushing the foot-plate of the stirrup bone with its attached membrane inwards, and thereby adding to the tension of the intralabyrinthine fluid.

During this experiment the patient experiences:—First, a loud and prolonged sound, like dwelling on the word ping-g-g-g. Secondly, he becomes giddy, followed by total loss of power, so that unless supported he would

fall off his seat. Thirdly, vomiting ensues, with a sense of faintness, but no loss of consciousness.

In this experiment, all the symptoms of which disappear when the pressure is withdrawn, we have a recapitulation of most of the phenomena of Vertigo, howsoever or wheresoever originating. To these is added one other—the pinging sound—it refers to the participation in the tension of the cochlea endolymph, and appertains to the domain of “Tinnitus”; just as the giddiness points to implication of that of the tonus labyrinth. Its production in this experiment naturally leads to the remark that these two symptoms, Vertigo and Tinnitus, are frequently associated in the same patient; but this association is by no means always the case, although it may not be easy at first sight to understand how the one symptom could possibly occur without the other being present likewise.

The concluding act in the drama exhibited for our instruction in Weber-Liel's experiment is the *Vomiting*. Though not a symptom peculiar to Vertigo *e læso stomacho*—in fact it occurs less frequently in it than in any other phase of the disease—it will be convenient to complete here the remarks upon it, which were reserved when the symptom was previously alluded to.

The question has been discussed whether, in Stomachic Vertigo, the vomiting precedes the giddiness or follows it. On this point the author's experience of the sequence of events shows the latter order to obtain. That is, vomiting is the last symptom to occur, just as in the experiment under review. This point would scarcely require comment but for the fact that those who claim that sickness is the first symptom in these patients seek to base upon its assumed priority a means of differentiating cases of stomach origin from Vertigo arising in other organs.

The author submits that this suggested aid towards a differential diagnosis is entirely fallacious.

It has already been stated that uncomplicated Stomach Vertigo is extremely rare except in senile subjects, and in them vomiting is almost unknown, although the slightest indiscretion in diet on their part will induce severe Vertigo.

By the term "complications of Stomachic Vertigo," just made use of, is meant that any case of the kind, other than senile patients, will usually be found to have some pre-existing lesion, either in the ear or the nose, each of which contribute either some element of direct pressure upon, or of reflex irritation of, the end-organ of the labyrinth. Neither the one nor the other may suffice to establish an attack of Vertigo—though in many cases either condition may do so—the patient experiencing, however, from time to time very disquieting feelings of threatened giddiness in consequence of the existence of either.

Should he under these circumstances become dyspeptic, or develop an irritable state of innervation of the *primæ viæ*—conditions to which his existing lesions already predispose him—he will then be likely to experience those vessel-dilator waves which, originating in the viscera, are transmitted through the mechanism already mapped out to the arterioles of the labyrinth. Here they add a new and sudden source of pressure to the already sorely irritated labyrinth. This last accession of tension suffices to disperse the function of labyrinth tonus, whose widely reaching and mysterious energy has already been described in the quotations from Ewald's researches.

In consequence of this dispersion of the tonus energy of the labyrinth, first one and then another group of voluntary muscles lose their precision of action, beginning with those most amenable to the tonus influence, and finally involving

those most remote from it. Confusion now follows upon order. Powerlessness on one side is opposed by irregular action on the other. Objects dance before the sufferer's eyes, his head swims, and he himself becomes involved in a rotatory whirl, wherein the relationship to his surroundings is confused or lost. He is compelled to sit or lie down, to avoid a fall.

With the cessation of the dilator wave, the arterioles contract, intralabyrinthine tension is withdrawn, the attack passes off, and the patient is himself again.

When it is considered how largely the vertebral artery is concerned in the blood supply of the brain, and what important centres depend upon it for nutrition, the advantage of the arrangement of its distribution in such wise that the very earliest departure from the normal state shall be thus prominently notified deserves at least a passing reflection. Because in this way the organ of equilibration—that is, the tonus labyrinth—serves a *sentinel-like function* to give warning as to the state of the cerebral circulation as a whole. Over and over again shall we see this benign function coming into operation as our study of the causes of Vertigo progresses.

## CHAPTER IV

### MENIÈRE'S DISEASE.

IN the preceding chapter there were discussed certain forms of hyperæmia of the labyrinth which originate in vaso-motor reflexes. Such changes of vessel calibre by no means of necessity imply exudative or inflammatory states; neither do they altogether exclude the possibility of these. In fact, inflammation of the labyrinth is extremely rare except in syphilis; or, perhaps in the eruptive fevers, including Diphtheria. Concerning these latter there exists but little accurate information.

It is by a natural stage, therefore, that we pass from those altered statical conditions of the circulation of the labyrinth to the consideration of a more permanent type of change in the blood supply of this organ.

These, when of idiopathic origin, are usually grouped under the head of Menière's disease. It is necessary to arrive at clear ideas respecting this term, as its application is subject to widespread abuse consequent upon the confused notions appertaining to it. This term, then, originated in a case described by Menière in 1861. A young woman, after experiencing a chill, was attacked, almost simultaneously, with complete deafness, incessant Vertigo, and vomiting. All the symptoms persisted with unabated severity from the commencement of the attack till her death, which took place in a few days. Post-mortem examination revealed apoplectic extravasations into the semi-circular canals, the brain and spinal cord being

healthy. All the details were carefully observed and scrupulously recorded.

Parenthetically, the author would draw attention to the following points in the above case. The lesion was confined to the semi-circular canals; it was of the same kind, but more intense than the analogous lesions hitherto adduced; the attendant symptoms differed only in their severity and fatal issue from those hitherto ascribed to intralabyrinthine tension arising from milder phases of vessel distension. These features of the case, he submits, may be regarded as confirmatory of the conclusions already arrived at up to this stage of the argument.

Returning to Menière's patient, it must be borne in mind that, as a case, it is unique. The author is unacquainted with any other instance which corresponds in its fatal issue, *and post-mortem confirmation of its nature*, to this case of Menière's. It may be assumed, therefore, that such extreme developments of intralabyrinthine congestion are rarely met with.

Even in chronic cases, in aged atheromatous subjects, where hyperæmia of the labyrinth is persistent, the giddiness, present up to a certain period, is apt to pass off—probably owing to the abnegation of the function of the organ from the changed nature of its vessels, this result being further evidenced by the total loss of hearing—the patient ultimately dying of cerebral apoplexy, long after the cessation of his Vertigo.

Notwithstanding the comparative rarity of Menière's type of the disease, it is common for patients to be so labelled in whom the cause of their labyrinthine disturbance is seated in the middle ear, or in the external auditory canal; or, again, in those whose tonus function is deranged by reflex impressions originating in the nasal branches of the trigeminus—both of which causes of

Vertigo will come under examination in the succeeding pages. The author contends that the term "Menière's disease" as applied to such patients is a misnomer.

Respecting the residuum of Vertigo cases of the simple congestive type, the question arises how to differentiate them from the more numerous instances pertaining to other groups of the same disease?

The diagnosis must proceed mainly by the process of exclusion. The negative signs are the absence of any disease in the ear or nose, or of any other source of irritation implicating the branches of the fifth nerve. The positive indications will be derived from the fact that the patient, previously in good health, has prior to the attack suffered from exposure, or has undergone a severe chill. The congestive character of the attack will be confirmed if, after the Vertigo has passed off, the sufferer remains very deaf, has also tinnitus of a distressing character, headache or pain in the side of the deaf ear, and persistent nausea. The evidence of hyper-pyrexia will probably co-exist, but ordinarily to a slight extent only. Under these circumstances it will be safe to predicate the condition to be one of congestion of the labyrinth, plus inflammatory exudation, or, possibly, of extravasation also.

Profuse perspiration of the upper part of the body, especially of the head and face, has been claimed by some authorities as a pathognomonic sign of Menière's disease. The author cannot fully endorse this view, because, while admitting its occurrence in these cases, it is so frequently present in Vertigo owning a quite different origin, that he is indisposed to attach any diagnostic value having a causative bearing either to the presence or absence of this symptom.

Unless the author has failed clearly to convey his meaning, the reader will already have recognised the fact

that *any phase* of intralabyrinthine tension may be reinforced by dilator-vessel impressions originating in the *primæ viæ*. This remark is equally applicable to the idiopathic congestions of the region now under review.

Indeed, it is by no means clear that what has been described as statical hyperæmia of the labyrinthine circulation, of stomach origin—otherwise Stomachic Vertigo—may not in some instances be sufficiently intense and prolonged to pass into the transudative stage. In which case it might be impossible to say whether the hyperæmia were inflammatory or a simple vaso-motor reflex in its inception.

Such differentiation is, however, of less importance, because the treatment in either case is alike. It is mainly with the view of emphasising a point in the therapeutics of Vertigo that the foregoing remarks have been introduced. This is to the effect that *in all cases* the stomach and adjacent organs must be so managed that they shall be incapable of augmenting existing tension by contributory vaso-motor impressions originating in them. The details of this management will be fully explained in the section on the treatment of Vertigo.

The cases of Vertigo which do not fall into the groups already considered constitute by far the larger number of instances of the disease. They may be classified under two heads, according as they arise in one or other of the two organs to the diseased states of which they may for the most part be referred. These are:—

I.—Vertigo due to Ear Disease.

II.—Vertigo due to Nose Disease.

The morbid conditions present in the above-named organs, besides giving rise to Vertigo, are similarly those which induce Tinnitus and Deafness. The author believes it will satisfy the requirements of the reader, and enable

him at the same time to avoid needless repetition, to discuss these symptoms conjointly under one head. He proposes, therefore, to defer to the chapters on Tinnitus what remains to be said respecting Vertigo.

Before entering upon this arrangement, it will be convenient to consider the treatment of those aspects of the disease to which attention has been up to this point directed.

*Treatment of Vertigo due to Hyperæmia or Congestion  
of the Labyrinth.*

It will be an inference from the foregoing observations that the physician who is confronted with a case of Vertigo should, as a preliminary measure, carefully examine the nose and ears with the view of eliminating any possible source of irritation which may be present in these organs. If any such are discovered, they must be treated on the lines to be subsequently described.

Having satisfied himself on this head, the observer will probably be impressed with the collateral symptoms of the attack—viz., the nausea, vomiting, or headache associated with it. His natural impulse, therefore, will be to conclude that “something is wrong with the liver.” The blue pills and black draughts which follow in logical order from this inference are perhaps not so far wrong as the reasoning which leads to their administration. Because these aperients, by unloading the portal circulation, and therefore that of the intra-cranial sinuses, tend to relieve also the hyperæmia of the labyrinth. Be it observed, however, that this treatment may do harm if it reduce the vital powers of the patient—a certain amount of nerve energy being required to restore the vaso-motor equilibrium, the reflex loss of which, as regards the vessels of

the labyrinth, is the underlying factor in the production of his symptoms.

Doubtless it was in contemplating the possible existence of some, to him, unknown situation of the kind here referred to that induced Trousseau to summarise his views on the treatment of Vertigo, as practised in his day, in the following remark:—"I have frequently asked myself whether the treatment which in these cases I directed against the affection of the stomach was not, unknown to me, directed to the nervous system; and whether I had not diagnosed a gastric affection rather from the effect of treatment than from the symptoms of the disease; whether I had not been led into an error of diagnosis by obtaining success from treatment usually employed with benefit in dyspepsia." \*

In dealing with a mild case of Stomachic Vertigo the primary indication for treatment will be derived from the experience of the toothless patient, as already related. Here Vertigo followed the ingestion of unchewed meat, and ceased as soon as a more appropriate diet was substituted. Hence may be derived the axiom that the senile stomach is unsuited to the digestion of butcher's meat—an axiom which cannot be too strongly enforced. But the object lesson afforded by this patient extends beyond the limits of the aged subjects of this disease; inasmuch as hyper-sensitive states of the digestive apparatus are common at every period of life. They are, indeed, particularly prone to co-exist with chronic disease of the nose and ear, which, as already stated, are capable of inducing dyspeptic disorders.

It becomes necessary, therefore, to emphasise the fact that no case of Vertigo, whether of stomach origin or otherwise,

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\* Lecture on Clinical Medicine. New Sydenham Soc. Vol. 3, p. 544.

has any prospect of successful treatment until the patient has been denied access to solid food ; and that butcher's meat especially, except in the form of fluid extract, must be rigorously excluded from his diet.

In almost every instance an aperient should be given at the onset of an attack, preferably a combination of calomel and quinine. Three to five grains of each drug will suffice, to be followed in a few hours by a saline purge. The addition of the quinine is not empirical, as there exists physiological evidence to show that the accredited effect of calomel, in unloading the venous system generally, is greatly enhanced as regards the venous sinuses of the cranium when it is administered in combination with quinine.

The above dose may be repeated once or twice a week, according as a tendency to recurrence of the attack shows itself. In this latter event the bromides will prove of service. But in mild cases very little treatment will be necessary, provided the restrictions as regards diet already insisted upon be carried out for a considerable period after the attacks have disappeared.

We have now to consider the more pronounced types of the disease, in which the symptoms are severe and persistent. Here, the hyperæmia—which in the previous class resembled somewhat the character of blushing, or such an injection of the vessels as is seen in mottling of the forearms, and was described under that head—assumes rather the nature of congestion, with exudative tendencies—*i.e.*, we have to deal with a true inflammation of the labyrinth.

In addition to the Vertigo proper, the patient will complain also of distressing Tinnitus ; whilst headache, and fever generally, will be prominent symptoms.

The treatment already described will now require to be enforced by the liberal abstraction of blood from the

head. For this purpose six to eighteen leeches should be applied to the mastoid process and to the concha, the external auditory meatus being first occluded with wool to prevent the entrance of blood into the external canal.

The patient must be confined to bed, absolute rest being an essential element in the management of the case. The bromides now are specially demanded; the following combination of these commends itself to the author's experience:—

℞ Ac. hydrobromic, dil. ....	℥ xx.—℥ xxx.
Potas. bromid. ....	gr. x.
Quin. sulph.....	gr. ij.
Aq. chlorof. ad. ....	℥ j. Misce.

4tis h. s.

It may be necessary to repeat the leeching and purging at intervals, in respect of which proceeding the physician will exercise his own judgment.

The adoption of these or equivalent measures has been fully justified by the author's experience of their efficacy. If failure ensue, it will do so not because of the inadequacy of the treatment to combat the condition for which he advises it, but because the case is complicated by one or more lesions in adjacent organs, which, even when objectively prominent, are too often overlooked by the non-specialist practitioner.

To these latter attention will now be invited.

## CHAPTER V.

### TINNITUS.—INTRODUCTORY OBSERVATIONS.

THE further examination of the subject of Vertigo introduces us to an extensive group of cases in which Tinnitus is associated with it, and, in fact, becomes the more prominent symptom of the two, usually persisting after the giddiness has ceased. In a large proportion of the cases of Tinnitus which are daily met with in aural practice, it will be found on careful inquiry that at the commencement especially, and later on at long intervals, the patient experiences varying degrees of giddiness. It is seldom, however, that he associates this symptom with Tinnitus in other than a casual manner, it being usually referred to indigestion or an "attack of bile." Since the noises go on always, to obtain relief of this latter symptom, and not the occasional and rare attacks of Vertigo, is that for which he seeks the aid of the physician. The association of two symptoms so differing in their manifestations will cease to be matter of surprise when it is remembered that the various organs which make up the complicated structure of the labyrinth are practically continuous with each other, that their blood supply and vaso-motor innervation are identical, and, more important still, that the special nerves of the equilibrating and auditory portions are united in intimate anatomical association; when all these circumstances are considered, the marvel is rather that they should ever occur separately and apart than that they should so often be found in conjunction.

Having thus drawn attention to the frequent coincidence of these two symptoms, we will now turn to the consideration of the subject of Tinnitus. It is a large and difficult one, and is not usually dealt with to any exhaustive extent in the text-books.

Before entering, however, upon the discussion of this symptom it will be interesting to glance at some striking exemplifications which it affords of the general influence exerted by disease upon the course of human affairs. In doing so we shall find that some of the details of the historical examples recorded below throw a strong side-light upon certain obscure phases of the disease in question. The study of the evolution of these will assist in rendering more intelligible similar intricate phenomena occasionally manifested by patients in the present day. The first example we take is that of Mahomet, the founder and prophet of Islamism.

It is recorded of Mahomet that in middle life he retired to the solitude of the bare and desolate mountain Hira for the better pursuit of prayer, meditation, and ascetic exercises. His natural temperament was morbidly introspective and excitable. He soon became subject to fits, heard sounds, voices, bells, and saw visions. Sprenger, one of his biographers, concludes that his medical or physical state gives the key to the whole problem of Islam. What was that physical state? It has been set down in turn as epilepsy, catalepsy, and hysteria. It was certainly neither of these. The record of his attacks prohibits such a conclusion, for it is distinctly stated that in them he appeared to swoon, but without loss of inner consciousness. These features fulfil the requirements of an attack of Vertigo; whilst the voices, bells, and other sounds which accompanied the attacks point conclusively to the co-existence of Tinnitus of labyrinthine origin.

The voluntarily selected environments of the prophet during this period of his life are noteworthy. Whether

“Cold mountains and the midnight air”

lend themselves to the development of an ecstatic mood is probably a question of temperament; certainly no more appropriate predisposing causes of catarrhal affections of the ear and nose could have been arranged, and it will be apparent in the sequel that these are competent causes of Vertigo and Tinnitus.

The later developments of these experiences naturally assumed the bent of Mahomet's individualism. His morbidly intensive and introspective self-consciousness soon satisfied him that he had received the true prophetic call. Encouraged by these mysterious voices, the sounds of distant bells—which he declared to be the bells of heaven made audible to him as a mark of Divine favour—the visions of his Vertiginous trance came to include visitations from the angel Gabriel, who, in confirmation of his heavenly call, carried him to Jerusalem, and thence through the six heavens.

Such was the physical condition which played so important a part in inducing the fanaticism that issued in the propaganda of a religion which, commencing in the early years of the seventh century, now dominates a large part of the population of the civilised world.

Joan of Arc affords another historical example of the extraordinary developments which the percipient of noises in the head may, when of introspective and enthusiastic temperament, import into the course of events under circumstances favourable to fanatical excitement. In many respects the conditions leading up to this development were not dissimilar to those which have been noted in the preceding instance. Engaged from her earliest years in

petty agricultural pursuits, Joan of Arc spent much of her time in solitude. Her temperament, like that of Mahomet, was intensely introspective. The condition of her unhappy country had entered her soul. The ravages of the victorious armies of England on her beloved and sunny land of France, and the desolate condition of her young king, absorbed all her thought, and, as is usual with people of her tone of mind, what in others was a vague desire with her became a passionate enthusiasm. While in this state of mental tension she evidently became the subject of Tinnitus, chiefly, it may be inferred from what is recorded, of the chattering, talking type. Then came the reaction of her mental condition which converted these sounds into articulate voices. These soon assumed the form of "commands spoken to her by the saints." Impelled at length by the urgency of these, as she believed, angelic voices, she was enabled to overcome all obstacles, devoting her entire energies to the prosecution of the project whither they all directed her, which, of course, was exactly to that goal which had formed the subject of her solitary meditations—viz., the delivery of her country from the bonds of the invader.

It is unnecessary to follow further the history of these remarkable personages. To many it may suffice to explain their mental state by describing them as semi-lunatics, or as standing on the borderland of insanity. To such an explanation the author is unable to object, though it does but describe the situation in other terms, whilst it brings us face to face with the problem so frequently confronting us in Tinnitus patients of to-day. The sequel will show that the processes operating to produce the symptoms exhibiting themselves in many of the severer forms of the disease are exactly those which can and do induce

mental aberration. The tendency of the present age, however, does not lead these mental sufferers to seek relief in supernatural excitements, but rather to get quit of their sufferings by the alternative of suicide.

As this subject will be dealt with again under the head of hypochondriacal complications of nasal disease, it is unnecessary to continue its examination further than to intimate the presence of a physical basis—a local morbid condition which occasions these terrible symptoms—a condition which is, moreover, curable in most, and which cure, when accomplished, restores the patient to sanity and health.

It will be conceded that among the ills of life, common alike to all classes of society, Tinnitus is one of the most frequent. Not rarely it becomes a veritable thorn in the flesh, pursuing its victim with relentless torture, as well by night as during the day. Some patients tell us their noise resembles the boiling of a kettle; farm labourers who have to do with agricultural implements compare theirs to a "chime going round"; in some it is like the roar of the distant sea, or wind sweeping through trees; varied, it may be, with occasional cracks and mild explosions. Many bear witness to hearing a sort of rhythmical thud, as though their head were the anvil of some unharmonious blacksmith. Yet another group hear voices, seldom articulate, more of a chattering character. In this group are met the bell-like noises which, when experienced by domestic servants, are likened to anything but "the bells of heaven."

Some patients have a difficulty in locating the noise—certain of them referring it to the middle of the head, others to a little distance outside the head; the large majority, however, place it clearly in the ears, one or both.

As if to satirise the infirmity, a large proportion of its subjects are more or less deaf to the sounds of the outside world. A considerable divergence is recognisable in the degree of fortitude with which different patients endure what to the observer appears to be the same degrees and kind of Tinnitus, a fact which is due largely to the temperament of the individual sufferer. Perhaps the most generally annoying is the pulsating variety, though, happily, it is not the form most usually met with. If to the Deafness and Tinnitus Vertigo be added, it will not be matter of surprise to find in the literature of the subject not a few instances of patients who have sought in self-destruction a respite from their persistent torture.

The application of the term *subjective*, to describe those sounds heard only by the patient, is responsible for much of the difficulty which besets the student of this symptom. We shall clear the ground to be traversed in its investigation if we dispose of the *subjective* hypothesis at starting. To do so it will be well to try and ascertain what meaning is attached to the use of the term in this relationship. A lexicographer defines the word "subjective" as denoting "those internal states of thought or feeling of which the mind is the 'conscious subject.'" Whereby it appears that a *subjective* sound is one due to a particular mental condition. By the acceptance of such a definition of Tinnitus we should banish all hope of progress. Further discussion would be barren of practical results, while its acceptance could only divert the mind from intelligent search for causes competent to explain the symptom. Little wonder is it that physicians who accept the *subjective* theory advise their Tinnitus patients to "strive to forget the noise, for treatment is useless to alleviate it." None know so well the cruel futility of the first

clause of the formula as the unfortunate sufferer who is called upon to practise it.

The case, then, as the author conceives it, in favour of the objective nature of Tinnitus stands thus. It may be confidently affirmed of any impression appertaining to the special senses that if it persist, or be of frequent recurrence, it acknowledges an *objective* cause; meaning thereby that it depends on morbid physical conditions, capable for the most part of recognition by suitable methods of observation. The probability is great that these persistent sounds have a reflex origin. Because, if due to local lesion in the sound centre, or in the nerve or its nucleus, or their end-organ, it is most likely that such lesion would disintegrate the textures in which it may be seated, and so put an end to the symptom. The persistency of the sound therefore proclaims its reflex character.

In view, therefore, of any such persistent sensation, our duty is to endeavour to delineate the exact mechanism by which it may be caused. This rigid mapping out of the factors of a symptom will usually be equivalent to the transference of it from the category of subjective to that of objective phenomena, and is the essence of every true advance in the science of medicine.

It would be easy to multiply examples in proof of this position. The following instance will suffice to illustrate it:—A gentleman, otherwise mentally sound, became possessed of the impression that he was followed by a black dog. He could not reason himself out of this conviction, because whenever he looked round the creature was palpably visible to his sight. The persistency with which he complained of his, to others invisible, companion excited alarm among his friends on the score of his sanity. At length the ophthalmoscope coming into vogue, resolved the apparition, by showing it to depend upon a substance

floating in the transparent media of the eye, and which assumed, when in the field of vision, the shape and appearance of a black dog.

Any subject which comprises a multiplicity of facts the phenomena of which overlap each other can only be treated scientifically by breaking up the mass of occurrences and distributing them in allied groups—in other words, by classifying them. So it is with the complicated phenomena of Tinnitus. It is only by having recourse to some method of classification that we can hope to understand it.

In the accompanying scheme of classification designed for this purpose, each kind of noise is referred to a definite pathological state of some part of the auditory apparatus, so far as the author has been able to decide the point. It follows that this morbid condition, if correctly assigned, is the true *objective* cause of the sound in question. Its determination should be the guide to the correct line of treatment.

## CHAPTER VI.

### TINNITUS AURIUM.

#### CLASSIFICATION OF TINNITUS AURIUM.

CLASS I. ... ..	SOUND HEARD BOTH BY PATIENT AND OBSERVER.	
	<i>Morbid Cause of Sound.</i>	<i>Character of Sound.</i>
	The voluntary or involuntary action of muscles in closing and opening the Eustachian tube already affected by catarrh.	Resembles a subdued click.
CLASS II. ... ..	SOUNDS HEARD ONLY BY PATIENT.	
	<i>Morbid Cause of Sounds.</i>	<i>Character of Sounds.</i>
Labyrinth— Intrinsic cir- culation of.	(a) Minus arterial tension = hyperæmia. (b) Plus arterial tension = anæmia. (c) Venous congestion, extending to intra-cranial sinuses.	Pulsating.  Do., fainter.  Chattering, chirping, or like bells; also rushing sounds referred to various parts of head, or to a distance from the head.
Labyrinth— Perceptive innervation of.	(a) Impressions conveyed reflexly to octavus from irritation of sen- sory nerves, chiefly the branches of trigeminus, or 5th nerve, <i>e.g.</i> , progressive deafness. (b) Exostosis of internal auditory canal causing direct nerve pressure.	Tidal— <i>i.e.</i> , faintly rhythmical; most intense and unbearable when the source of irritation is in the nose.  Musical. N.B.—One case only.
Middle ear or tympanic cavity.	Presence of fluid in ... .. Congestion of, extending to Eusta- chian tube ... .. Suppurative catarrh ... .. Atrophic catarrh. See Labyrinth(a)	Bubbling or gurgling. Rare.  Tidal. Do. Do.
External ear.	(a) Cerumen ... .. (b) Foreign bodies ... .. (c) Eczema ... .. (d) Furuncle ... ..	Tidal. Do. Do. Do.

## CLASS I.

## SOUND HEARD BOTH BY PATIENT AND OBSERVER.

THE paper read by the author at the International Congress of Medical Sciences, held at Copenhagen, 1884,\* contains all that need be said on the subject. The cases then quoted are the following:—

Case I. (reported by Dr. Holmes, Chicago, *American Journal of Otology*, March, 1879).—A young lady, æt. 17, was the subject of involuntary spasm of the pharyngeal muscles since childhood. There were about twenty in one minute; each was accompanied with a clicking sound heard 18 inches from patient's left ear, but less distinctly on right side. Rhinoscopy showed separation of lips of Eust. tubes with spasm. Throat normal, but Eust. orifices were bathed in secretion. With each spasm there was slight motion of left memb. tympani, for which reason the reporter refers the sound to contraction of tensor tymp. muscle. There seems no valid reason, however, to receive a different explanation for this case to that which applies to the others.

Case II.—Dr. Burnett, Washington, reports, *Archives of Otology*, December, 1879, the case of a gentleman, æt. 44, who possessed since childhood the power of producing a sound referred to the ears. It resembled a moist râle, and was heard at 50 centimetres from right ear, rather less from left. It was accompanied with a contraction of the throat, but no movement of memb. tympani. With each sound the posterior lip of tube moves obliquely forwards and upwards across mouth of tube. Burnett refers sound to separation of moist lips of tube after being approx-

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\* See Transactions of the above Society.

imated by the contraction of levator palati, and excludes any influence of tensor palati.

Case III.—Dr. Todd, in *American Journal of Otology*, reports [a Mr. H——, æt. 28, who had experienced a noise in right ear for several years, audible half-foot off resembling a sub-crepitant râle. It is accompanied with strained action of sterno-mastoid muscle, and at the time of making the noise the soft palate is seen to move “as if in response to contractions of tens. palati.” He has dry catarrh of pharynx. Rt. m. t. fixed, except its ant. sup. segment; there is a sense of pressure in right ear. Paracentesis of rt. memb. tympani was performed without benefit. Reporter explains phenomenon by patient attempting to relieve sense of oppression by forcible inflations of rt. tube; the separation of the tubal walls give rise to crackling sounds.

Case IV.—Miss A——, æt. 36, applied to the author in 1883 for deafness and tidal Tinnitus of the left ear. At the same time she stated she could produce a sound in her *right ear* at will. This was heard repeatedly through the otoscopic tube; it resembled a subdued click, and was produced by a half-swallowing movement in which the trachea is raised as in commencing deglutition. There was no movement of the memb. tymp. during the production of this sound. Its causation was the same as in all the other cases—viz., the separation of the moist lips of the tube after being approximated by the contraction of the levator palati, in the partial act of swallowing referred to.

During the interval which has elapsed since the above record was published parallel cases have occurred and been reported by the observers. There is little of real interest in this group of noises heard by others beside the subjects of them. The sticky surfaces of the ostium tubæ adhere when in apposition, and, when separated by muscular effort,

the parting of these surfaces produces the sound in question. Besides drawing attention to the catarrhal state of the tube on which its stickiness depends, the sound itself is obviously immaterial.

## CLASS II.

### SOUNDS HEARD ONLY BY THE PATIENT.

In this relationship the first point to be noted is that the *perceptive* portion of the auditory apparatus, seated in the *pars petrosa* of the temporal bone, known as the Labyrinth or Internal Ear (including the vestibule, semi-circular canals, and cochlea) receives its *arterial blood supply* from the vertebral artery—being a terminal branch of the basilar artery—a totally distinct source from that which supplies the more external (middle and external ear), or conductive sections of the ear apparatus. Two points suggest themselves in connection with this fact: First, the very distant source from which this artery is derived—viz., the subclavian at the root of the neck; second, that the *nervi vasorum*, by which its calibre is regulated, come from the inferior cervical ganglion of the sympathetic chain, similarly situated in the neck. The arrangement indicated brings this vascular tract into certain special relationships, some of which have already been considered in connection with the phenomena of Labyrinthine Vertigo; it is a point of value also in respect to the forms of Tinnitus which are due to changes in the intrinsic circulation of the labyrinth. The *veins* which discharge the blood from the labyrinth pass into the superior petrosal sinus, and remembering that this small canal is directly connected with the two receptacles of venous blood in the cranium—viz., the cavernous sinus in front, and the lateral sinus behind—it is easy to see how any obstruction to the venous circulation generally will

proportionately retard the outlet of venous blood from the internal ear.

(a) *Minus arterial tension.*—*Congestion or passive dilatation of the arterioles, resulting in Pulsating Tinnitus.*

This condition implies a diminution of vaso-motor inhibition, in which the vessel walls are dilated, and contain an excess of blood above the normal average. Consequently these dilated vessels occupy more space than in their normal relation they would do. In considering the subject of Vertigo, many circumstances conducive to this dilatation of arterioles have been pointed out, and, further, that under these conditions of altered tension the vessels may become enormously distended with blood. Remembering the extremely sensitive character of the perceptive portion of the auditory apparatus, amongst the terminal nerve expansions of which these dilated vessels ramify, it is easy to understand that under these circumstances their beats become audible to the patient, and that they are synchronous with those of the heart. For in the state of equilibrium that normally exists between the tonus of the vessels and the tension of the intralabyrinthine fluid, the vibration of the blood vessels is not heard. But when either of these conditions is changed the arterial throb becomes appreciable by the patient.

(b) *Plus tension of the arteries.*

This means diminished calibre of these tubes, and is equivalent to anæmia of the area implicated. It may arise from increased vaso-motor inhibition and from the influence of constrictor elements, wherever such can be shown to exist. Such a change taking place in the labyrinth, by disturbing the physical balance between the

intralabyrinthine fluid and the blood vessels, would express itself in Tinnitus of a feebly pulsating character. It is similar in kind to that induced by quinine and the salicylates, and analogy shows that it may be established reflexly over a given area. This form of Tinnitus is probably rare. It would be difficult to distinguish from the preceding variety, and even if correctly diagnosed its differential treatment would be hard to define. It is quite distinct from the Tinnitus of general constitutional anæmia, which implies quite another state of things.

Obviously, these two forms of Pulsating Tinnitus may occur in an otherwise healthy ear from causes connected with the vaso-motor system of nerves, as was abundantly illustrated under the head of Vertigo. Practically, we may confine our attention to those causes which result in vessel dilatation. When associated with deafness, as it often is, these pulsating noises may remain after treatment has removed any other abnormal condition.

The *Treatment of Pulsating Tinnitus*, when occurring as a symptom apart from any objective ear disease—*i.e.*, when it exists as a purely reflex vaso-motor state, consists in the administration of hydrobromic acid in xv. ℥ to ʒ i. doses, largely diluted with water. Under the conditions stated above this drug has an almost specific effect. When, however, this symptom occurs as a complication of ear disease, the latter must be first got rid of by treatment adapted to the nature of the case, which may be exceedingly variable, before the drug is administered. The first instance in which, in an experimental way, the author gave hydrobromic acid for the relief of pulsating noises will serve to illustrate his meaning. The patient, an adult male, under treatment for neglected otorrhœa, presented the common conditions of profuse discharge, perforation of the drumhead, and numerous excres-

cences of granulation tissue projecting into the external canal. After the removal of these objective conditions, the patient still complained of throbbing noises with giddiness and headache, increased by stooping or exercise. Hydrobromic acid in xv. ℥ doses, was prescribed every four hours. Relief to these latter symptoms was immediate, and they shortly disappeared altogether.

It is a curious commentary on these facts, which were published at least fifteen years ago, that quite a furore set in for treating *all* forms of Tinnitus with hydrobromic acid. The author may safely say that in few cases was any heed paid to the conditions laid down to aid the differentiation of those cases of Tinnitus in which hydrobromic acid may be regarded as a specific remedy—cases that are comparatively rare—and those numberless other cases of Tinnitus in which this drug is not of the slightest use because it has no relationship to the causes on which the Tinnitus depends, those that have other than a vaso-motor origin.

Nothing, indeed, could illustrate better the chaotic state of mind prevailing at that time on the subject of Tinnitus in general than the promiscuous administration of this drug, which followed the publication of the foregoing line of treatment. As with drowning men, this therapeutical straw was caught at, and when the expected salvation was not realised, there followed, naturally, abuse of the remedy. When given to patients whose Tinnitus fulfils the above indications, hydrobromic acid will prove of great utility. That it does so in Labyrinthine Vertigo of a hyperæmic type is generally acknowledged and acted upon. Pulsating Tinnitus is also a hyperæmia of the labyrinth. Analogy, therefore, supports the theory of its use, while others besides the author have proved its efficiency.

(c) *Venous congestion of the labyrinth and adjacent intracranial sinuses.*

These constitute the cause of the next group of noises; they are characterised by *chattering, chirping, or musical sounds*, often compared to the *ringing of bells*, intermixed with rushing noises referred to various regions of the head, and not infrequently appearing to proceed from a distance outside the head. These may be present with and complicate the simple arterial pulsation already described. It is important to note that a loaded portal system, the recumbent posture, excessive eating, drinking, and smoking, are all capable of increasing the intensity of the above forms of Tinnitus.

That these noises have for their cause an overloaded state of the venous sinuses of the brain, or of the veins connected with them, is evidenced by the fact of the most persistent buzzing and rushing sounds having occurred in patients in whom some peculiarity of the veins existed elsewhere than in the neighbourhood of the ear. In one such case the Tinnitus was coincident with a large varicocele. In another the superficial veins of the nose were congested and tortuous, suggesting a corresponding but unrecognisable state of the veins of the auditory apparatus.

Apart from these exceptional examples, venous congestion does no doubt play an important part in many forms of Tinnitus, often inducing it when the ear itself is free from any particular lesion. The following is a case in point. A patient states that after any departure from his usual moderate habits, such as "dining out," &c., he would be awakened in the night by what appeared to him to be subdued conversation carried on under his bedroom window. Impelled by this impression, he at first got up and opened his window to ascertain the cause of this supposed talking, which always ceased

when he assumed the upright posture. Directly he lay down again with his head resting on the pillow the muttering recommenced. In this way he learned to recognise that he was himself the producer as well as the hearer of the sounds described.

Amongst numerous cases acknowledging a like causation the author has met with two in which the noises assumed the character of a bird singing in the bedroom of the patients, sufficiently loud to awaken them from sleep, and which ceased or was greatly moderated when they sat up in order to detect the source of the annoyance. In both the symptom was traceable to tobacco-smoking, and disappeared with the moderation of the habit.

Three elements appear to be concerned in the production of these noises: first, *withdrawal of vessel inhibition*, such as in some persons of mobile vaso-motor constitution would follow an unusual indulgence in alcohol and tobacco, which condition implies a retardation of the venous circulation over the area implicated; second, the *influence of posture*, adding a mechanical incentive to engorgement, which becomes especially operative after the first factor has been established; third, the *effect of pressure*, when the foregoing conditions are in operation, in obstructing the venous current and throwing it back on the penultimate channels.

The effect of *posture* in inducing vessel engorgement is well illustrated in its effect upon the erectile tissue of the nose, especially that of the inferior turbinated bones. Thus it is a common complaint with patients to say they cannot go to sleep because the nostril of the side on which they are lying becomes obstructed; if they turn round, the other side becomes similarly blocked, so that they are compelled to sit upright to get relief. In this way the sleep of these patients is very much disturbed. No doubt this state of things is aggravated by excessive smoking, but is frequently

met with in non-smokers, and is due to local irritation, such as the presence of an ethmoiditis, whereby the tonus of the adjacent vessel areas is greatly weakened.

The influence of *pressure* is evidenced by the fact that the noises in question are increased, in such cases as have just been quoted, by resting the head on the pillow, the body being recumbent. If the patient lay on his back, the occipital emissary vein connecting the *torcular hierophili* with the occipital veins of the scalp would be occluded, and thus one outlet of the mechanically distended sinus would be closed. If he lay with the side of the head downwards, similar pressure would be exerted upon the emissary vein passing through the parietal bone, and relieving the longitudinal sinus through the superficial veins of the head. It must be admitted that these emissary veins are exceedingly minute, though probably they are not smaller than the effluent veins, which discharge the blood from the internal ear into the petrosal sinuses. The occlusion by pressure of the former will retain a certain amount of blood in the larger sinuses which is probably fully commensurate with that leaving the ear, the escape of which being retarded in consequence must induce a corresponding amount of venous engorgement of the labyrinth.

Whether pressure be really a factor in the production of sounds heard under the circumstances above portrayed, is not of so much moment as is the establishment of a direct relationship between certain forms of Tinnitus and an engorged state of the venous circulation, especially that of the intra-cranial sinuses. To it, and the consequent venous congestion of the labyrinth, whether aided by tobacco-smoking or not, may be referred those noises which patients seem to hear at a distance, particularly if they assume a muttering or chirping character; as well as those which

are referred to some part of the head other than the ear. If associated with headache, drowsiness, or other indications of intra-cranial congestion, the diagnosis would be confirmed.

*Treatment.*—It was probably in cases of this kind recorded by the older writers that bleeding effected a cure. Thus we read of a patient with persistent noises in the head, which defied every kind of treatment known at the period, who was permanently relieved by a copious bleeding from the temporal artery. There are, however, so many contributory causes of Tinnitus, nasal and otherwise, which will be examined in due course, that their elimination as possible factors of the symptom must be secured before having recourse to the lancet. It is quite probable that this weapon, so active in the hands of our fathers, is now too seldom employed for the purpose of combating persistent noises in the head. Previous to its use, however, purgatives on the almost equally ancient blue-pill-and-black-draught principle should be administered, with such other cognate remedies as the practitioner's experience may suggest. Failing these, relief by bleeding may be justifiably sought; the author's experience would, even then, lead him to apply leeches to the concha and mastoid in preference to the more heroic measures just alluded to.

It is interesting to note that the influence of some drugs is very marked on the circulation of the labyrinth, imitating and in some cases exaggerating the symptoms already reviewed. One of the most instructive of these is Tobacco, because by means of it we can trace how one vaso-motor reflex after another is implicated as the dose is increased, and its physiological effects augmented. Apart from every other consideration it is a noteworthy fact that tobacco-smoking is of itself a source of Tinnitus, which it is capable

of establishing when no other lesion, except that caused by the herb itself, exists to account for it.

The first effect of a *strong dose of tobacco smoke* is *salivation*, which arises thus: the specific effect of the drug is conveyed by the afferent nerves from the mouth to their vaso-motor centre, and is thus reflected to the vessels supplying the buccal mucous membrane in the form of waves of vessel dilatation. This means more blood and more secretion. As the vaso-motor nerves implicated in the act are derived from the upper cervical ganglion, the effect is gradually extended to other vessels supplied with nerves from this sub-centre until an area is involved which is almost co-extensive with that receiving its blood from the branches of the two carotids. The successive implication of these new tracts is indicated by throbbing in the temples, fulness and feeling of tightness in the head, as though a band were stretched round it. Succeeding these premonitory symptoms there will ensue lachrymation, redness and irritation of the conjunctivæ, flow of mucus from the nose, indistinctness of vision, giddiness or ringing noises in the ears. Each accession of a fresh symptom indicates the extension of the dilating influence of the drug over the vessels of a new area, mediated by the sympathetic ganglia.

If now the smoker lay down his pipe and hold some iced water in his mouth, or, better still, will chew a fragment of camphor, these symptoms will gradually pass off the latter drug being the physiological antagonist of tobacco. But if, intent on pursuing the experiment to the bitter end, the smoker continue his pipe, there will occur palpitation and uneasiness in the cardiac region, indicating the descensive implication of other ganglia, notably those from which the cardiac nerves arise. In this connection it is instructive to note that in some animals nicotine “possesses the power of paralysing the terminations of the

inhibitory fibres contained in the trunk of the vagus without affecting the intrinsic inhibitory ganglia of the heart" ("Handbook for the Physiological Laboratory," page 280). Then follow aching of the arms, eructation, nausea, and vomiting, until eventually the lower bowel participates in the influence of the drug and its contents are voided; the patient now passes into a state of collapse and is unable to stand. The latter condition denotes the implication of the ganglia supplying the splanchnic nerves, and recalls the phenomena attending their division, a feeble imitation of which is afforded in the earlier stages of Cholera.

Now, while the foregoing is the course of the symptoms in a typical case of tobacco poisoning, there can be no doubt that habitual smokers who affirm they experience none of these effects do, however, manifest some evidence of the physiological action of the drug in the induction of what may be termed a very mobile state of the vaso-motor centres primarily affected by it, rendering them peculiarly susceptible to any superadded disturbing influence. In this way may be explained the peculiar liability to post-nasal catarrh and noises in the ear to which smokers are liable, as well as the difficulty of getting rid of these troublesome ailments as long as the habit of smoking is continued. It is probable that this peculiar *mobility of the vaso-motor centres* is transmitted by great smokers to their offspring, giving rise to a tendency to ear disease, croup, and to extreme liability to nasal catarrh seen in the children of some families. The author entertains very little doubt that there exists a tobacco cophosis just as there is a tobacco amaurosis. Where excess in alcohol obtains as well as in tobacco, all these proclivities will be intensified; the effects on the succeeding race will then be especially manifest. The experience of every medical man in extensive family practice will justify these observations.

## CHAPTER VII.

### TINNITUS AND VERTIGO AS COMPLICATIONS OF PROGRESSIVE DEAFNESS.

#### CLASS II.

UP to this point, the study of the symptoms of Vertigo has been confined to those phases of it which acknowledge a *reflex vaso-motor* origin, and in which the original source of irritation exists at a more or less remote site from the organ of equilibration, whose response to which irritation expresses itself in the phenomena of Vertigo. This in the main has been shown to arise from a passive influx of blood, with consequent added tension, or pressure upon, the nerve apparatus of the labyrinth.

We have now to enlarge our knowledge of the disease by extending it to those forms of it which are due to reflex disturbance of the vestibular nerve, by the implication in morbid processes of certain sensory nerves, which are in anatomical association with it through their respective nuclei. We have, in short, to deal with that vast number of cases in which Vertigo occurs as a *sensory motor reflex*, the sources of irritation being those located in the nasal organs. Disease in this region involves the sensory branches of the trigeminus, and it will be clear in the sequel how this area of irritation works out as a cause of reflex excitation of the vestibular nerve, and in this way is a competent cause of Vertigo. As might be expected, Tinnitus is the constant, and even the more persistent product of this reflex, from concurrent implication of the cochlear branch of the octavus, and thus both symptoms

Vertigo and Tinnitus, require to be considered in connection with the aural reflexes proceeding from disease of the nose, which is synchronous with that in the ear, and which, taken together, constitute the factors of progressive deafness. If this position be a correct one, we must admit the existence of a form of deafness in which the associated giddiness and noises occur largely as nasal neuroses.

There are, it is true, numerous vaso-motor complications, in the present phase of ear disease also; they are due to fasciculi from Mackel's ganglion and other sources becoming involved in the same nasal lesions. These give rise to trophic changes in adjacent organs, which will be noted as the pursuit of this inquiry brings them across our path. But it will become apparent that it is to irritation of the trigeminal branches found in the nose, and the reflex responses which this excites, that we must look to explain the Tinnitus and Vertigo so frequently associated with disease of this locality. It remains to establish this position.

What was an almost hopeless task when the author, some fifteen years ago, commenced a course of observations with the object of making clear the connection between diseases of the nasal organ and the symptoms now under review is to-day a matter of complete demonstration. The clinical and pathological investigations which he then undertook have not been without result, inasmuch as they proved the existence of a disease, Necrosing Ethmoiditis, which dominates in importance all other affections of the nose; besides revealing the pathogeny of nasal polypus, explaining its recurrences, and thereby affording indications for the radical treatment of this hitherto intractable complaint.

Meanwhile, the advances made in the general field of anatomical and physiological research have supplied the facts the absence of which, up to a recent date, compelled

the exact solution of the problem to remain in abeyance. It is to Landois and Stirling on the one hand, and to Ewald on the other, that we are indebted for the data by which the position it is sought to establish can be made clearly demonstrable.

The former of these authorities, by establishing the communication of the nucleus of the trigeminus in the medulla oblongata with the motor nuclei of all the nerves located in that region, except the sixth, and, therefore, with the nuclei of the octavus (acusticus), show how impressions affecting the sensory branches of the fifth nerve can be transmitted to the nerves of the labyrinth, and thus give rise to disturbances in the functions of that complex organ, exciting Vertigo in respect of the branch of the octavus supplying the semicircular canals with the utricle and saccule, and Tinnitus when the cochlear division of the octavus nerve is involved in the reflex.

The researches of the latter (Ewald) as shown in the excerpts from his writings, afford exact information of the behaviour of the end-organs of equilibration when subjected to disturbing influences. These have been already exemplified as regards the remarkable motor phenomena effected through the influence of the vestibular section of the octavus upon nearly all the muscles of the body, and will be still further exemplified in connection with its reflex disturbance in nasal disease.

Clinically, these reflexes have been shown to be legion. So long as the anatomical basis of this association was not clearly established, the symptoms referred to this cause, as matters of observation on the part of rhinologists, were derided by many members of the profession, and were regarded with suspicion by others. Now that the unbiased researches of these scientists have vindicated the position claimed for nasal practice as covering a multitude of

physical ills, we shall in the future probably hear less of the innuendos cast upon this branch of specialised medicine by its would-be censors than has been the case in the past.

During the studies above referred to careful records were made of the coincidence of Ear Disease with Ethmoiditis. These observations were recorded in respect of the patients attending the author's ear department at the London Hospital, at the London Throat Hospital, and his private work. Needless to say that the correspondence in results derived from these several sources was practically uniform, and extended over many hundred instances. For the purpose of this work, however, only cases attending the London Hospital have been selected—the records covering the four years 1887-8-9 and 1890.

Before examining the results of this analysis it is necessary to state that a certain amount of selection has been exercised in the cases used for this comparison; the object being to arrive at the etiology more especially of chronic deafness of the progressive type, in which, although there is usually an absence of gross objective lesions of the auditory apparatus, Tinnitus and Vertigo are more or less persistent symptoms, and respecting which form of deafness comparatively little has been advanced in exposition of the causation or treatment. Obviously, therefore, all ears exhibiting gross local mischief, such as chronic suppurative catarrhs of the middle ear; polypus of the ear, as well as deafness due to post-nasal growths, have been excluded; also those whose origin and seat were found to be confined to the external auditory canal.

All these, as having no special bearing on the elucidation of chronic forms of the disease of the progressive type, have been excluded from this analysis.

Exclusive, then, of the cases above enumerated, there

were, in the four years above stated, a total of 921 patients who presented the conditions for this inquiry.

Small fractions are excluded from the calculation.

Of these 921 cases of deafness—

1 in  $3\frac{1}{3}$  exhibited also the presence of Ethmoiditis—viz., 274 in number. Of these patients showing both deafness and Ethmoiditis—

1 in 4 had Tinnitus only.

1 in 25 had Vertigo only.

1 in 14 had both Vertigo and Tinnitus.

In round numbers, out of 274 patients exhibiting Ethmoiditis associated with deafness, 101 were complicated with Tinnitus or Vertigo, or both of these together, or 1 in  $2\frac{3}{4}$ .

Of the remaining majority of patients whose chronic deafness was not associated with Ethmoiditis, 647 in number—

1 in 9 had Tinnitus only, against 1 in 4 of the preceding table.

1 in 64 had Vertigo only, against 1 in 25 of the preceding table.

1 in 32 had both Tinnitus and Vertigo, against 1 in 14 of the preceding table.

In round numbers, out of 647 patients exhibiting chronic deafness without Ethmoiditis, 102 were complicated with Tinnitus or Vertigo, or both of these symptoms together, or 1 in  $6\frac{1}{3}$ .

From these early observations it appeared that about 1 in  $3\frac{1}{3}$  cases of chronic deafness of the non-suppurative type were associated with Ethmoiditis, while the proportion of those not so associated was 1 in  $6\frac{1}{3}$ .

Impressed with the striking results indicated by these statistics, the author has since continued his observations of this association of nasal and ear disease with even greater care than at first, with the result that during the

five years that have elapsed since the above-recorded observations were made he has found distinct evidence of ethmoidal disease in at least one out of two of all the examples of the disease which fulfilled the conditions laid down above—that is to say, in those patients who having no gross objective lesion in the ears complain of deafness with giddiness, or Tinnitus, or of any combination of those symptoms. The author does not exceed the limits of his experience in affirming that 99 per cent. of these patients—those, viz., showing both nasal and ear disease—revealed the presence of necrosis in the ethmoidal region of the nose.

It is desirable here to anticipate some facts dealt with in detail in the pathological portion of the subject, which indicate that when the *nasal* organs of these patients are examined under the most favourable conditions of illumination, &c., there are a number of them who exhibit no *objective* abnormality of the organ. In some, on the other hand, aggravated phases of middle turbinated disease are quite obvious. The latter conditions may exist, and yet there may be no ear symptom whatever. Where, then, is the seat of the mischief in the former class of cases that show no visible indications of its presence? The answer to this question is that it is placed far backwards and upwards, on the outer wall of the nose, in the posterior ethmoid cells, or their nasal walls; or, perhaps, in the sphenoid bone. Again, it is possible for the necrosis to exist in this locality and yet no ear symptoms be present, though there will be cognate neuroses which call attention to the locality and lead to its examination.

It will be seen from the foregoing statement that the surgeon must be prepared to meet with very puzzling variations in the symptoms, and in the conditions of the disease which gives rise to them. It is only by the patient

comparison of many cases that light slowly dawns upon the observer.

Bearing in mind the information contained in the foregoing observations, statistical and otherwise, we shall be the better prepared to discuss in detail the phenomena of the disease to which they refer, viz. :—

#### PROGRESSIVE DEAFNESS.

For the sake of greater clearness it is necessary to point out that under this heading the author includes those phases of Ear Disease variously described as "Hypertrophic Catarrh," "Non-suppurative Catarrh," and "Atrophic Catarrh" of the middle ear—all of which are more or less characterised by Deafness, Tinnitus, and Vertigo. The most marked feature, however, which they all alike exhibit, is that the Deafness, and usually the Tinnitus, are surely if slowly *progressive* in their severity, while the Vertigo tends to disappear, and is usually absent altogether in the later stages of the disease.

As all the above-named groups appear to the author to own the same causal relationship, to have, in fact, a similar pathological kinship—viz., fibrosis—it seems to him preferable on the score of simplicity, as well as of avoiding scientific confusion, to connote these by a term which conveys their most marked characteristic. He proposes, therefore, to consider them under the above heading, *Progressive Deafness*, a term introduced by the late Professor Weber-Liel, as already stated. The symptomatology of the disease as first definitely formulated by him,\* especially in the later stages, was complete.

It is true that more recent developments of the nerve relations and functions of the auditory apparatus compel

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\* *Schwerhörigkeit-Progressive.*

the adoption of a different or modified explanation of some of the phenomena to that which he gave to them at this now distant date. At the same time, it cannot be doubted that in Weber-Liel's enforced withdrawal from otological work, and in his premature removal by death, the science of otology suffered a loss, which those of his co-workers who are most familiar with his research will most deeply deplore.

*Etiology of Progressive Deafness.*—Although this form of deafness is, *par excellence*, that which most commonly occurs in adult life, it is not confined to grown-up persons, being by no means rare in children. It will be observed that the comprehensive grouping of cases included under the present heading embraces the acute or hyperplastic stages of the disease, which, considered as hypertrophies, or thickenings of the tympanum, are usually placed in a group distinct from those in which atrophic changes are more marked. This severance the author regards as disadvantageous from every point of view. Atrophy is the usual pathological sequence of hypertrophy, and it is difficult to see what end is gained by classifying these two stages of one and the same disease separately, and thus suggesting a distinct biogeny for each.

It is the author's contention that the disease, as a whole, is the local expression of a constitutional diathesis; *fibrosis* in fact, which, in common with other diathetic tendencies, is an inherited proclivity, and as such may, and often does, manifest itself in quite early life.

This being so, it might pertinently be asked, Why not describe the disease as *Fibrosis of the Middle Ear*, which would not only include all the stages of it, but would, *ex hypothesi*, be a strictly scientific description? Certainly the author could have nothing to object to such a term; but, on general grounds, there are objections to introducing

a new nomenclature for already well-known lesions, and that selected is not only familiar to most students of the subject, but indicates a feature so marked as at once to distinguish the affection to which it is applied.

The evolution in the form of ear trouble of the inherited tendency may, in some instances, be traced to an illness, or shock, or some other recognised starting-point; but much oftener the patient has no such historical data to which to trace his infirmity. This, however, does not preclude the existence, in probably all these cases, of a stage which, pathologically at any rate, was acute. This is the period of hyperplasia, seen in fibrosis of other localities, and, however brief and unnoticed by the patient, must, in all probability, have preceded the chronic stages in which atrophic changes predominate. It will be apparent in the sequel that evidence of such hyperplasias are present in most examples of the disease, however advanced they may be.

*Symptoms.*—The concluding remarks of the previous chapter will have prepared the reader for the statement that the symptoms in this form of deafness are largely of a reflex nature. Patients who are the subjects of it will say they have been slightly deaf for a long time, and are for the most part unable accurately to fix its commencement. In many it has only become a noticeable annoyance since a more or less recent cold in the head. In those cases in which Tinnitus preceded the deafness—and their number is considerable—the deafness is commonly attributed to the noise. Usually it is only after many months, and often even years, of endurance that the patient seeks advice. He has, in fact, become aware that not only does he not get better, but that all his symptoms are gradually, very gradually it may be, becoming worse with the lapse of time.

Careful questioning seldom fails to elicit the fact that

Vertigo is occasionally present, as well as Tinnitus—the former at rare intervals. The patient has not associated it with his deafness, but, following the old professional faith, has referred his giddiness to a temporary attack of “bile.” *Headache* is frequently complained of, and is relegated to the same cause. A good number of these patients suffer from trigeminal neuralgia, palpitation, or tachycardia as it is now called, and other neuroses, due rather to concomitant nasal disease than directly to the ear mischief. Frequently, however, the subjects of progressive deafness pronounce themselves in perfect health save for the noises and deafness.

Now, it will not be disputed that these cases have always presented grave difficulties to otologists, because when the ear is examined the morbid objective states are for the most part insignificant. The most frequent of these are some degree of retraction and foreshortening of the manubrium mallei, with rather more prominence of the short process than in the perfect ear; a corresponding flatness of the entire membrane, or a depression of one or other of its segments, usually the anterior. The triangular area of light, sometimes called the “bright spot,” is impaired in its outline, or is broken up so as not to present a complete pyramid with its base at the circumference of the membrane and its apex near the umbo. The more important of these appearances of the drumhead and ossicles—viz., retraction and prominence of the processus-brevis mallei—were early investigated by Professors Gruber and Weber-Liel. The former first pointed out that the tendon of the tensor tympani muscle is inserted into the anterior surface of the handle of the malleus. This fact has an important bearing on the position which the manubrium will assume when subjected to the strain of the muscle which acts upon it. Under these circumstances the bone will undergo a kind of

semi-rotation on its transverse axis, the effect of which is that, while the distal end of the manubrium is directed inwards, the upper end of the malleus bulges against the membrane, throwing the two *plicæ semilunares* into marked prominence, at the same time the processus brevis is brought into view. While, therefore, the upper part of the manubrium stands out boldly in relief, its distal end retreats towards the inner surface of the tympanic cavity, so that, when seen from the external meatus, the process is foreshortened. Usually the anterior segment of the membrane is retracted as well, appearing to fall away from the plane of the rest of the membrane in the direction of the cavity of the tympanum.

It is quite usual for a retracted membrane to acquire some point of adhesion, either on its own part or through the medium of the ossicles, more usually the latter. The membrane thus becomes fixed in its depressed position, a condition which is indicated by the immobility of the ossicles when air is insufflated. This is a matter of primary importance in these cases, and we shall return to it in considering the question of treatment. The membrane often looks thinner and more translucent than normal, so that the long process of the incus can be seen; and if with this the outline of the ossicles is attenuated, it is customary to speak of the case as one of *atrophic catarrh of the middle ear*.

The deceptiveness of the appearances above described for diagnostic purposes is evidenced by the fact, well known to all who are accustomed to examine the ear, that they may be, and often are, more or less present in persons whose audition is perfect, and who have no Tinnitus.

In view of the remarks already made, it is interesting to note, in connection with the examination of the external ear, that the subject of a progressive deafness coming on

in later life may have had ear trouble of a gross kind in infancy or childhood. Complete recovery may have seemed to follow, and its occurrence has been forgotten. Certain pathological appearances in the drumhead afford unmistakable evidence of this bygone affection. It is important to recognise the true relationship to the present deafness of these bygone troubles, otherwise the long interval of good hearing power may tend to divert the mind from its true bearing. This, as already intimated, is evidence of the acute hypertrophic, or hyperplastic, stage of the malady, and which, if it have proceeded to suppurate, may have arrested for the present the further development of the malady—probably by eliminating the sclerosing tissue. With the lapse of time this tendency reasserts itself, this time in the guise of chronic atrophy. In most cases where there are no cicatrices to point to a former acutely destructive process, the hyperplastic stage has left its mark in fixation of the ossicles, atresia, &c.

Seeing, then, that the external ear so often affords evidence quite disproportionate to the symptoms complained of by the patient, we turn to other regions for instruction on this point—*i.e.*, we direct the succeeding steps of the examination to the throat and nose. In this relationship the throat will afford most suggestive information, but the successful interrogation of this locality demands that certain details be observed.

*Examination of the fauces* should always be conducted by means of reflected light. The surgeon, seated in front of the patient, directs him to open his mouth, quietly, and without holding his breath or exerting the inspiratory effort by means of which many attempt to reconnoitre the fauces. The light reflected from the frontal mirror of the surgeon now illumines the cavity, but usually nothing

will be distinctively made out, as the arches and curves of the palate are hidden by the tongue.

It will be necessary, therefore, to depress the tongue in order to allow a complete inspection of the fauces, &c. This must not be left to the patient to accomplish by calling upon him to "show his throat"—the muscular effort required for this purpose negating the information we have to acquire by the examination. This is—and it is necessary to have quite clear ideas on the subject—to ascertain the *state of innervation of the soft palate*, which is almost invariably defective in the disease under review. That is to say, there is paresis of the palate muscles, either on one side or both. This fact, or rather its explanation, affords an important clue to the solution of various problems associated with the disease; its diagnostic value cannot therefore be too strongly insisted upon.

The inefficiency of the numerous tongue depressors in use to satisfactorily deal with the situation led the author to devise an instrument which would supply the existing deficiencies. Its long-proved adaptability to the purpose induced him to submit it to the profession; a description and figure of it appeared in the *British Medical Journal*,\* and are here introduced.

The instrument may be divided, for the purpose of description, into three parts—the blade, the stem, and the handle. The *stem*, which forms the middle portion, is curved somewhat after the fashion of Fraenckel's depressor, but the curve is smaller, affording room to clear the teeth and the chin of the patient only. It ends in a straight short length set at a right angle to the curved portion, and at the termination of this latter is the *blade*. Viewed from

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\* February 29th, 1896.

the under or tongue surface this shows a central projecting ridge running along the whole length of the blade; it is grooved transversely, and is intended to lie upon the central raphe of the tongue, into which it sinks on slight pressure, causing the lateral halves of the organ to bulge up into the fenestrated wings, the margins of which are likewise lightly grooved. It will be observed that these wings are set longitudinally at a slight angle upwards from the midrib, and the entire blade projects upwards at an obtuse angle from the end of the stem. It is claimed that by this arrangement the blade adapts itself to the shape of the organ it is intended to control. It does not slip, nor, when depressed, does it choke the patient, as it allows the tongue to be drawn at the same time somewhat forwards towards the teeth. In this way the soft palate, when relaxed, or paretic, is fully exposed to view, a matter often difficult of accomplishment with other instruments, while the fauces and posterior pharynx are at the same time clearly seen. These advantages are gained by the fact that the blade takes possession of the tongue where it is strongest and most bulky. To do this it must be applied sufficiently far back, at a point which the surgeon will select according to his choice. The *handle* is set in a straight line with the front end of the curved stem, and is of sufficient length and weight to be held firmly, so as to enable the observer to move the tongue forwards, backwards, or from side to side, without disturbing the position of the blade. The above features are more or less shown in the accompanying figures (Fig. 2). The instrument was made for the author by Mayer & Meltzer, Great Portland Street.

The patient having his mouth wide open, and breathing naturally as already directed, the tongue depressor may be applied, but with only so much force as is necessary

to expose the pharyngeal wall. The surgeon will now be able to observe the state of the soft palate as regards its innervation, which is a primary object of the examination of the throat in progressive deafness. It will be

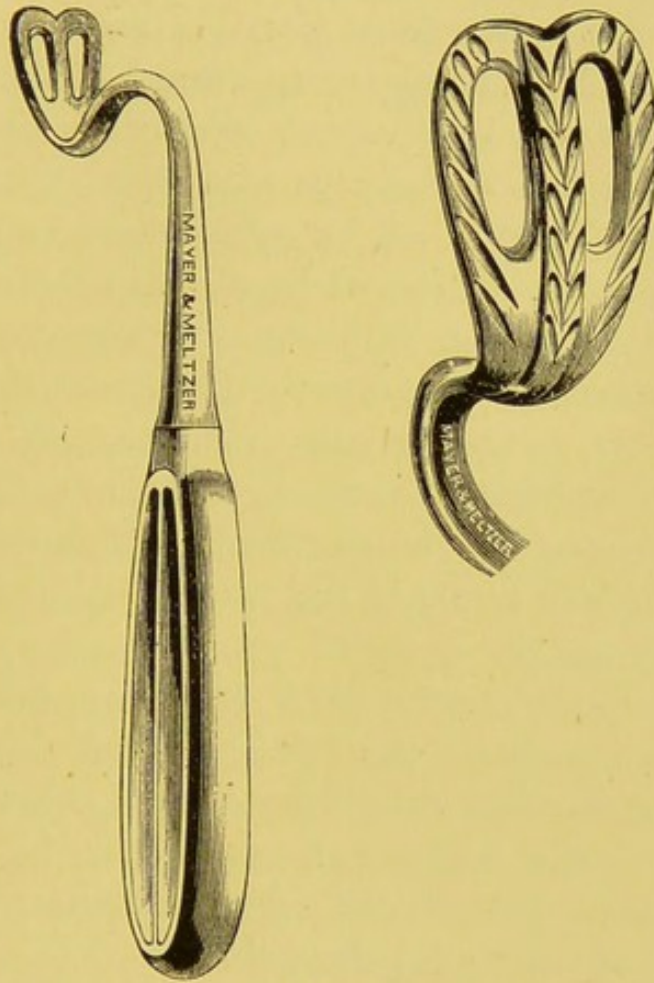


FIG. 2.

found almost invariably in a state of paresis, either unilateral or bilateral—the latter being present in the majority of instances. The reader is referred to the frontispiece, in which these forms of paresis of the palate are contrasted with the normal state of the region. The study of these diagrams will afford a better idea of the situation than would much descriptive letter-press.

Incidentally this examination of the throat will usually reveal a marked degree of pallor of the faucial mucous

membrane indicating the anæmic condition into which these patients are passing or have already passed, when thus examined. One suggestion for treatment will be thus afforded, and should not be lost sight of.

Also the pharynx will not rarely show indications of atrophic catarrh—pharyngitis sicca—in varying degrees of development. The thin glazed appearance of the posterior wall of this region, in advanced cases, when the fibres of the constrictor muscles may be seen through it, is often very striking. Upon it will be observed wave-like collections of secretion, so shaped by the action of the soft palate when in contact with the pharyngeal wall. This also is a noteworthy fact, because it points to the nose as the source from whence this thick, altered secretion is derived. Obviously it cannot come from the glands of the pharyngeal mucous membrane, as these are lost or obliterated as the result of the atrophy of the tissue in question.

When questioned on the point many patients will affirm that they have no particular *Discharge* from the nose, notwithstanding the demonstrable presence of this secretion, a fact which, simply interpreted, means that the secretions pass backwards through the posterior nares rather than through the anterior nasal channels.

The weight of these considerations tells against the inference sometimes advanced, that where there is no abnormal discharge from the anterior nares there can be no necrosis in the nasal organs. It is the author's contention that necrosis is all but universal in these patients, as the sequel will explain.

Besides paresis of the palate there may be more or less *Dysphagia*—occasionally this is very marked—but more often it occasions no more inconvenience than is expressed by the admission of a tendency to choke whilst

eating, or that the patient has to be careful in swallowing certain kinds of food.

If the examination be extended to the *Larynx*, defects may be found in the apposition of the vocal cords during phonation, more frequently in the left, but occasionally in both cords. These patients complain of getting tired when reading aloud, or their voice is apt to fail suddenly, or, is always feeble.

Without unduly anticipating the full discussion of this subject already deferred to a later occasion, it may be desirable to explain to what causes the author refers these various manifestations of defective muscle activity. Obviously that solution will be most acceptable which is alike applicable to the greatest number of instances. Bearing in mind the frequency of chronic nasal lesions in this form of deafness, as shown in the statistics already given, it seems clear that irritation of the sensory branches of the 5th nerve by the persistent ethmoidal disease is communicated to the vestibular nerve, and so has a causal relationship to the phenomena resulting from disturbance of the function of the organ innervated by it—viz., the labyrinth tonus. The muscular paresis is the reflex response to the trigeminal irritation, and is effected through the communication of the nucleus of the 5th with that of the octavus. Now we have learnt that one function of this vestibular portion of the octavus is to secure the "precise action" of such muscles as act in pairs, and particularly that this function is most pronounced in those groups of muscles which answer to this description in the head and neck.

As the result of the interference with such function, there is a suspension of the equilibrium which normally exists between the particular pairs of muscles affected. In the case of the palate, it is as though one should relax the

cord which suspends a curtain, whereupon the curtain falls, more or less, according to the degree to which the tension is interfered with.

The reason for rejecting a sensory motor reflex as the cause of the palate paresis is that there is no known association between the motor nerves of the palatal muscles and the seat of the irritation of the sensory branches of the 5th nerve situated in the nasal organs.

For the fuller consideration of these points the reader is referred to the second volume of this work; the evidence in support of this contention will accumulate as we proceed.

To return to the examination of the throat; opportunity will now be afforded for observing the state of the teeth and tongue. *Diseased teeth* will certainly maintain ear mischief in the face of the best-directed treatment, which can only prove abortive until this frequent source of reflexes generated in the 5th nerve be removed.

Besides the ordinary clinical indications afforded by the *Tongue*, the experienced observer will not fail to note certain indications of specific disease should such be present. Of this sort are denuded patches of epithelium, especially if arranged symmetrically on either side of the *raphe*; silvery patches, wherever situated, &c.

It is a noteworthy fact that the *muscularity of the tongue* is seldom much impaired in these pareses. In uncomplicated cases of reflex pareses of the kind under review, the author has never noted any marked disturbance of muscle action, even when the palate, pharynx, and larynx give unmistakable evidences in this direction; unless, indeed, a bulky, flabby organ, but little under the control of its owner, is to be so regarded. This latter state is common enough in paretic deafness. But the tongue can be protruded and moved in any direction, and hence there need be no danger of confusing the foregoing paretic

phenomena with paralysis of a bulbar origin. The author therefore trusts he may be permitted to call special attention to his contention. The medulla is not in these cases the seat of disease, but is involved in the production of symptoms only because it is a centre where many lines of nerve traffic converge, and where such can be shunted from one line to another.

Since the issue of the last edition of this work, the true innervation of the palate muscles has been made clear, largely through the labours of a talented colleague, Dr. Turner. This has necessitated a revision of the views which were legitimate at that date concerning the nature of neuroses of the palate, and which, as then set forth, had become increasingly unsatisfactory to the author. But until the researches of Landois and Stirling on the one hand, and those of Ewald on the other, had furnished the requisite data, it was impossible to arrive at a correct view of the subject. The explanations just offered bring the subject in line with these later developments of scientific research, and afford a broader, and therefore more reliable, explanation than had up to this time been possible.

The occurrence of Vertigo as an intermittent symptom in progressive deafness points also to reflex implication of the equilibrating function, in the same way as just described as accounting for the muscular pareses. It is not due in many cases, at least, to local ear mischief, as it is the first symptom to disappear when the nasal necrosis is alone treated.

Having noted any points gleaned from the foregoing examination, attention should next be directed to the *nasal organ*.

The steps of this examination need not be repeated here, as they are set forth in their proper place when the

subject of nasal affections is under review (*vid.* Vol. II.). Premising only that the chief object of investigating the nose in progressive deafness is to ascertain the condition of the ethmoid region, there are several preliminary observations to be made before this locality is reached.

The first of these is the *inferior spongy process*, or *inferior turbinate*, the pathological changes in which are, however, more often concerned with other forms of deafness than with that now under review. Still, there are cases of progressive deafness in which this anatomical region will demand treatment. These relate, for the most part, to its permanent enlargement, due to thickening of its osseous structure, or of its soft coverings, or more probably of both. Posterior rhinoscopy should be resorted to in every case where practicable, so as not to overlook a possible erectile tissue tumour, or other enlargement of its posterior end. Much more frequently, however, this element of the nasal edifice will afford but negative evidence of the causation of symptoms now discussed.

*Deviations of the septum*, and other morbid conditions of the partition, such as *spurs* and localised *protuberances*, whatever their nature, should be noted. If present they may add to the difficulty of exploration, either by touch or sight, of the more remote regions of the nasal cavity. Minor irregularities of the septum are more often present than not, even in the normal member, and so-called spurs, unless obviously obstructive, or so placed as to stretch the tissues overlying them, and with them the septal nerves, need not excite the surgical zeal of the examiner.

The *ethmoid region* of the nose now remains to be examined. This should be done as directed in the chapters treating of the Diagnosis of Ethmoiditis (*vid.* Vol. II.) Though any stage of this disease may be present, it is usual to find the so-called atrophic period

already well advanced. The middle spongy bone will then be small and thin—it may be red or pale.

At this point the author desires to call attention to a previous remark, that the distinction between hypertrophy and atrophy in inflammatory processes of the middle spongy bone is entirely artificial. There is no stage of ethmoiditis in which some one or other of the constituents of the soft tissues, or of the bone itself, is not undergoing change of an atrophic character. Because as soon as mucoid changes set in, and these are of the essence of the disease, the glands, or blood sinuses, or arterioles become pressed upon or invaded, and so become atrophied and lost, leaving only microscopic evidences of their former existence. The bone, even before it is denuded of periosteum and starved by the cutting off of its blood supply, gives evidence of actively increased absorption. The cavities which form in the tissue of the spongy bone, which may be cystic or otherwise, contribute to the exaggerated size which is often seen in these cases, whilst the rapid growth of the fibrous-tissue elements tend to this end. The distinction, therefore, between hypertrophy and atrophy is not one on which the author is disposed to insist, as such insistence implies a pathological error. The mere diminution in size of the spongy process to less than normal, which is a frequent characteristic of patients with progressive deafness, indicates rather the long duration of the disease; the grosser changes which mark the early stage have passed off, but the absorption, the wasting and disintegration of structure, is still at work, though its more active display has been transferred to the ethmoid wall and cells, where it is not capable of being seen.

What the examiner is now concerned with is to find the detritus left by the lapsed phases of the disease. A

conflagration has swept over the region and is still smouldering in its recesses, and, clinically speaking, it is in the discovery of the ashes that remain that the evidence of its presence will be found.

The methods of searching for the dead bone, as well as the situations in which it is most likely to be found, are more particularly set forth in the chapter above referred to, to which the reader is urged to give special attention.

The presence of a necrosing ethmoiditis, it is the author's contention, is the chief cause of the patient's symptoms—of his deafness, his giddiness, and his Tinnitus. The existence of dead bone more especially acts as would a foreign body, and becomes an established source of irritation to the sensory branches of the 5th nerve, distributed in the ethmoid. Reflexes are thereby excited through the nuclear communications in the medulla as just described.

If the argument given a few pages back, that a persistent symptom must have a localised cause, be accepted, there are many arguments in favour of such a persistent cause exercising its effect through the medium of what we understand by a nerve reflex, rather than by means of a direct lesion of the nerve which exhibits the symptom. The chief argument against the latter alternative is that we can conceive of no lesion of a nerve so delicately constituted as one that actuates a special sense-organ that could exist for even a short time without obliterating the function of the end-organ implicated. If this premiss be accepted, we have good *a priori* ground, in the *persistence* of the Tinnitus, which often endures through the greater part of the patient's lifetime without destroying the hearing (since it is only rarely, and after many years of endurance, that these patients become stone deaf), for seeking such a cause of

reflex irritation of the octavus to explain the Tinnitus as it occurs in these cases.

Another fact which the author and those who have worked with him have established in a large proportion of cases in which necrosis has been discovered, is that it is seated in that nostril *which is on the opposite side to the ear which manifests the Tinnitus.*

This is not a constant rule, for it occasionally happens that dead bone is detected in both nostrils when the Tinnitus is referred to one side of the head only. Besides being very rare, the noise in such is usually described by the patient as difficult to locate—it is rather a “rumbling in the head,” sometimes even “outside the head,” than distinctly centred in one ear.

Also, it is matter of everyday observation that necrosis in the ethmoid exists without occasioning any Tinnitus, and where the patient has no ear trouble at all. He has other neuroses—to be considered in course—but they are not auditory. The explanation of this fact is obvious. *The nucleus of the 5th nerve covers a large space in the medulla, and is connected with all but one of the nerve nuclei, likewise seated in that locality. In such patients as exhibit no auditory response to the irritation of their 5th nerves in the nose, it may be inferred that the fasciculi so irritated reach in them some portion of the 5th nucleus which is not anatomically associated with that of the octavus, but with some other nerve nucleus, which forthwith displays its proper neurosis.*

In concluding this portion of the subject, we may summarise as follows. Just as the reflex occurrence of Vertigo has been traced to the vestibular section of the octavus, so the Tinnitus and deafness are referred to implication of its cochlear section. These latter symptoms are the reflex response on the part of the cochlear nerves to the impres-

sions reaching them through the 5th nerve. The facts here insisted upon are to be regarded as additional factors of deafness, apart from such other causes in the middle ear as may have been previously brought about in that locality, in many instances during the presence of the hyperplastic stage of the middle-ear catarrh. These are indicated by fixity of the ossicles, atresia, dry and adherent mucus, and other changes which serve to hamper and alter the conductive apparatus, although their original cause has long since ceased to be operative. The inference to be drawn from this position is, that though all these *middle-ear* abnormalities may be got rid of, or reduced to a minimum, the symptoms remain much the same as at first, because of the nerve reflexes proceeding from the nasal lesion. The practical outcome being that treatment to be effective must be directed to both regions—nose and *cavum tympani*.

The examination of the *Eustachian tube*, and through it of the *interior of the tympanic cavity*, should next be undertaken.

The details of performing *Eustachian catheterisation* were amply described in a former work on "Post-nasal Catarrh" by the author (Chap. VI).\* More than fourteen years having elapsed since its issue, and the method therein set forth being so widely known and generally practised, it may seem superfluous to repeat them. But as this volume has long been out of print, their introduction here may be appreciated by some readers; the more advanced will naturally skip these details. These are selected from the various methods propounded by different teachers, those only being accepted which

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\* "Post-nasal Catarrh, and Diseases of the Nose causing Deafness," London, 1884.

expedite the process of catheterisation, while all the superfluous proceedings are rejected.

The patient should be so seated that his back and head are firmly supported in the erect posture. He should be directed to close his mouth and breathe steadily through his nostrils throughout the entire manipulation. The surgeon then places one end of the otoscopic tube in his own ear, and the other end in that external meatus of the patient corresponding with the Eustachian tube to be examined. Next he rests his left hand on the patient's forehead, and with the forefinger gently raises the tip of his nose—this latter step is necessary to avoid striking the catheter against the margin of the nostril on attempting its introduction. The operator then takes the short silver catheter between the forefinger and thumb of his right hand, and introduces it into the nostril of the patient on the side that already supports the otoscopic tube. When the beak of the catheter has freely passed the vestibule, it should be depressed until it is felt to rest on the floor of the nose; it is then passed onwards, being still held so lightly that any check which may be encountered is appreciated by the operator, before pressure has been applied to the obstruction, and pain thereby caused. Should an obstacle be encountered, the beak of the catheter must be manœuvred in such a manner as to pass it without raising the instrument out of the inferior channel. When, by the cessation of the resistance caused by contact with the nasal floor, the operator becomes aware that the instrument has entered the post-nasal space, he should give it a quarter turn inwards and gently withdraw it until the curve of the catheter comes into gentle contact with the septum. If during this time the patient has been breathing through his nose, the veil of the palate will not be encountered,


so that the surgeon is free to complete the operation by making a firm, but gentle, turn of the instrument over half a circle outwards, following the dependent surface of the soft palate as his guide, until the ring of the instrument (which is so attached as to correspond to its curve) lies outwards and upwards.

If the foregoing details have been successfully carried out, and they should be performed in one continuous movement without break or jar, the beak of the catheter will be now resting in the orifice of the Eustachian tube. The funnel or projecting end should now be seized between the thumb and forefinger of the operator's left hand, without removing the remaining fingers from the patient's forehead, where they were placed at the commencement of the proceeding. His right hand is now freed from the catheter, and with it he places the nozzle of the tube attached to the hand-ball bellows (previously suspended by a loop from the button of his coat) into the presenting orifice of the catheter. With the disengaged right hand he next compresses the bellows, and if no obstruction exist in the Eustachian tube, he will hear the air enter the tympanum.

When the catheter is introduced in the manner above described, the surgeon need not concern himself about the posterior wall of the pharynx, or Rosenmüller's fossa, neither of which regions is encountered. It is necessary to have some guide to the situation of the orifice of the Eustachian tube, the bearings of which are given when by the quarter turn inwards, the curve of the catheter touches the posterior free margin of the vomer or septum nasi, which is opposite to the Eustachian orifice, and which is entered by the catheter when the half turn outwards is completed. This latter step cannot be executed at all unless the conditions of breathing already enjoined be

strictly carried out. For if the patient breathe through the mouth, the soft palate will be drawn upwards and fix the catheter as in a vice, at the same time causing pain to the patient.

In very nervous subjects, or those with narrow or obstructed nasal channels, it may facilitate the above proceeding to spray the nostrils with a weak solution of cocain a few minutes before commencing the manipulation.

The Eustachian catheter, whether used for the purposes of diagnosis or treatment, is deprived of half its utility unless its employment be accompanied by that of the bougie. The *Eustachian Bougie*, as now supplied by the instrument makers, is a thin, rounded rod of celluloid with olive-shaped ends, and this form has practically superseded all others. Of late years the author has used a modification of this shape, his bougies being made flat, the edges being bevelled off, so that in section they represent a double ellipse, thus . This flattening is continued quite to the end of the bougie. His object in adopting this shape is to adapt the instrument to the form of the tube to be explored by it. The Eustachian tube, it should be remembered, is not a round canal, but resembles rather a slit, the long diameter of which is several times larger than the transverse one. He has found it necessary to finish these bougies himself, by scraping them to the required flatness with a sharp knife; especially is this necessary with regard to the point, which, as the bougie is usually supplied, is a mere lump, often a good deal larger than the rest of the instrument. Care must be taken so to graduate the thinning that there is no specially weak part towards the end, in order to avoid the risk of breakage.

It is necessary to have some mark on the bougie to serve as a guide to its position when introducing it. The author

has long discarded the markings originally made use of for this purpose when the bougie was first brought into use, because he found them rub off or become obscured, so that one mark was liable to be lost or be mistaken for another. In their place he has substituted a sharp bend of the celluloid at the desired point, which angle is readily *felt* as the bougie is passed, and gives the clue required. To make this angle he proceeds thus:—The bougie, when planed and the point finished as above described, is passed into the short silver catheter till it shows at the distal end; it is then pushed on till it projects the estimated length of the Eustachian tube, about one and a half inches. This is the measurement which has to be indicated on the bougie, so that the operator may know when he has reached with it the tympanic end of the Eustachian tube. He makes this mark as follows:—Retaining the two instruments as above adjusted, the length projecting from the big end of the catheter is bent sharply against its rim to a right angle across the flat plane of the bougie. This suffices to give the instrument a permanent mark at this point, even when it resumes a nearly straight line; and is the only mark which the author employs. With it one can always *feel* what length has been introduced, even in the dark, and the author has found its adoption to greatly facilitate the manipulation of the bougie, and thereby add to its instructiveness. Several sizes of bougie should be at hand. The author's set consists of three sizes; those which he uses he has adopted as the result of experience, a course, no doubt, pursued by other otologists.

The Eustachian bougie effects important objects. One of these is that by its means obstructions are detected and removed. It is not uncommon for an obstruction to exist in the tube of the existence of which the catheter, if used alone, affords no indication. This comes to pass in con-

sequence of the shape of the Eustachian tube referred to above, which will allow a block to exist while a passage for air may remain open on one or both sides of it, which passage may be forced by the pressure of air from the hand bellows used in catheterisation, a fact which may easily mislead the unwary.

If it be argued that an obstruction past which air can be forced is of no moment, and its detection a matter of indifference, the reply is that every obstruction is an abnormal state, and implies a pathological causation. It is a factor, therefore, in the complex elements which go to make up the condition of the patient, and as such demands treatment. Care must be taken not to confuse a fold of mucous membrane, which may engage the point of the bougie, with a pathological obstruction of the kind above referred to. This may be difficult, and in any case can only be avoided by practice. It may be sometimes overcome by using a larger instrument.

Another advantage which the bougie affords, and which the catheter certainly could not, is that we can with it explore the cavity of the tympanum.

In the phase of ear disease now under consideration—viz., progressive deafness—the presence of an obstruction situated at or near the tympanic end of the tube is exceedingly frequent. The locality affected is peculiarly characteristic of this form of disease, because in ordinary catarrh of the tube an obstruction, if present, is more often found near the junction of the osseous with the fibro-cartilaginous sections of the tube, and is usually assumed to partake of an inflammatory nature. It is clearly otherwise in progressive deafness, though it is difficult to define the exact cause of the stricture in this situation. The author is inclined to favour the view that it is produced by a peculiarity in the tensor tympani muscle, whereby the

orifice of communication between the tube and the cavum tympani is more or less obstructed.

The presence of this stricture appears to mark a stage of the disease in which treatment is likely to prove beneficial. Thus it often happens that the same patient, in whom this stricture exists on one side only, has both ears affected with the disease. This will be found in the ear last affected—supposing the case to be one in which the symptoms in one ear had long preceded their development in the other. Such patients often say the one ear has long been useless, is, in fact, quite deaf, but they had not troubled about it until the other one began to *go* also. On examining such a pair of ears, that which has been deaf many years will usually admit the bougie freely into the drum cavity, and this ear in his experience gives but little response to treatment; whereas the other, which presents the stricture above described, is not yet beyond the reach of help.

It would thus appear that the condition which is responsible for the narrowing of the tube is one that plays itself out with the lapse of time. It is not, however, to be supposed that the tendency of this particular state to disappear spontaneously is one that points to the removal of all pathological states of the organ—*i.e.*, recovery. It seems rather as if the increased activity of function in the part displaying it has ceased because of the exhaustion of the vital energy of the apparatus in which it had been so long maintained. One element of the organ has become passive because no longer capable of responding to the stimulus which had up to this point excited it. Such an ear is then like an exhausted volcano, now affording in its bare and inactive state the evidences of the convulsions to which at one time it was subject. These facts enforce the argument for the early

treatment of the disease, in order to arrest the processes working towards the consummation above indicated.

This brings back the question, What is the state of the muscle—*tensor tympani*—in progressive deafness, and is it capable of producing the obstruction at the distal end of the tube as above suggested? The following considerations may guide to the solution of the problem.

The presence of paretic palate is an incontrovertible fact, as is also a retracted drumhead, with such a degree of rotation outwards of the short process of the manubrium as imparts an abnormal prominence to the latter when viewed from without. These latter appearances (*membrana tympani* and ossicles) were regarded by Gruber and Weber-Liel as indicative of contraction of the *tensor tympani* muscle, which, it will be remembered, is inserted into the *manubrium mallei*. The latter also affirms, from anatomical investigations—and his views are of the greatest value in reference to this subject—that the *tensor tympani* is the antagonistic muscle of the *tensor palati*, and that when the latter is paralysed the former becomes antagonistically contracted. Weber-Liel did not attempt to assign (so far as the author knows) any explanation of the paresis of the palate, other than that he surmised it would be found to be due to some nasal lesion. We have already seen that it is impossible to refer the palate paresis to a sensory-motor reflex of the ordinary kind, and have traced its occurrence to implication of the equilibrating apparatus as explained. But, apart altogether from Weber-Liel's hypothesis of antagonism, an ordinary sensori-motor reflex can be brought about, as regards this muscle, by the conditions of the disease, because the anatomical arrangement of nerves involved fulfils the requirements of such a reflex. This will be evident when we recall the fact that the nerve for the *tensor tympani* muscle is derived from 3rd division

(motor) of 5th ; that it does not originate in the otic ganglion, but simply passes through it on its course to the muscle. Irritation of the sensory branches of the 5th by the nasal disease satisfies the physiological condition by which to bring about contraction of this muscle. So far we have two channels suggested, by means of which disturbance of the tensor tympani may be introduced.

There is yet a third method—viz., an abnormal state of action on the part of this muscle may be induced by its implication in the series of muscle disturbances brought about through the introduction of the equilibrating apparatus, in the same way as paresis of the palate has been explained.

Of these three ways of explaining the *modus operandi* of deranged action of the tensor tympani in these cases, the author inclines to regard the last as the most probable, and for the reason that it explains a greater number of the conditions better than the others.

It will be well to recall these. It has already been remarked that the signs of disease in the drum membrane are often slight, that they are variable, and that the more marked degrees of them are occasionally seen in persons with normal hearing, or devoid of Tinnitus. It would seem, therefore, that the contraction of the muscle cannot be very intense, although there are cases in which the collapse of the membrane is as complete as its situation will admit of, and in which the distal end of the manubrium is resting on the promontory. These latter are probably complicated with some bygone inflammation of a more acute character.

The condition of the muscle which is responsible for these variable appearances can be more satisfactorily explained by referring it to the consequences of interference with its equilibrium by irritation of the organ.

regulating this function—viz., the labyrinth tonus—giving rise to interference with the “precise action” of the muscle, “which may begin too late, or last too long, or be deficient in strength.”

The author does not intend to imply, in the foregoing remarks, that he draws hard-and-fast conclusions from the experimental physiology of Ewald, and makes them applicable to the case in point. The subject is not yet ripe for such definite inferences. That the tensor tympani is affected is clear; that the character of its disturbance does not always or often coincide with the requirements of the two other possible influences that might affect it is also clear; therefore another alternative is required to explain a number of cases, and which is provided by that last described.

Possibly all three causes, or various combinations of them, contribute to the condition of the tensor tympani. But however this may be, it would appear that the tendon near the muscle, and possibly the adjacent portion of the muscle, comes to occupy more space in the tube, drops, as it were, into the orifice, or in front of it, with the effect of almost completely occluding it. The author can find no other explanation of the daily observed fact of the narrowing of the distal ends of the tubes in these cases. Moderately firm, graduated pressure usually suffices to pass the bougie through this obstruction, beyond which no obstacle is, in many cases, encountered. On attempting to withdraw the bougie, the portion of it engaged in the stricture is felt to be forcibly gripped, to such an extent sometimes as to necessitate the exertion of considerable effort to do so. This circumstance precludes the explanation of the cause of the stricture being due to mucus, or other accumulation, at the distal orifice of the tube. Furthermore, when the bougie is

removed the obstacle is restored, to be again encountered on the occasion of the next treatment. This state of things may endure for weeks, only disappearing if the concurrent treatment of the nasal necrosis should have succeeded in greatly diminishing the latter. From the author's point of view this means removal, more or less, of a source of reflex irritation, and he can see nothing in the anatomy of the locality which is the seat of the stricture which is capable of such response to a distant irritation other than the muscle with its tendon.

While the author propounds the above explanation of the observed facts, he is conscious of the objections to which it is open, and, in the present inchoate state of our knowledge of the subject, his last intention would be dogmatically to advance an hypothesis which subsequent discoveries may show to be untenable.

But, apart from theory, the fact of the existence of an obstruction of the tube at its tympanic end will be patent to all who have acquired any experience in the use of the Eustachian bougie, and in these cases its recurrence after treatment will be known to some. That it disappears when the exciting cause is removed—*i.e.*, the nasal necrosis—is a point for which he claims the attention which it seems to demand.

The author has encountered several instances in which the firm character of the resistance, ultimately surmounted by gentle persistent pressure, has conveyed the impression that the cochleariform process was bent by the tendon and drawn across the tympanic orifice of the tube; occasionally also a rough, grating sensation imparted to the bougie as it passed this point suggested that the process itself was broken off, or had become necrosed. The conditions which are competent to give rise to such a weakening of the cochleariform process by absorption or necrosis have long

been pre-existent in the tympanic cavity—viz., the hyperplastic and atrophic stages of fibrosis. The analogy drawn from the consequences of the disease in the ethmoid region of the nose shows the osseous tissue underlying the fibrosis in this locality to constantly undergo both absorption and death. It is not, therefore, unlikely that such a fibrosis occurring near the distal end of the tube may so weaken the bony hook of the tendon as to cause it to yield under the strain of its spasmodic contractions, and so to produce the phenomenon in question.

We have seen that the conditions are present in this disease for occasioning reflex spasm of the tensor tympani muscle. The question which will occur at this point is—What part does a contracted (spasm) tensor tympani play in the production of Tinnitus in these cases? The possibility of its constituting such a factor was first pointed out by Laennec, and the probability that it does so act is fortified by an experiment that anyone may perform for himself. For this purpose let him lie with one side of his head resting on a pillow and tightly clench his jaws, when he will hear a sound which closely resembles that produced by holding a shell to the ear. It is due to the contraction of the muscles which close the jaws; a similar sound is known to occur whenever a muscle contracts strongly. In the above experiment, this muscle sound is audible to the subject by reason of the proximity of the contracted pterygoids to the auditory apparatus. It is not unreasonable to conclude that if the sound in question can be heard, though situated without the ear, a similar powerful contraction of a muscle placed within the auditory apparatus, as is the tensor tympani, would be even more likely to be audible to the patient.

No doubt, therefore, the tensor tympani does, in those cases in which it is the subject of reflex sensori-motor

irritation, contribute an element in the production of the sound. But it is difficult to conceive of this or any other muscle enduring for many years in such a state of tension. The time must arrive when it ceases to respond to the stimulus. Such are the cases, referred to above, in which the ear has become useless or nearly so, and in which there is no stricture at the distal end of the tube. Yet these patients still complain of Tinnitus, and, though they describe the ear as useless, are seldom quite deaf.

The persistence of the noise is a fact that suggests some other cause than that due to contraction of the tensor tympani, and must be referred for the most part to implication of the cochlear nerve, a conclusion which may be accepted if the presence of necrosis in the ethmoid is demonstrable.

Thus we arrive at the conviction that Tinnitus is usually the product of a complexity of causes. We have already examined a number of its factors, and there are others to be considered. But one cause stands out as the most important, because it is so persistently associated with the commonest form of deafness furnished in adult life—viz., Progressive Deafness; and this cause must undoubtedly be assigned to the presence of necrosis in the ethmoidal region of the nose. This acts as a persistent irritant to the branches of the 5th nerve, and by means of the communication of its nucleus with that of the octavus, is reflexly made to implicate the cochlear branches of this nerve.

#### PATHOLOGY OF PROGRESSIVE DEAFNESS.

Analogy supports the view that the pathological state of the middle ear in Progressive Deafness corresponds in most particulars with that of ethmoiditis in the nose. There are divergencies, of course, due to such diversity of structure as

the two organs display. There is, presumably, a hypertrophic stage, attended with increase of the fibrous elements of the mucous and sub-mucous tissue; but this stage is not so marked as in the adjacent organ, because there is nothing analogous to the spongy processes of the nose in the ear. There occurs, however, without doubt, that peculiar change which we shall later on learn to recognise as fibrosis of the mucous membrane. The thickening due to this occurrence is probably of short duration, and, in typical cases, this hyperplastic stage is soon passed. It is, doubtless, in the earlier stage that those adhesions of the ossicles to adjacent parts, and the fixity of their articulations, take place. Afterwards, a general thinning of all the implicated regions sets in, affording the appearances universally recognised as atrophic changes.

It is matter of regret that so little modern pathological work has been done in this direction. The absence of this scientific labour, in this country at least, is no matter of surprise. These patients do not die of their ear disease. They have, probably, seen many specialists during the lengthened period of their ear experiences. When at length some illness proves fatal, it is, according to the ideas at present prevalent, of a kind altogether dissociated with the old ear symptoms, and even if an autopsy be held, the ear is never examined. Therefore, the aural surgeon has no chance of examining, *post mortem*, the condition of the patient as regards the organ he is specially instructed in. Moreover, few, if any, such specialists are qualified to conduct a long course of microscopical investigation into the changes set up by sclerosis. Indeed, it may be said without disrespect that but few pathologists recognise the full scope and bearing of this morbid condition. The subject will be further considered later on. Here, however, it may interest the reader to know that, when recently

Professor Politzer was examining the author's microscopical drawings of sections of ethmoiditis, he recognised the appearances presented in the mucous membrane changes in some of these as corresponding exactly to those he had frequently seen in the mucous membrane of the ear.

Should the stage of hyperplasia become excessive, so as to approximate that seen in the nose, then the scene changes, and we are introduced to a state of things known as hypertrophic catarrh of the middle ear, with its attendant secretions, ulceration and perforation of the drumhead, &c., &c., and in which palpable gross lesions in the ethmoid bone are equally frequent as in that under review.

The crucial point to be recognised from the pathological view of these cases is that we have to do with a fibrosis of the middle ear, and for what this means we must refer the reader to a later chapter, in which the pathology of fibrosis as witnessed in the adjacent nasal organ is discussed.

#### TREATMENT OF PROGRESSIVE DEAFNESS.

In treating a case of Progressive Deafness the first point is to ascertain what stage of fibrosis the affected organs exhibit at the time. Whether, *i.e.*, the hyperplastic stage has already passed, and with what damage to the contents of the middle ear—whether there are adhesions of the membrane—atresixæ, fixity of the ossicles, thickening or rigidity of the fenestræ, &c., whether the atrophic stage has fairly advanced.

Some guide to the condition will be gained by observing the stage of the nasal affection which, in ninety-nine cases out of a hundred, will accompany and correspond more or less with that of the ear.

Although making use of these terms as affording con-

venient guides to the progress of the disease, they must not be taken too literally, because, as already insisted upon, atrophy is in evidence as soon as hyperplasia commences. It is of the very essence of this fibrosing process that the increase of the submucous fibrous tissue should occasion atrophy of the histological elements of the organ in which it occurs; thus glands are aborted and blood-vessels invaded and occluded, notwithstanding that the bulk of the lining membrane is at the time much thickened. With the lapse of time this mucoid tissue itself begins to waste, becoming reduced to a quasi-cicatrical tissue, which takes the place to a greater or lesser extent of the lining membrane of the tympanic cavity, and the adjacent cavities and organs with which the middle ear communicates.

It thus becomes evident that we have to deal, in treating a case of progressive deafness, with a constitutional disorder—fibrosis or sclerosis—having its most objective expression in the organs of hearing and in the nasopharynx. It should, however, be borne in mind that such local manifestations of the disease which bring the patient under the notice of the aural surgeon by no means preclude the possibility of the existence of a similar condition in other regions of the body. On the other hand, the subject of a disseminated sclerosis may have almost every organ invaded but the ears; or these may succumb, and the patient become deaf from this cause in the few months preceding dissolution, after a long experience of the disease elsewhere.

From the point of view of treatment, the reader may here require to know what, if any, is the causal relationship between the nasal affection and that of the ear? To such query the author would reply that, with the exception of those symptoms which acknowledge a reflex

origin in the nasal disease, the persistent Tinnitus, &c., the local ear mischief is not directly due to that taking place in the nose. The two organs are adjacent, and their mucous membrane continuous; and the same constitutional proclivity to fibrosis which these subjects exhibit causes both regions to be areas for its development, which may be simultaneous or otherwise; but in their initiation they are independent one of the other. We have therefore to deal with a diseased condition of the two organs, though no doubt the catarrhal state of the nose which the presence of an ethmoiditis entails, and also those numerous causes of nasal respiratory obstruction which in their earlier stages are thereby engendered, do so hinder the Eustachian function, that it would be impossible to accomplish any effective relief to the ear disease so long as that of the nose were allowed to pass unnoticed.

The nasal troubles may necessitate surgical interference for removing masses which obstruct respiration through it, or deviations of the septum, or large spurs and other excrescences may have to be dealt with before the ear can be treated with success. But it must not be forgotten that when all this is done the auditory apparatus is an independent morbid locality which will require subsequent treatment, many of the lesions going on in it being unaffected by any remedial measures directed to the nasal affections.

And it is important that the patient and friends should be made clearly to understand this, as they are too often disposed to run away with the notion that an operation, when advised, will cure all the patient's troubles, and when later on they find this is not the case, and the ear requires further and often prolonged treatment, disappointment and distrust may arise, which a little plain speaking at

the outset, on the lines above indicated, would have avoided.

As already intimated, Tinnitus is the most afflictive symptom in these cases. Patients will often say, "I am not so deaf but that I could put up with it, if only the noises, which get worse rather than better, could be got rid of." It is exactly in this connection that the nasal disease exerts a direct causative influence. So soon as necrosis is present in the ethmoid region of the nose, so does it become a direct cause of the Tinnitus, according to the views already set forth in the preceding pages.

Hence it will be clear that all along the line of treatment the two localities, nose and ear, have to be dealt with simultaneously.

The first step being to ascertain the state of the Eustachian tubes, the catheter should be used for this purpose, followed, for reasons already explained, by the careful exploration of its canal by means of the bougie. This, of course, pre-supposes the nasal channels to be in a sufficiently patent condition to allow the introduction of the catheter, and should this not be the case, catheterisation must perforce be deferred until such operative measures have been carried out as are calculated to secure this purpose. The author usually begins the exploration of the Eustachian tube with the smallest bougie, care being taken that its olive-pointed end is not caught in any fold of mucous membrane, which would at once arrest its progress. Should this happen, especially if a larger bougie likewise fails to pass from the same cause, it is safer to forego further examination till another occasion. A barrier to the entrance of the bougie may arise from the position of the catheter, the distal end of which should be fairly engaged in the ostium tubæ, or otherwise, when the bougie is attempted to be pushed onwards it will strike the

cushion of the tube, and be there arrested. Needless to state, the short catheter recommended by the author many years ago is essential to any extensive and useful application of the bougie, because of the greater accuracy with which it can be manipulated through it.

Should the bougie be arrested at any point short of the distal extremity of the tube, the obstruction will be due, in the majority of instances, to a hyperplastic thickening at this point. It will generally yield to gentle pressure, perhaps not at the first or second attempt, but ultimately. It is a good plan in such a case to allow the bougie to pass as far as it can be made to without eliciting pain, and to leave it *in situ* for fifteen to thirty minutes. At the end of this time it will occasionally happen that, on attempting further pressure, the obstruction will be passed; if it should not so happen, further treatment should be deferred for a week.

Such hyperplastic strictures are usually encountered in patients in whom the atrophic changes are not far advanced. Whereas, it is usual when this wasting stage has been long established to find the tubes not only patent, but the calibre will exceed that of the normal tube. This condition will usually be associated with diminished spongy bones in the nose, a dry and glazed state of the mucosa in the ethmoid region, and a marked degree of pharyngitis sicca. Tinnitus and deafness will then be constant, and frequently a thick tenacious mucus collects behind the soft palate and is most annoying to the sufferer. It is just in these cases that necrosis in the ethmoid walls and cells will be abundantly evident. When the middle ear is inflated under these circumstances, the drum membrane is blown outwards, even beyond the normal plane. This movement is accompanied with a sort of click, clearly heard through the otoscopic tube, and some improvement in the hearing

often accompanies the change of posture; but this is lost after a variable interval, as the membrane gradually passes back into its collapsed condition.

Intermediate between the hypertrophic stricture attendant on the early stages of the disease on the one hand, and of complete atrophy, with increased calibre of tubes, on the other, is that larger class to whom reference has already been made, where the stricture resides at the tympanic end of the tube. This obstruction is usually overcome by gentle pressure kept up evenly for several minutes. It usually yields very gradually, and when the olive-shaped end has slipped through there may occur that gripping of the bougie, just beyond this point, to which reference has already been made. The exact nature of this obstruction remains at present undetermined. All one can as yet say about it is that this stricture is not removed by simply passing the bougie through it; but if the treatment of the necrosis in the ethmoid be carried out at the same time, it will disappear almost suddenly—*i.e.*, so soon as a proportionate amount of diseased bone in the nose has been got rid of by treatment.

The following precautions, especially applicable to beginners in the use of the bougie, should be observed in dealing with any obstruction in the tube, though most pertinent to those last alluded to, whose situation is at its tympanic end. There is usually more or less retraction of the drumhead in these cases, so that its anterior segment may lie much nearer the tubal orifice than it should do. The tube itself varies in length in different subjects. Given, then, a shorter tube than the average, with only slight narrowing towards the tympanic end, it may be easy for the bougie, where there is such a depressed membrane as just described, to come in contact with it before the operator is aware that his instrument has already entered the tympanum. Further

pressure under these circumstances might lead to perforation of the membrane by the bougie, a result not at all to be desired. A practised hand can usually discriminate between contact with the membrane and that of a tubal stricture. Where there is the slightest doubt, and this must at times happen to all, further manipulation should be deferred and the bougie be withdrawn. Some authorities never inflate the ear after passing the bougie through a stricture for fear of causing an emphysema; this is, no doubt, a safe line of practice, but its adoption deprives the patient of the immediate relief to all the symptoms which usually follows the inflation of air through a newly dilated stricture. This traumatic emphysema may be unavoidable; it must be of rare occurrence, however, and the few cases that have come under the observation of the author subsided after a few hours. In view of its potentialities for evil, the risk of incurring it should be avoided by all possible means.

Every step in the manipulation of the Eustachian bougie will be greatly facilitated by a free lubrication of the tube through the catheter prior to its introduction. This is readily effected by injecting a little adepsin oil, or other equally limpid paraffin oil, into the catheter when *in situ*, with a dropper, and then blowing it on into the tube by a gentle inflation from the air-bag.

It is impossible to lay down any hard-and-fast measurements to guide the operator in the use of the bougie. Because not only do the Eustachian tubes vary in length in different individuals, but they sometimes vary in this respect on opposite sides of the same subject. In every case it is well to proceed with increased caution when the last quarter of an inch remains to be inserted. It will often be found that a larger instrument passes more readily than a small one, as it does not so easily become

entangled in any slight inequality or fold of the lining membrane.

Supposing the patency of the tube to have been so far secured that air can be freely forced into the middle ear, the effect of this proceeding upon the drum membrane should be carefully observed. This is easily accomplished if an assistant (or, in some cases the patient) performs the inflation through the catheter, while the surgeon observes the membrane. Probably at first there will be no movement in response to the inflation. It is then necessary to formulate, mentally at any rate, a notion of the cause of the immobility of the membrane and ossicles. If dried mucus be diagnosed as the cause, the tympanum should be gently filled (through the catheter) with a warm and weak solution of bicarbonate of soda—gr. v. to the  $\bar{3}$ j. Even if the adhesions consist of organised bands, this can do no harm, but, on the contrary, favours their yielding to the air douche. The fluid, after a short interval, may be blown out as readily, and by the same means, as it was introduced. The foregoing procedures should be followed up by a few strong, steady inflations through the catheter, which may or may not be accompanied with a palpable yielding, partial or complete, of the adhesions.

At this point it will be necessary to accurately observe the drumhead, with the view of ascertaining whether its vessels are becoming injected in consequence of the treatment. Should this be the case it will be better to defer the next step in the treatment for a week, in order to avoid inflammatory re-action, with pain, which might necessitate a prolonged rest. It must not be forgotten that the limits of interference with the tympanic cavity are soon reached, for which reason it is better to distribute the treatment over a considerable interval of

time, rather than risk the necessity of its total cessation.

Should, however, no evidence of irritation be present, the next step, that of practising traction upon the drum membrane, by means of *exhausting the air in the external canal*, may be proceeded with. Here it should be remarked that this step should never take precedence of the measures already described, which are designed to secure a free communication between the tympanic cavity and the external air through the Eustachian tube and nasal air passages. This being accomplished, the air on the tympanic side of the membrane will exert the same pressure upon it as does the column of air entering through the external canal. When this natural counterpoise of air pressure is re-established by the means detailed above, the traction upon the membrana tympani by means of the vacuum apparatus will be facilitated, because the weight of the atmosphere then has the effect of an evenly applied cushion, acting from within outwards against the membrane, thus aiding the object in view. Whereas, if pneumatic traction be applied without these conditions being first secured, there will be considerable danger of some portions of the membrane being torn through—a result which can only delay further treatment in the direction now desired.

The suction in question may be applied in two ways: (a) *gradually*, by means of Delstanche's exhaust pump, which is so arranged that the effect of each stroke of the pump upon the membrane can be watched through an airtight speculum; (b) *suddenly*, by means of a metal reservoir, which is first exhausted of air to the extent judged necessary, and is then fully opened in the ear when the entire effect of the exhaust is at one *coup* exerted upon the drumhead.

Both these methods have their separate uses, and cannot be regarded as substitutionary. Thus, while the sudden method is well adapted to detach the membrane from adhesions, or to tear through synechiæ which bind it in its abnormal position, the first described may be advantageously employed afterwards to move the ossicles and restore the use of their articulations, where this is practicable.

*Treatment of nasal necrosis*—occurring in association with Progressive Deafness.

It has been made a reproach against the author that he stated "it was rare to meet with a healthy middle turbinate bone." It is to be regretted that the animus which dictated the implied censure should have based its justification on a garbled quotation. The statement in question was made ten years ago. His intervening experience obliges the author to repeat, and at the same time to supply, the context omitted, that in the class of patients referred to in the above quotation—viz., those *with chronic nose and ear affections*, it is rare to find a healthy middle spongy bone. The statistics already quoted show that an enormous preponderance of cases of Progressive Deafness are associated with some form of ethmoiditis, usually the stage in which atrophic changes predominate. These are often spoken about as cases of *atrophic rhinitis*. We are not now concerned to discuss either the nomenclature or the nature of the disease itself, both of which have their place in the second part of this treatise.

The present object being to insist on the necessity of dealing with the necrosis as the exciting cause of reflexes in the octavus nerve, and therefore of a large share of the symptoms, it is important to quote any corroborative evidence for the existence of such necrosis in so-called atrophic rhinitis. Such corroborative evidence will be

found in the valuable article on the "Pathological and Clinical Features of Atrophic Rhinitis," read by Mr. Wyatt Wingrave at a meeting of the British Laryngological and Rhinological Association, and published in the Transactions of that Society—Vol. III., pp. 66 *et seq.*, 1893. In this paper Mr. Wingrave states that, out of sixty cases observed by him, bare bone "was distinctly felt on probing the anterior ethmoidal cells in ten instances." That is to say, bare bone in the region named was detected by him in one out of six of his cases. He does not tell us whether he explored the posterior ethmoidal cells or their nasal wall, and from the absolute candour of his observations, the presumption is that he did not do so. This omission the author especially regrets, because it is exactly in this region he is most accustomed to find the evidence of bare bone in cases of Progressive Deafness with Tinnitus associated with atrophic changes in the ethmoid region of the nose. When the exploration of the latter locality comes to be more generally adopted, there is little doubt that a large increase in the number of cases exhibiting necrosis will have to be made on that given in Mr. Wingrave's figures. In the meantime it will suffice to note the corroboration afforded by Mr. Wingrave's observations, so far as they go, of the statements on this point long insisted upon by the author. In most other particulars the pathology of atrophic rhinitis is identical with that of necrosing ethmoiditis.

It seems necessary to remark that the stress laid upon the existence of nasal necrosis as a cause of the symptoms must not be interpreted to mean that it is the sole cause. There are, besides, the local conditions of the ear itself. The intent here is to emphasise the fact that, besides being a competent reflex cause of Deafness, Tinnitus, and Giddiness, the auditory apparatus cannot be efficiently dealt with on its own account, unless the ethmoidal necrosis is likewise treated.

The accomplishment of this latter object resolves itself into two parts:—First, the detection of the exact site of the bare bone by means of a suitable probe. Second, the treatment of the necrosis when so discovered. For the full consideration of these topics the reader is referred to the chapters on Ethmoiditis in the 2nd vol. of this work. This also receives a full share of consideration in the chapter on Treatment of Necrosing Ethmoiditis in the same volume.

It may be convenient to the reader, however, to anticipate here some details bearing on this part of the treatment, as follows. When the exact seat of the dead bone has been localised, the chromic acid carrier (previously prepared by dipping in a saturated solution of chromic acid, and evaporated to dryness over a small flame) should be applied to the spot. This is conveniently done by following up the probe with the carrier, gradually withdrawing the former and following on with the latter. The carrier may be allowed to remain in contact with the necrosed area about five minutes. At the expiration of this time a previously prepared *warm* solution of sodium bicarb. (gr. xx. to ʒj.) should be injected, first, through the opposite nostril to neutralise and wash out any free acid that might otherwise be swallowed, in the performance of which the patient should be directed to keep his mouth wide open; and, to secure the complete washing away of any superfluous acid, the injection should be repeated through the nostril in which the bone has been attacked.

If these precautions be observed, no inconvenience will arise from the application of the chromic acid.

The acid may be applied once weekly for three, four, or five times. It will then be usually found that a change has been effected in the bone, so that if it be lightly pressed upon by a rough-pointed instrument, such as a dental drill

or minute rosehead, it crumbles away under this pressure, and is so got rid of. If, as is often the case, more dead bone is found beyond that originally detected, the chromic acid treatment must be commenced *de novo* upon it, with the same precautions as already detailed, and so on until all is removed. This may take several months to accomplish, but the patient, having been previously instructed as to the probability of the length of time required to extirpate his disease, will, in most cases, be encouraged to persevere by the gradual improvement from the first in all the symptoms associated with his case.

Thus, he will say that his headaches and Vertigo, usually the first symptoms to be ameliorated, have soon entirely left him, whilst there is a marked modification in the constancy and irritating quality of the Tinnitus. Trigeminal neuralgias, the frequent accompaniments of Progressive Deafness, are also got rid of.

If, in the meantime, the treatment of the Eustachian tubes and cavum tympani have proceeded *pari passu* along the lines already indicated, there will be in many cases a marked improvement also in the hearing power.

Obviously all this will take place quickly and permanently in proportion as the patients are young in age, and come under treatment early in the course of the disease. The patient who is over fifty years of age, who has been deaf for many years, though gradually getting worse as regards his hearing and more worried with the noise, whose Eustachian tubes are abnormally patent, and whose tympanic cavities afford evidence of advanced sclerosis, are, indeed, objects for commiseration rather than for hopeful prognosis from treatment. From among this class it will occasionally happen that encouraging results accrue from treatment, especially when the nasal organs afford indications of marked disease. In every case of this kind,

however, it is not only politic but honest to lay before the patient the entire prospects of his position, so far as they can be ascertained. Should he then elect to be treated with the hope of rendering his life more tolerable, it can scarcely be the duty of the surgeon to deny him this chance. The real difficulty in such cases arises from our ignorance of the extent to which the perceptive apparatus has become involved in the fibrosing process. Atrophy of function in the nerve apparatus may reasonably be anticipated in an organ which has been in abeyance for twenty years. How far atrophy of tissue from invasion of the nerve apparatus itself may have to be reckoned with as a possible factor is at this date impossible to say, though there are reasons to believe that the nerves of special sense are exceptionally exempt from such invasion.

Even in the most promising examples in young people it is important to speak only of *improvement* as the result of treatment. The Giddiness and Tinnitus, the palpitation, headaches, &c., undoubtedly disappear altogether; but even in the most successful the hearing power, though restored to a point of great practical utility, is seldom placed on a normal footing.

The constitutional treatment of these patients is of paramount importance. The majority give evidence of depreciation of health, and many have a marked cachectic appearance. Nor is this surprising when it is considered what a large proportion of them suffer, or have long suffered, from post-nasal catarrh. As already intimated, the evidence of this condition is frequently obvious on inspecting the pharynx, even when the patient is unconscious of it. Such a continuous discharge passing into the stomach for a lengthened period of time must exert a deleterious influence on the health generally, even if it be not capable of a more specific influence. Considering

its source in the diseased ethmoidal tissues, where it is often delayed in its course to the posterior watershed of the nose until decomposition has commenced, it may fairly be questioned whether by the time it enters the stomach it does not possess the potentialities of a true virus. What may be the exact nature of the toxic endowment of these post-nasal discharges the author is unable to suggest, but it seems abundantly evident that some such process of auto-toxication is in progress in many of these patients. Such toxæmia of nasal origin may be safely predicated in patients whose Tinnitus takes the form of audible voices, who are depressed in spirits to the point of melancholy, and whose suicidal proclivities are distinctly marked. The author is unable to recall a single instance of this kind in which extensive necrotic nasal disease was not present, and not more than one in which the hypochondriacal state did not disappear with its removal.

In view of these remarks a question of great importance arises—viz., whether the particular poison in question, having found access to the circulation, has any special affinity for particular tracts of the sensorium—say, for example, the auditory centre? If this suggestion should prove to be correct, it might be possible to establish a causative relation between it and the symptoms under review. It is true this point, if established, would add but one cause more to the many already shown to underlie the conditions referred to. Even then we shall be conducted to the *causa causans* of the toxic material, which is the nasal fibrosis or sclerosis, and so we are brought back to the point where our inquiry started.

In the meantime, however, while as yet we are unable to positively point to post-nasal discharges as the direct cause of any one of the symptoms of Progressive Deafness,

there is no room to doubt their depreciating influence on the *general health* of these subjects. It is incumbent, therefore, in treating such a case, to direct immediate attention to the removal of these discharges, and further that this should be attempted as near the source in which they are generated as is practicable.

The first step in the accomplishment of this purpose is the frequent use of what is now generally known as the alkaline lotion, and which the author introduced into the Throat Hospital Pharmacopœia many years ago. Generally speaking, this is most conveniently and efficaciously applied to the interior of the nostrils by means of sniffing it through these organs, the fluid being placed within them by means of some convenient appliance adapted to this purpose. The *irrigator* introduced and figured in the author's work on "Post-nasal Catarrh," 1884, still appears to approve itself on the grounds of simplicity and efficiency. The nasal douche is not suitable for the purpose, neither is a syringe, save in exceptional cases, as in young children. It is well known that bicarbonate of soda is the chemical solvent of mucus. To act thus in the nose it must be applied in such a way as will secure its remaining in contact with the localities implicated as long as possible. Sniffing up a few drops of the solution at a time secures this prolonged contact more perfectly than a stream of the fluid rapidly and violently introduced can do. By the act of sniffing, moreover, the solution is made to enter the recesses of the cavity in a way impossible when a stream is forcibly impelled through the nose. The addition of a few drops of carbolic acid and tincture of iodine are distinctly advantageous by reason of their well-known aseptic and disinfectant properties.

With the view of further keeping up the deodorising effect in the locality it is a good plan to introduce a small

portion of wool saturated with iodoform or iodol. The former is the more efficient of these, but its smell is objectionable to many, and in some causes nausea, so that iodol wool is more generally preferable. It is necessary to observe in this connection that the ordinary 5 per cent. wool supplied by the chemists is next to useless, and, in prescribing either of these preparations, it is desirable to notify that a 50 per cent. degree of saturation is to be provided. After using the lotion an interval of half an hour should elapse before the wool is introduced, or otherwise it would be speedily washed away by the mucous flux which follows the former application. Whilst on the subject of washes for the nose—Collunaria as they are called—a word of caution should be given against their use whenever a wound has been made within the organ, whether by snare, galvano-cautery, saw, or otherwise. It is matter of experience that any aqueous solution introduced under these circumstances causes irritation, and occasionally severe pain and inflammation. Oily sprays, such as carbolised adepsin oil, are not open to this objection, but, under the circumstances referred to, the author prefers to insufflate twice or thrice daily a powder containing boric acid, iodol, and morphia (*see* formula). After an application of chromic acid as above detailed, there is not this inconvenience in having recourse to periodic washings; but even here it is preferable to wait forty-eight hours before doing so, and in the interval apply the snuff above referred to.

Internal remedies—such as tinct. fer. perchlor. quinine, strychnia, and hydrobromic acid—singly or in combination—should be associated with the local treatment. The perchloride of iron is the sheet-anchor in these cases. Largely diluted, it exerts an aseptic and eliminating influence upon the toxins generated by the disease, while at

the same time reducing the anæmia resulting from the absorption of these poisons into the system.

In conclusion, it is to be noted that the success of the line of treatment above advocated depends largely on the persistency with which it is carried out. For it is a discouraging fact about many patients of the "progressive" type of deafness that, though improvement in hearing and diminution of the Tinnitus will take place after a few weeks' treatment, yet when this has been discontinued for a time the good effect tends to pass off, and the patient relapses into something approaching his antecedent state. It is just here that the treatment should be renewed; before, that is, the relapse has advanced to any considerable extent. Therefore in two or three months after the first course of treatment the patient should return for its renewal. On such subsequent occasions three, four, or five repetitions, at weekly intervals, will generally suffice to secure a further advance. This succession of short treatments, followed by increasing intervals of rest, may be prolonged over one, two, or more years, with the result of effecting occasionally complete recovery, and nearly always with a maintenance of improvement in all the symptoms.

## CHAPTER VIII.

### TINNITUS ARISING IN THE MIDDLE EAR.

#### CLASS II., SCHEME.

##### *Tinnitus arising in the Tympanic Cavity, or Middle Ear.*

THE sounds heard by patients comprised in this group have their origin presumably in the middle ear, in which region the abnormal conditions are mainly located. In the preceding class the noises were found to be referable to nerve reflexes whose origin was largely nasal. The experienced reader will understand that it will often be difficult to draw any hard-and-fast line between the origin of some of the noises heard in both these groups; because, undoubtedly, severe middle ear catarrhs are frequently accompanied by pre-existing nasal lesions—in fact, they are seldom so unaccompanied. Hence, the forms of Tinnitus about to be considered, though owning a distinct local causation, are apt to be mixed up with the Tinnitus originating in nasal reflexes, and overlapped by it.

The author does not propose to enter exhaustively into the subject of middle ear diseases, inasmuch as they are well considered in every text-book on diseases of the ear—they afford the coarsest and therefore the most readily observed lesions, so that errors of diagnosis are not very likely to occur in regard of them.

(a.) *Bubbling, bursting, or gurgling sounds* are occasionally complained of, and may be referred to the presence of fluid in the middle ear, usually of a catarrhal origin.

In the author's experience, these sounds are more rarely complained of than they used to be, a fact which points to the improved methods of dealing with the morbid states on which they presumably depend. A sensation resembling the *bursting of bubbles* in the ear has been referred to the elimination of putrefactive gases, when decomposing fluid is confined within the cavum tympani. This symptom must be very rare, though one could wish that such a pathognomonic indication of pent-up fluid, often very obscure and difficult to make out, were more frequently met with whereby to indicate with precision the necessary lines of treatment.

(b.) *Congestion of the tympanic cavity.*—It is well known that the exclusion of air from the middle ear, by whatsoever cause it may be occasioned, produces a mechanical dilatation of the vessels of the cavity by altering the physical relations on which their normal calibre depends, and that this condition is usually associated with Tidal Tinnitus. Such a state of passive vessel dilatation obviously cannot long be maintained without passing into inflammation, an acute *otitis media* being thus established. In the latter state there is no more constant symptom than severe Tidal Tinnitus. Its causation under these circumstances is a matter upon which opinion differs widely. It cannot be, in the case just supposed, where air is excluded from the tympanum, that the augmented vessel vibrations are communicated to the air in the middle chamber and so to the conducting apparatus, through which they reach the auditory nerve, because, *ex hypothesi*, there is no air present to become the medium of such vibrations.

In this relationship it should be noted that the tubes in *otitis media* are rarely quite impervious to air for any length of time, especially if appropriate measures have been adopted to secure their patency; and yet the Tinnitus,

though sometimes relieved by such treatment, usually remains long after a healthy state of the tubes is restored.

It must not be forgotten that Vertigo is frequently present in the early stages, at any rate, of any form of acute inflammation of the middle ear—whether suppurative or hyperplastic—a phenomenon which, though it may possibly be produced by severe pressure upon the fenestræ, is, as we have seen, more usually due to reflex irritation of the vestibular nerve. It is probable, therefore, that a large share of the Tinnitus in these cases acknowledges a similar origin, through the cochlear nerve.

Other factors which may go some way to account for this symptom—for patients describe very differing sounds which alternate with each other or are audible at the same time—are contraction of the tensor tympani muscle already examined, and a murmur originating in the dilated and congested vessels of the cavity.

It has already been argued that dilated arterioles *in the labyrinth* give rise to Pulsating Tinnitus, because of the proximity to the perceptive apparatus in the midst of which the dilated vessels are placed. In the middle ear such dilated arterioles are further removed from the auditory nerve, and before reaching it the pulsations become modified into a rhythmic murmur.

Another way in which Tidal Tinnitus may be caused was suggested by the author in his paper on the subject read at Copenhagen in 1884.\* It depends on the presumption—which is almost an established physiological fact—that air passes into and out of the Eustachian tubes with each act of respiration. This, it is assumed, would provide a movement corresponding to the quasi-rhythmical sound

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\* Transactions of the International Congress of Medical Sciences, Copenhagen, 1884. Vol. IV., p. 16.

of Tidal Tinnitus. This air current in a healthy state of the organs is inaudible, but when the tubes are inflamed the elements of narrowing, roughness, and rigidity are introduced, which completely change the normal physical relations between the lumen of the tube and the air passing through it. The effect is compared to that of a stream of water which passes noiselessly through a wide and deep channel, but becomes a noisy torrent when its banks are narrowed or its course obstructed.

That this air current may in certain cases contribute to the multiplicity of sounds which go to make up the symptom of Tinnitus was proved in the case of a patient who was the subject of advanced progressive deafness, with wide patent tubes and general naso-pharyngeal atrophy. It was a repeated experience in this case to hear distinctly the respiratory murmur through the otoscopic tube, the inspiration and expiration being quite distinct, though rhythmical. Careful examination failed to detect any movement of membrane in correspondence with these sounds. In a second case, where the ossicles were fixed and an interstitial deposit existed in the posterior upper segment of the left membrane, a to-and-fro motion of a limited portion of the membrane, including the deposit, was very apparent, and this movement was synchronous with the acts of respiration, but slightly behind them. An incision through this portion of the drumhead, followed subsequently by pneumatic suction, considerably reduced this patient's Tinnitus.

It must be admitted, however, that such a demonstration of the conditions above described is extremely rarely met with. The subject appears to the author worthy of more attention than it has hitherto received.

The foregoing kind of Tinnitus, due to inflammation of the middle ear, must be treated by measures directed to

the removal of that condition, respecting which it has already been stated any text-book on ear disease will furnish the details. Disappointment will not unfrequently attend such treatment, even when this has been so successfully carried out as to remove the local ear mischief and restore the organ to a fairly normal state. It is under these circumstances that it becomes necessary to bear in mind the liability of nasal disorder to complicate that of the ear, and its potentiality to produce reflex Tinnitus. Under these circumstances ethmoiditis should be searched for, with a view to detect a hidden necrosis, which may always be suspected if what is often called the atrophic stage of the nasal disorder has been reached. The lines of treatment to be then adopted are given in the chapter on Progressive Deafness.

The author would here lay still more insistence on the conviction which every year impresses itself more forcibly on his mind—viz., that diseases of the nose, naso-pharynx, and middle ear, when associated, possess one uniform type—that is, they are of the nature of fibrosis. Speaking, that is, of ordinary catarrhal affections of these regions, whether they be so-called dry catarrhs, or are attended with discharge of mucus or pus, excluding, of course, such heterologous changes as fibromata, traumatic lesions, or malignant disease, &c.

Should the reader pertinently ask, What about ear lesions in the exanthemata? the author would reply, that vastly more patients recover from these ailments without ear complications than those in whom scarlet fever, measles, &c., is attended with ear trouble. What is it that makes this difference? Obviously there must be something more present in the constitution of those who do thus suffer than is the case with those who do not. It is the author's conviction—the reasons for which are given when this subject

is more fully under discussion at a later page—that this something is the presence of fibrosis. This statement predicates the existence in a large number of the human family of a particular diathesis—the fibrosing diathesis. The subjects of this constitutional tendency are born with it, they inherit it just as the gouty, or tuberculous, or other diathesis is inherited. When it affects the mucous tissue of the upper air tract it manifests its presence early in life by the ease with which the fibrosed tissue breaks down under the stress of exanthematous diseases, by the proclivity to post-nasal growths, and later on to the development of ethmoiditis—of hyperplastic middle ear disease, equally prone to become a suppurative catarrh, on due excitation—and later still, even when they may have escaped all the preceding dangers, by the development of atrophic catarrh of the naso-pharynx and ear.

The foregoing contention, if it can be sustained, will at least have the merit of harmonising and simplifying many otherwise obscure and discordant points with which otology is crowded. Hitherto scattered, disconnected, and puzzling, they become so many consecutive links of a chain the elemental unity of which is supplied by the presence of a deteriorated fibrous tissue, having its own proclivities of change as development advances, and which entail on their possessor, along with many other troubles, most of the conditions of which we have latterly been treating.

## CHAPTER IX.

### TINNITUS ARISING IN THE EXTERNAL EAR.

#### CLASS II., SCHEME.

THE abundant nerve supply of the external auditory canal is presumptive evidence of its capacity to give rise to reflex symptoms whenever it is itself the seat of diseased or abnormal conditions.

These nerves are derived from two sources. The main supply consists of branches of the auriculo-temporal, a branch of the third division of the 5th nerve. There is another small branch from the vagus, the auriculo-pneumogastric, or Arnold's nerve, which is usually but not invariably distributed to the floor of the external canal. Both these are sensori-motor in their endowments; the latter is specially available for experiment, and from it we may derive some instructive lessons concerning the behaviour of the former when subjected to like circumstances of irritation.

Every surgeon who is in the habit of using the ear speculum is familiar with the phenomenon of spasmodic cough which is thereby induced in a certain number of subjects, and which symptom is known as *ear-cough*. It is almost needless at this date to observe that the cough in question is induced through irritation by the speculum of the auriculo-pneumogastric in the meatus; this irritation is reflected along the motor fibres of the superior laryngeal nerve (another branch of the vagus), and so excites in the larynx the act of coughing by causing contraction

of the crico-thyroid muscle; in some very susceptible persons vomiting is also induced. Now, *impacted cerumen* occasionally has the same effect, and patients with an otherwise unexplainable cough should have their external ears examined to exclude this possible cause.

Miss Edgeworth relates a case in which a practical use was made of this correlation of areas. At a certain feast in Norway one of the guests, an ecclesiastical dignitary, showed signs of choking. Thereupon some one present commenced a vigorous blast of air with a bellows into the priest's ear. The effect was magical; the expulsive action of the laryngeal muscles thus called into action speedily got rid of the food which had gone "the wrong way"; an incident worth noting on account of the practical lesson it conveys. This nerve, the auriculo-pneumogastric, is also known as the *aldermanic* nerve, because the sated feaster is said to stimulate his capacity for more food by tickling the auditory meatus with the wetted corner of his napkin.

These homely illustrations of reflex-muscle excitement on the part of the pneumogastric nerve in the ear, the phenomena of which can clearly be traced, though they have nothing to say to Tinnitus, are introduced to show the parallel sort of reflex action which is set up by irritation in the meatus of the much larger nerve supply from the auriculo-temporal of 5th. Furthermore, the typical character of the series of occurrences due to this particular correlation of areas—viz., external ear and larynx—may be extended to illustrate the method by which trophic tissue changes may be induced in the ear through the medium of its nerve supply.

The following example of trophic changes in a reflex area is afforded by Arnold in a case of a girl suffering from persistent cough and profuse expectoration, accompanied with emaciation. It transpired that the girl had many months

previously introduced a bean into each ear, where they were severally discovered on visual examination. After removal of these foreign bodies, the symptoms ceased and the patient recovered.

The following is the explanation of these events:—The irritation of the sensitive fibres of the auriculo-pneumogastricus excites the act of coughing in the manner already explained. In some very susceptible subjects the reflex excursion through the vagus may extend to the stomach and lead to vomiting also. These muscular spasms would appear to represent the limit of reflex influence due to the *excito-motor* elements of the nerves implicated in the respective regions. Yet if the stimulus be sufficiently prolonged, as in Arnold's case, other conditions ensue—viz., *tissue changes*—which make the evidence of participation in the process of the vaso-motor elements supplying the region quite unimpeachable. We then see structural lesion added to functional derangement, not by varying the experiment, but simply by prolonging it.

What happens under these circumstances will become evident on reference to the accompanying diagram (Fig. 4). The original irritant in the external auditory canal, *e.g.*, a bean, by its continued presence involves the vaso-motor fibres associated with the auricular nerve (1), and they conduct their impression to the secondary vaso-motor centre, the ganglion of the pneumogastric, and thence it is shunted through a sympathetic fasciculus proceeding from it to the first cervical ganglion (2). This latter furnishes the *nervi molles* to the external carotid artery and its branches, and therefore to the vessels supplying the mucous membrane of the larynx (5). In consequence, there will commence in the latter that train of symptoms which we have already noted as the result of reflected vaso-dilator impressions—viz., congestion of the

vessels supplying the mucous membrane of the part, and shortly effusion from these vessels. In other words, a profuse mucous secretion is set up, assuming a muco-purulent

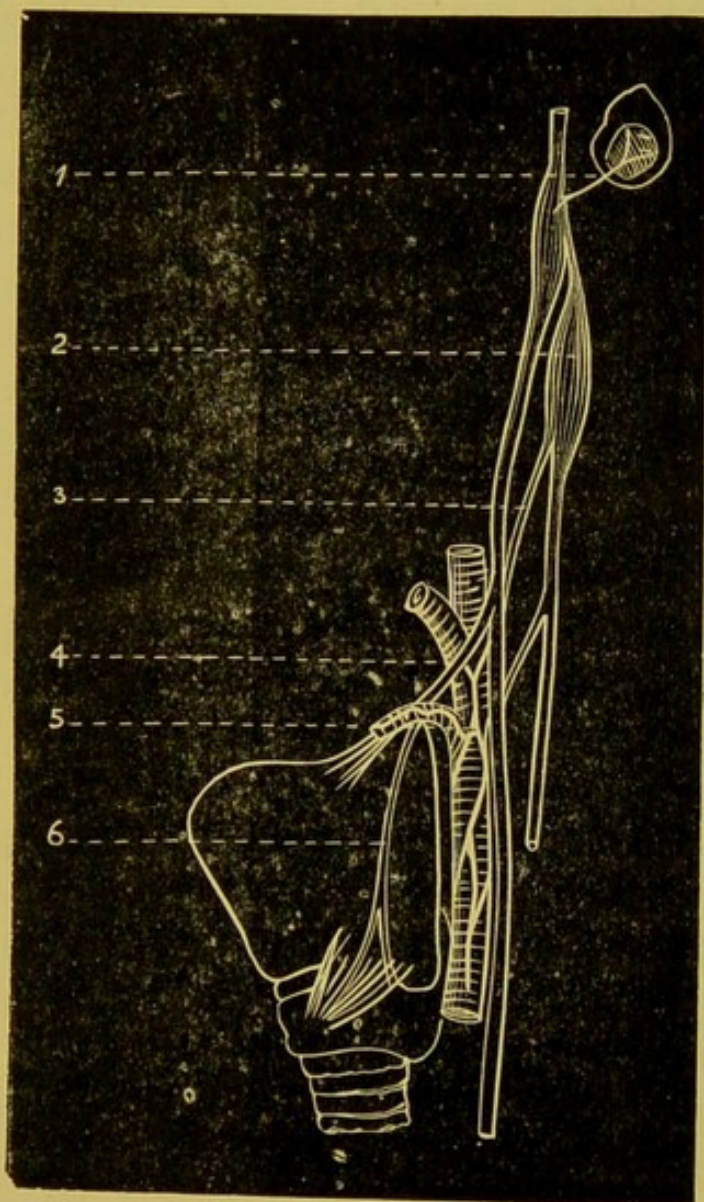


FIG. 4.

1. Auriculo-pneumogastric nerve passing from the 2nd ganglion of the vagus to the external auditory canal.
2. 1st cervical ganglion of sympathetic receiving br. fr. ganglion of vagus and giving off.
3. Nervi molles to external carotid, and its branches, 4.
5. Laryngeal artery, with vaso-motor *n* distributed upon it.
6. Superior laryngeal nerve supplying crico-thyroid muscle.

character, if the irritation, as in the instance before us, be sufficiently protracted.

In an impartial review of the first edition of this work by Dr. Orne Green (*Boston Medical and Surgical Journal*, December 25th, 1879) it is suggested that the commotion of the larynx, consequent on the cough, might be the cause of the local inflammatory mischief in this organ observed in the case under comment, and in others analogous to it. This alternative explanation had not escaped the consideration of the author—it is, indeed, the one ordinarily adopted. It failed to commend itself to his acceptance chiefly because such laryngeal complications are frequently—one might say usually—absent in chronic bronchitis, whooping cough, and other diseases in which the larynx is even more violently commoted than in the case referred to in the context.

Parallel sources of reflex trophic changes in the middle ear will meet us all along the line of our present studies. It will be well, therefore, at starting to get clear ideas on the subject. To this end the following case is introduced as having a typical value.

Many years ago the author was consulted by a gentleman for otorrhœa of the right ear of considerable standing, and in which excrescences of granulation tissue were present in the fundus; a further symptom was very troublesome Tinnitus.

The growths were removed with forceps, and all the then known resources of otological art were brought to bear upon the disease. Still very little impression was made upon it; when the granulations were removed, they recurred in a few days, which seemed the more remarkable as no caries or other local irritant could be detected to explain this recurrence. It did not, therefore, occasion the author much surprise when, after some months of persevering compliance with his treatment, the suggestion to again destroy the growths elicited a decision on the patient's

part to obtain another opinion. Fortunately for my late client he sought the advice of an eclectic practitioner, who on learning his history, examined his teeth, and advised the extraction of a decayed lower molar on the same side. Whereupon, without other treatment, this long persistent otorrhœa cleared up, the granulations disappeared, and the patient rapidly recovered.

Now this decayed tooth did not ache, there was neither pain nor swelling between it and the ear—nothing, in fact, to draw attention to it. The two-fold lesson of this experience was not to be easily lost. First, the *practical lesson* which the author readily admits he ought to have anticipated even in the archaic era of ear-knowledge to which this case dates—viz., that of including the teeth as a possible source of reflex irritation in very chronic cases of ear disease. Second, the necessity for tracing out and defining the mechanism of the tissue changes induced by the teeth in the auditory apparatus. At any rate, there could be no question in this instance of muscular commotion of the affected organ which might tend to keep up suppuration in it.

Another case illustrative of the capacity of a morbid state of the teeth to produce ear symptoms is that of a patient, a middle-aged female, in whom biting a crust or other similarly resisting substance gave rise to a loud twanging sound in the ear. This noise was of short duration, and seems to point to a reflex contraction of the tensor-tympani muscle excited through the sensitive condition of the dental nerve when thus subjected to pressure.

The due remembrance of these cases will render us better prepared to enter upon the consideration of the complicated phenomena to which Tinnitus originating in the external ear introduces us. These phenomena bring us in contact with a wide range of conditions, extending from

the presence of some tightly fitting plug of cerumen, causing perfect occlusion of air, to the presence of eczema, fungi, insects, and other foreign bodies, in all which the air has free access to the drumhead. All of these, although presenting us with very opposite conditions, are attended with obstinate Tidal Tinnitus, so long as the exciting cause remains.

One, at least, of the factors of Tinnitus excited by the above-named irritants in the external canal is contraction of the tensor-tympani muscle. Its explanation runs on all fours with that advanced in the case of ear cough just examined. Only we have in Tinnitus arising in this region to do with the branches of the auriculo-temporal of 5th, instead of those of the vagus.

Substitute the third branch of the 5th in the case of disease of the external ear for the first and second branches, which are the seat of irritation in progressive deafness, and the explanation of Tinnitus due to contraction of the tensor-tympani muscle therein described will apply equally to the present situation. It is unnecessary, therefore, to repeat it. Indeed, it would seem more in order to refer Tinnitus arising out of morbid states of the external ear to contraction of the tensor-tympani muscle, because that division of the trigeminus nerve which is distributed to the external auditory canal is also that which supplies the muscle in question. A reflex spasm in it in the latter case would be more direct, and therefore more intelligible, than in the former.

But other symptoms besides Tinnitus very frequently attend disease of (or the presence of an irritant in) the external canal. These are Vertigo in its most aggravated forms: headache; a sense of dulness and oppression in the head, sufficient often to obscure the mental faculties as well as to depress the physical energy of the patient.

In fact, the parallelism between the symptoms caused by ethmoidal disease in the nose and those associated with lesion of the external auditory canal is such as to compel the conclusion that a common factor is operative in both to bring about such a complete similarity of symptoms. The only factor common to both these regions is that already indicated—viz., their nerve supply from the various divisions of the same nerve (the 5th). Hence the same line of argument which was adduced to explain the symptoms in the one case is equally applicable to the other. It has been seen that the noises heard by the patient are of a varying and mixed character, which correspond with the complication of causes they acknowledge. Some of them in both classes are due to reflex contractions of the tensor-tympani muscle; but, as we have already seen, this alone is incompetent to explain the intensity and persistency of the Tinnitus in either, and is quite insufficient to account for the collateral symptoms.

It seems obvious, therefore, that we ought to refer the larger share in the production of the Tinnitus in both classes of patients to implication of the cochlear nerve of the octavus, while to the simultaneous implication of the vestibular section of the same nerve is due the Vertigo—in the same way as this symptom has been traced to it in the ordinary forms of so-called Menière's symptoms.

To this reflex implication of the octavus may also be consigned the headache, mental confusion, as well as the attendant physical depression.

Just as the parallelism between the symptoms which complicate external ear affections with those associated with tympano-nasal disease has been insisted upon, so is it necessary to direct attention to a marked divergence between them. It is this: while in the former the symptoms, though equally severe with those present in the

latter, yield and disappear totally with the removal of the cause, which in many instances can be accomplished rapidly by the interference of the surgeon; in the latter it is not so, many months of patient and laborious treatment being required to eliminate the double mischief with which the surgeon has then to contend.

#### IMPACTED CERUMEN.

Strange as it may seem, this condition of *impacted cerumen* is the source of more errors of diagnosis and more inefficient or even harmful treatment than happen in respect of any other affection of the ear. The author, therefore, does not apologise for the following details in respect of it. Usually it is at the starting-point, when the question is one of diagnosis, that the first mistake is made; almost any complaint of deafness on the part of a patient sufficing to secure for him a "good syringing." Now it cannot be too strongly insisted upon that this proceeding is positively injurious when, as often happens, the ear is quite free from cerumen. The first point, therefore, should be to ascertain the state of the external canal in this respect, and to do this satisfactorily *reflected* light should be used by means of a forehead mirror and lamp, the meatus being gently opened by a Kramer's or bivalve speculum, or ear funnel. In many cases the accumulation is so near the orifice that a glance suffices to assure the observer of its presence. But in a considerable number of instances the plug is more deeply seated, and requires careful searching to make it out. Having convinced himself by these means of the presence of a substance the removal of which is a necessity, the next question for the practitioner to decide is, What means should be adopted for the purpose? In by far

the larger number of cases, the author is satisfied that the course to be adopted is to soften the mass by the use of warm solution of soda bicarb. gr. vj.- $\bar{3}$ j: poured into the ear and allowed to remain in contact with its contents for some fifteen or twenty minutes—a proceeding which may be repeated on three or four successive nights—rather than at once to have recourse to syringing. When this plan is adopted the patient should be warned of the probability of his becoming more deaf in the interval, as the cerumen which is dissolved by the alkaline solution runs into and fills up all the spaces previously existing between the walls of the canal and the mass, so that the passage of sound is now more effectually excluded than previously. This, however, is a minor inconvenience compared with the advantage gained by this method when the time for syringing arrives, as it will then be found that two or three syringefuls of the warm solution of soda, gently but steadily injected, will suffice to remove all the offending matter. The canal should be visually inspected after each syringeful introduced into the ear. This will enable the operator to avoid, on the one hand, impelling a stream of fluid upon the delicate drumhead, which would happen if the syringing were prolonged beyond what is necessary for the removal of the wax; the then unnecessary syringing is attended only with evil to the patient; while, on the other hand, it will enable the surgeon to feel satisfied that everything is removed which interferes with a view of the fundus, and thereby to know that his operation has been efficiently performed.

Other details which facilitate the foregoing process are the following:—Before commencing to syringe, the auricle should be drawn gently upwards and backwards with the left hand of the operator, a proceeding which will open

the meatus to its fullest extent, and enable the next point to be attended to. This consists in carefully observing, by means of the light reflected from the mirror, any spot where a chink or space exists between the mass and the boundary walls of the canal containing it, as it is into this space the stream of water should be directed. For it is the return current, consisting of that portion which finds its way behind the mass that secures its expulsion. To effect this object the nozzle of the syringe should have a tolerably fine bore, and the capacity of the instrument need not exceed 2 ounces. The ordinary ear syringe of the shops is greatly in excess of the requirements of the case, and its coarse nozzle is subversive of any nice adjustment of the means to the end to be accomplished. After syringing, it is desirable to dry the ear by carefully introducing a shred of absorbent cotton wool, in order to prevent the evaporation of the residual fluid, and the consequent chilling of the organ.

There is a form of accumulation in the external ear which, from the trouble it occasions, requires a special comment. It consists of layers of desquamated cuticle derived from the canal, mixed with secretion and loose shreds of epidermis, and still adhering to the walls of the canal by reason of the imperfect separation of the outer layer derived from these. Such a mass is called by some writers *Cholesteotoma*. It appears to originate in a chronic state of inflammation of the corium, and occasionally involves the outer layer of the drum membrane, a cast of which may be thrown off when extrusion of the mass is secured. This disease obviously involves conditions of a much graver character than the preceding form of accumulation of wax pure and simple. Both conditions, however, the lighter equally with the graver, must be regarded as owning an inflammatory origin, though in the

former the hyperæmia is confined to the region of the ceruminous glands, while the latter involves the entire cuticular area of the external auditory canal. They have these points in common: both conditions are met with at all periods of life after infancy; both are alike liable to recur. It has been pointed out, the author forgets by whom, that ordinary excessive secretion of the ceruminous glands usually coincides with some form of pharyngitis—an observation which is in accord with his experience. He would, however, go farther and extend the parallel to cases of cholesteotoma, in which likewise he has usually observed co-existent pharyngeal catarrh. It is to be noted that the pharyngitis here referred to is usually present as an affection due to some form of chronic nasal disease, for the most part ethmoiditis. When such a combination exists, the hyper-activity of the ceruminous glands is to be regarded as a vaso-motor reflex due to the persistent nasal affection.

The treatment of this latter phase does not differ largely from that of the former variety of obstructed canal. It requires, however, more care in the syringing, so as to avoid irritation from this source. It is better to give several sittings for this purpose, the intervals being utilised to introduce the alkaline solution, rather than to attempt removal at once. Even then it may be necessary to remove shreds of loose epidermis with suitable forceps, on the delivery of which syringing has little or no effect. Some care, too, should be observed in the after treatment of these cases, in order to prevent myringitis, or inflammation of the memb. tymp., which is already *in posse*. To this end, the canal and membrane should be dusted over with finely powdered boric acid, applied by means of an insufflator, and repeated once or twice weekly for some period.

It is in accordance with the observations respecting the concomitant affection of the pharynx and nose that in the

author's experience the most reliable prophylactic against the recurrence of either of the foregoing ailments is to treat the naso-pharyngeal catarrh.

The relief of the symptoms produced by the pressure of a plug in the external auditory canal—viz., deafness, giddiness, and Tinnitus, together with a sense of compression about the head—which follows its successful removal is so immediate and so complete as to be little short of the miraculous. The gratitude of the patient is wont, likewise, to be expressed with corresponding emphasis.

Since the foregoing remarks were written, an example of mismanagement of an ordinary case of impacted cerumen has occurred to the author, which appears to more than justify the insistence bestowed upon the subject in the foregoing pages. A young medical man, suspecting himself to be the subject of such a plug in his right meatus, called in the services of a neighbouring practitioner to syringe his ear. Owing to some awkwardness of manipulation, this friendly doctor succeeded in driving the nozzle of the syringe right through his patient's drumhead, with the result of inducing an otorrhœa and permanent perforation of somewhat large proportions.

#### ECZEMA AURIUM.

This affection is a frequent cause of Tinnitus; not so much in the gross form in which the entire external auricle is affected (which cases ordinarily find their way to the Skin Departments of the Hospitals, and differ in no respect from eczema occurring in other localities) as in those cases in which the disease has its habitat within the external canal, and is limited or mainly limited to this area. It is true that this latter class may remain as a legacy of the former, in which the disease commencing in the auricle

extends insidiously into the external canal, where it is very apt to become a chronic condition, because the local treatment is not extended to this region. The cases, however, to which it is especially desired to draw attention are those in which eczema begins in the canal, and, as a rule, is confined to it. Occasionally even in these examples the skin-space between the tragus and anti-tragus exhibits traces of excoriation, or such excoriated patches may be found hidden in the folds of the pinna if carefully searched for—an external indication of the deeper-seated mischief suggesting its presence, and calling for careful examination of the external canal. Such an obvious irritation of the external integument naturally simplifies the diagnosis. The real difficulty arises when there is nothing to suggest the presence of eczema apart from the actually observed condition of the meatus externus. Under these circumstances the patient complains of slight deafness, with usually mild Tidal Tinnitus. In severe cases of the skin affection both these symptoms will be more pronounced.

*Diagnosis* is simplified when the subject of these symptoms exhibits absolutely negative indications as regards the rest of the auditory apparatus. This may seem an obvious remark, on the supposition that a casual examination of the external canal would at once yield satisfactory evidence of the presence of eczema. But such is by no means the case in a considerable number of examples, and it requires very careful examination of the canal with a good light to detect its milder phases. These are evidenced by a scaly appearance of the cuticular surface, which may be either general or confined to patches. The floor of the canal should be searched for deposits of the shed epithelium; and very often the surface of the membrane—which it is not unnecessary to remind the non-specialist reader is

itself constituted of a thin stratum of skin, continuous with that lining the meatus—this cuticular surface of the membrane will, under the circumstances, present a roughened, almost powdery, aspect, showing that cuticular desquamation is in progress here also. These, then, constitute the cases which are difficult to make out; the diagnosis will often be aided by questioning the patient as to his experience of eczema in other localities. Such questioning, suggested by the foregoing appearances, has frequently elicited the information that the subject of them has the rash elsewhere; moreover, he will often by his answers reveal that he has a gouty proclivity.

It is a fact worth recording that the patient whose one ear exhibits these slight traces of eczema will have in the other more or less marked stages of *exostosis*. As this latter condition has not in the author's experience any causative relation to Tinnitus, this reference to its possible etiology in the diathesis under review is all the notice it demands in this connection.

Eczema, limited to the external canal, will be met with in every phase, from that just insisted upon to a degree corresponding with its severest forms in more exposed situations. Thus, upon a markedly inflamed base, the surface will show fissures in the cuticle from which an ichorous fluid, usually scanty, oozes, and, mixing with the desquamated epithelium, collects at the external meatus; this, to the casual observer, will suggest the presence of an otorrhœa. The skin in severe eczema is swollen and the orifice narrowed to an extent that does not obtain in the latter disease. A careful inspection of the discharge will readily differentiate it from the muco-purulent secretion of the middle ear affection. It is not, however, beyond the range of possibility that the implication of the drumhead in the eczematous process may involve its deeper layers,

and even lead to perforation and a possible middle ear catarrh: thus reversing the condition frequently observed amongst hospital out-patients, especially children, where a neglected otorrhœa induces eczema of the external ear.

No doubt there are cases of Eczema Aurium which rival in their obstinacy in resisting treatment some instances of the disease which occur in other regions. One such case occurred in the author's Department at the London Hospital, and, being instructive, may interest others. It was that of a young woman, aged about twenty, who had for some months been the subject of a well-marked eczema of the right external meatus, encroaching slightly upon the concha, and showing a well-defined excoriation or fissure of the cuticle, between the tragus and anti-tragus. She had slight deafness and Tinnitus of a tidal type, otherwise she was in good health. Some improvement at first attended treatment on the lines indicated below, but the rash shortly returned as at first. A solution of nitrate of silver, later on, appeared likely to prove efficacious; but this ultimately failed. In short, every kind of treatment appeared beneficial at the start, but was ultimately followed by a return to the *status quo ante*. After several months of treatment with results of this negative character, it occurred to the author to examine the nose, which, contrary to his usual custom, had been in this instance omitted. The right nostril showed a well-defined proliferation covering the anterior margin of the middle spongy bone. On examining the nasal wall between it and the spongy process, the locality adjacent to the orifice of communication with the anterior ethmoid cells was felt to be rough and bare—*i.e.*, there was a distinctly marked area of necrosis in this locality. Although familiar with various forms of skin rash on the face in association with necrosing ethmoiditis, the author had not previously noted such an association in connection

with the external ear. Adopting the suggestion which the foregoing observation afforded, further treatment of the rash was discontinued in order to pursue that of the nasal affection. This was effected chiefly by local applications of chromic acid to the necrosis. The result was that the rash in the ear disappeared simultaneously and *pari passu* with the removal of the nasal disease.

The *Treatment of Eczema Aurium* will depend upon the degree of severity in which it is present. It is both local and constitutional. Where there is swelling, tenderness, and discharge, the first principle of treatment in this, as in all other diseases of the ear, is to secure perfect cleanliness, with the object of preventing the secretions accumulating and decomposing in the depths of the canal. For this purpose the warm alkaline lotion should be gently syringed into the canal once or twice daily. After an interval for draining, an application of carbolised vaseline, one drop to half an ounce, should be carefully applied to the excoriated surface by means of a soft camel's hair brush.

After subsidence of the acute stage, a mercurial ointment may be substituted for the preceding:—

℞	Hydrarg. ammoniati .....	ʒss.	
	Vaseline.....	ʒss.	
	Ac. carbol. ....	℥i.	
or,			℥.
℞	Ung. hydrarg. nitratis .....	ʒi.	
	Vaseline .....	ʒiij.	
			℥.

In the milder type of the disease syringing should be dispensed with if possible, and is only indicated where detritus has accumulated and must be got rid of. These cases are frequently cured by a daily application of the

dilute citrine ointment carried out for a week or ten days, and with it the Tinnitus will disappear likewise.

It is undeniable that cases of eczema will be encountered by the aurist of an equally persistent and perverse tendency as in other localities, where this disease often taxes the resources of the dermatologist.

It is probable that some assistance may be derived from constitutional measures. These may be summarised by a positive and a negative suggestion.

Alkalies and arsenic assist; whereas iodine (in the form of iodides, iodoform, iodol, or any other of its compounds) not only give no relief, but usually aggravate the symptoms.

#### FURUNCLE.

*Furuncle of the External Ear*, called also *Circumscribed Inflammation of the External Ear*, is usually, but not always, associated with Tinnitus of a tidal character. The prominence of this symptom depends very much upon the situation of the disease, it being more marked when the furuncle is deeply seated in the canal than when it is nearer to the orifice. Under any circumstances this disorder is of importance, not only from the severity of the pain and constitutional symptoms which may accompany the attack, but from its tendency to recur, not only in the ear first affected, but also in the opposite one. In a certain number of cases, moreover, sinuses may remain, leading to necrosis of the deeper-seated tissues, cartilage, or bone which the severity of the initial inflammation may have involved in its progress. To these extreme and comparatively rare sequelæ reference will again be made.

The *etiology* of Furuncle, equally with that of eczema may usually be assigned to that constitutional dyscrasia commonly described as the gouty diathesis. At any rate,

it seems to acknowledge as its predisposing cause some vice of metabolism in the processes of digestion, the outcome of which is to engender a state of system somewhat obscurely indicated by the term *lithiasis*. The marked tendency to recurrence favours some such diathetic hypothesis. It is a trite commentary on the foregoing observations that this form of disease is most frequently, in this country, met with in the well-to-do classes of society—at least, this has been the author's experience.

Whatever be the condition of constitution which *predisposes* a patient to become the subject of Furunculosis, modern research leaves no doubt about the nature of its immediate cause, and thereby affords definite and practical guidance for the prevention and cure of the affection. As far back as 1880 Pasteur made some culture experiments with pus from furuncles, and with blood and serum derived from others which had not yet suppurated. He found in every case a uniform generation of a peculiar micro-organism in the culture medium, consisting of very minute round granules varying from 0.5 to 0.8 mil. ( $\frac{1}{2000}$  to  $\frac{1}{1250}$  inch) in diameter. They were sometimes associated in pairs, more rarely in fours, but often in small agglomerated masses. The organisms — called staphylo-cocci — thus obtained were always the same, and without admixture with any others; cultures from the blood itself, derived from these furuncular patients (other than from the furuncle itself), gave negative results. From other experiments also it would appear that the organism cannot live in the blood, and Pasteur explained this by the resistance and refusal on the part of *healthy* blood to yield its oxygen to this aerobic <sup>e</sup>microbe, to whose existence it is essential. Pasteur, however, admits the possibility of the cocci being carried by the blood from the furuncular foci to other regions in which they may, perhaps, develop. Pasteur prosecuted

these investigations in other directions, and from the discovery of similar organisms in the case of osteo-myelitis, he speaks of this affection as one of furuncle of the medulla of bone.

Löwenberg has also devoted considerable attention to the pathology and treatment of furuncle of the ear. From his experiments and clinical observations, embodied in a communication to the Academie des Sciences (*vide Comptes Rendus*, 1880), and in a series of papers published in the *Progrés Medical* for 1881, he arrived at the following conclusions:—

1. Furuncle is caused by a microbic infection derived from external media, and invasion takes place through the cutaneous (pilo-sebaceous) follicles.

2. The commonly observed recurrence of furuncles in the same individual comes about through auto-contagion, by transmission of micro-cocci to the cutaneous surface.

3. The affection may be similarly conveyed from one person to another—*i.e.*, furuncle is contagious.

4. Invasion of the blood current by these micro-organisms (which is, however, rare) may occasion internal lesions (metastatic abscesses) in some cases of carbuncle, and even of furuncle, and may lead to a fatal termination.

Passet made extended researches in 1884 into the conditions of development and pathogenic significance of the staphylo-coccus group (*vide Fortschritte der Medicin*, 1885). These organisms are very constantly found in pus and tissues of men and animals in various pathological states, and may be cultivated in gelatine. Passet finds that the pathogenic characters of staphylo-coccus pyogenes aureus, staph. pyog. albus, and staph. pyog. citreus resemble one another. The potentialities for mischief in the animal order as developed by the researches of Passet, extending as they do to every part

of the organism, producing conditions in them quite incompatible with existence, are such as may well give pause to the practitioner who may encounter a case of furuncle. From the contemplation of these experimental results some comfort may be derived from the evidence of clinical experience that the animal man has a greater power of resistance to blood infection from such sources than have the lower animals which were submitted to experiment by Passet—a conclusion which the results arrived at by Pasteur would tend largely to confirm.

Finally, in 1885, Garré (of Basle) proved experimentally the correctness of Pasteur's and Löwenberg's statements regarding the etiology of furuncle. (*Fortschritte der Medicin*, 1885.) His self-sacrificing enthusiasm should not be omitted from any summary of the subject.

Garré made cultures in agar-agar from the blood of a patient suffering from acute osteo-myelitis. The organisms developed in this way proved to be staphylo-coccus pyogenes aureus. From these a second culture was made in agar jelly; and from this a third generation was in like manner obtained.

He then rubbed into the skin of his forearm some of the pure culture of the third generation. In a short time a large crop of furuncles made their appearance; and, in spite of energetic treatment (puncture and application of sol. of corrosive sublimate), there developed an enormous carbuncle. Needless to say the pus from these lesions yielded on cultivation the staphylo-coccus pyogenes aureus.

Further facts of interest and importance in reference to the staphylo-coccus group are—

(a) They constitute the most common pyogenic organism, being found in acute abscesses, in boils, in empyema, in pyæmia, ulcerative endocarditis, osteo-myelitis, and many other morbid states.

ae/

(b) The staph. aureus develops well in milk at a temperature of 95°, the milk becoming curdled. It is often found on the surface of the skin in health, and also under the nails (Bockhart); also in linen soiled by the evacuations of healthy infants.

(c) This coccus possesses great vitality; cultivations in gelatine or agar retain their activity for more than a year. It remains active after being dried up for twenty-four hours; and is not always destroyed by being submitted to a temperature of 210° for a quarter of an hour; it may even survive a temperature of 230°. It is not destroyed by freezing, and with difficulty by disinfectants. Dried on a silk thread it resisted the action of 1 per cent. sol. of carbol. acid for more than five minutes. Iodoform has no effect upon it.

(d) The liquefaction of gelatine by the coccus is due to the transformation into peptone. It does not generate toxic ptomaines; but disengages ammonia, together with lactic and butyric acids.

With such a record of almost universal dissemination and persistent *viability*, it is not surprising that persons of debilitated systems, of lax tissues, and especially those whose dermic follicles are in excessive activity—as is the case with many gouty subjects—should fall an easy prey to the inroads of an organism ever ready to plant itself in suitable soil. Fortunately, in the case of furunculosis, at least, a knowledge of the nature of the bane suggests also an efficient antidote, as will be shortly shown under the head of treatment.

*Diagnosis.*—If a person with previously healthy ears complains somewhat suddenly of acute pain in one of these organs, and on inspection presents a swelling at or near the orifice of the meatus, of such a nature that it is impossible to see any distance into the external canal, it will be a

nearly safe diagnosis of the case that it is one of commencing furuncle. If the focus of the disease be more deeply seated within the canal, there may be less swelling at the orifice, so that a speculum may be introduced, but none the less will the view be obstructed by a pyramidal projection into its lumen, the base of which will be continuous with one or other of the boundary walls of the canal, while the region is excessively tender if touched with a probe. The pain is out of all proportion to the cause, and increases in direct relation to the distance at which it occurs from the external meatus. This is due primarily to the rich supply of sensory nerves to the part, and also to the thin, tense character of its dermic lining. Redness is sometimes marked and diffused, but frequently the injection is limited to the site of the furuncle.

The amount of constitutional disturbance varies; usually it is greatest in the first attack, especially if this occur somewhat deep in the canal; and corresponds with the severity of the pain. Rise of temperature, general pyrexia, and even rigors may occur. These symptoms terminate with the bursting of the abscess and the discharge of a little thick pus. The advent of this discharge is indicated on inspection by the presence of a yellowish spot somewhere near the apex of the prominence; but when it points away from the observer this clue will be wanting.

Up to this time the sufferer will be very deaf, and be the subject of distressing Tinnitus of the tidal type. The deafness is due in part to the occlusion of the canal by the inflammatory process in it; but in some cases also, as pointed out by Gruber ("Diseases of the Ear," p. 238), it is caused by the "depreciated perceptivity of the auditory nerve, in common with that of the entire nervous system, as the result of the intense and prolonged pain. This is shown by the fact that the deaf-

ness stands in no direct proportion to the extent of the swelling in the auditory canal."

The Tinnitus here is caused partly by the thrill of congested blood-vessels, and partly by the contraction of the tensor-tympani muscle reflexly excited by the irritation of the 5th in the external canal, as already explained. *Giddiness* is not a usual symptom of furuncle, though not an impossible one should the contractions of the tensor-tympani muscle be strong enough to produce pressure on the endolymph by the thrusting inwards of the foot-plate of the stapes.

Such circumscribed swellings of the external canal are apt to implicate the adjacent lymphatic glands, especially those in the parotid region of the neck below the ear. In a recent case observed by the author the concomitant glandular affection was developed in the region of the mastoid, where it occasioned so much infiltration of the tissues as to convey the impression that the case was one of mastoiditis. Inspection, however, revealed the presence of a circumscribed swelling of the posterior wall of the canal, on the evulsion of which the mastoid resumed its normal condition.

It is true that the disease under review may by extension involve the deeper seated regions of the ear, and give rise to myringitis or an otitis media. The author's experience suggests that such complications are rarer in this country than would appear to be the case on the Continent, where the records of the ear clinics furnish numerous instances of aggravated sequelæ such as are seldom encountered here.

Extensive attacks of *diffused inflammation* of the external canal, except as secondary results of injury, erysipelas of the face, &c., as well as diphtheritic exudations of the part, are almost unknown to the author.

As regards the latter, speaking from an experience of five epidemics witnessed in a country district amongst all classes of the population, he did not notice one case of diphtheritic affection of the external ear. It is probable that the sanitary surroundings of the lowest classes in this country, bad as they sometimes are, compare favourably with corresponding circumstances in many parts of the Continent. Even aspergillus and mycelium parasites are rapidly disappearing from our outpatient department, for even among the lowest population of Whitechapel the author has not for some years met with a case of the kind—all of which facts tend to show that our national sanitation is surely, if slowly, advancing.

Allusion has already been made to the occasional occurrence of a *sinus after furuncle* in the external canal, the opening of which is marked by the presence of granulations. These are often troublesome to cure, from the fact that when explored with a probe, the end of which has been slightly curved to enable it to enter the sinus, bare bone may be felt in the depth of the track.

Very severe symptoms may accompany this condition. Headache, chiefly confined to the affected side, is constant, giddiness of a mild degree is usual; while the patient suffers from general malaise which unfits him for any occupation. There is persistent, but usually slight, otorrhœa, the deafness and Tinnitus depending upon the extent to which the middle ear has been implicated in the primary affection.

The disappointing circumstance about the disease, appreciated alike by patient and practitioner, is the tendency to recurrence. Just as the patient is congratulating himself on being rid of his suffering the rôle of symptoms recommences, either in the ear first affected

or in the other one as well. The progress of otological science has, however, robbed even this proclivity of much of its former terror, by showing the nature of the infective coccus which is the cause of the disease, and which is reproduced in great abundance in the pus discharged from the furuncle, rendering auto-infection probable unless protective measures be adopted.

*Treatment of Furunculosis.*

For some years past the author has adopted a uniform plan of treating furunculosis of the ear, not from any prejudice in its favour, but because of its uniformly satisfactory results. This consists in the liberal application of tincture of iodine (B.P.) to the entire surface of the external canal accessible to a fine, long camel-hair brush, and to the adjacent skin surface of the meatus and auricle. The tincture is applied twice to four times in the twenty-four hours, according to the severity of the symptoms. If the treatment be commenced before suppuration has taken place, the furuncle may be aborted, but in any case it lessens the swelling, pain, and discharge. At the same time he advises the unaffected ear to receive a similar slighter painting, with the view of preventing the disease appearing in it. If necessary, a preliminary washing out of the detritus with a weak solution of bicarbonate of soda and carbolic acid, warm, should be made, as it is requisite for the tincture to have free access to the entire surface of the canal. The application of the tincture is not made with the special object of reaching the drum membrane, but no pains need be taken to prevent it doing so. The fact of the furuncle having commenced to discharge is no bar to the application, which should then be directed, if possible, to enter the opening. Very slight pain results,

usually the patient speaks only of a not unpleasant increase of heat in the part. As a rule the case has terminated in three to four days ; and if the application be continued once daily for a week after all symptoms have ceased, a recurrence of the attack is quite exceptional.

The author traces the origin of this method of therapeutics to the recollection of his experience as dresser to Sir John (then Mr.) Simon, whose invariable plan it was in treating whitlow to paint the end of the affected finger, carefully inserting round the nail, with a strong solution of iodine in rectified spirit, and always with the result of cutting short the disease, while it not seldom secured its abortion. What the rationale of this treatment may be is not, perhaps, far to seek. Certainly, neither in its application to whitlow nor its later use by the author in furuncle of the ear was the connecting causal link of both affections in the presence of the same micro-coccus (*staph. pyogenes aureus*) known ; although it may now be surmised that a solution of iodine in pure spirit is an environment inimical to the said coccus. Iodoform, as already stated, produces no destructive effect upon it. On the other hand, rectified spirit is spoken of favourably in this disease by several authorities, since its original recommendation by Weber-Liel. Its usefulness, moreover, in granulations of the middle ear is well known ; and it will be remembered that the tinct. iodi. (B.P.) is made with rectified spirit. Dr. Jewell informs me that he treated cases of severe furuncle of the ear in Buenos Ayres by supersaturated solution of boric acid in pure spirit, usually with very marked and rapid results. Perhaps, therefore, the spirit may have as much to say to these results as the iodine or the boric acid, for both of these chemicals have but a poor reputation as germicides. Be this as it may, until experiment on the living coccus shall have decided the point the reader will adopt his own

theory, and select the spirituous solution which he may prefer.

The concomitant symptoms of furuncle, however, are too severe and urgent to allow of any wise practitioner limiting his therapeutical resources to one class of treatment. Since the introduction of *phenacetin* the author finds this drug most serviceable in the relief of pain, in fact of earache from whatever cause it may proceed. It also brings down the temperature with great certainty, relieves the tension in the head, and usually induces sleep. The dose ranges from grs. iij. to grs. x. every four to six hours in children, to grs. xx. or grs. xxx. in an adult. Generally a dose midway between these extremes answers best. It is a perfectly safe drug, and in this particular affection far superior to anti-pyrine, having none of the occasionally depressing and otherwise deleterious effects of the latter.

Anyone desirous of treating furuncle on more time-honoured principles than the foregoing will find in the text-books a variety of methods from which to select. Amongst them, the injection by means of a subcutaneous syringe of a 1 to 5 per cent. solution of carbolic acid into the swelling (Weber-Liel) has proved useful, though it has been known to temporarily add to the pain. A stronger solution than the above may be used, and it may be repeated according to the requirements of the case. Recently Gruber (*op. cit.*) has recommended the introduction into the canal of "ovoids" containing morphia (gr.  $\frac{1}{8}$  upwards) in a gelatine base, which are well calculated to relieve pain. The author would suggest some other menstruum than gelatine (*e.g.*, petroleum gelatine), which is the proper culture medium for the particular coccus of furuncle, and it seems scarcely wise, however convenient in practice, to provide the most acceptable environment for the reproduction of the pest in question.

Moist warmth applied over the ear, as by poulticing, cannot be too strongly reprobated; because, however grateful to the patient, it encourages a repetition of the attack: by weakening and relaxing the tissues these are placed in the most favourable condition for the implantation of fresh germs when set free from the abscess with the pus, which re-implantation is undoubtedly favoured by moist heat. *Respice finem* is essentially the principle to observe in treating furuncle, and relief of pain, however severe, is dearly purchased by means which at the same time lay the foundation for a speedy recurrence of the patient's sufferings.

Scarification, leeching, and the numerous other resources of the ancient *régime* are obsolete; indeed, they are unnecessary in view of the treatment originally detailed.

As regards after treatment, it is almost unknown that a case conducted on the lines advocated requires more than has been already indicated. The discharge ceases when the abscess has emptied itself, and complete immunity from recurrence is thereby secured.

Exception must be made for that class of cases referred to above in which one or more sinuses remain as a legacy of the original attack, a state of things impossible, one would suppose, to happen if the patient has been properly attended from the first. That they do present themselves occasionally in private, and not rarely in hospital, practice is a sufficient reason for discussing the best methods of dealing with them.

The author treats these sinuses as follows. A chromic acid carrier is selected having a fine eye, and this is bent into a curve corresponding to that which was found most suitable in the probe used for exploring the sinus. The carrier is then dipped in the concentrated chromic solution and gently passed into the sinus to its termination at the

seat of the necrosis. This proceeding may be repeated in five or six days and so on, till the disease disappears, which may be in three, four, or six weeks. No troublesome symptom has ever been noted as the result of this treatment, and all that is necessary to do in the intervals of applying the chromic acid is to insufflate boric acid powder—sulphurous acid lotion helps—and occasionally to wash out the external canal with warm alkaline lotion.

A case in point is that of Miss —, a school teacher from South Wales. An acute earache was followed by persistent discharge, continued pains in the side of the head, loss of health generally, and incapacity for the performance of her scholastic duties. She had a distressed, careworn appearance, and looked much older than she really was—a condition largely induced by the fear of being unable to continue the pursuit of her calling. Inspection showed the fundus of the left ear to be obscured by granulation tissue, which, when destroyed by chromic acid, revealed a healthy membrana tympani, while it was apparent that the granulations proceeded from a pyramidal eminence which also discharged pus, seated upon the posterior and upper wall of the canal, near the drum membrane.

A fine probe, slightly curved at its end, readily entered the eminence from which the pus was discharging; it passed backwards and upwards for about half an inch, when it was arrested by a rough surface of bare bone, apparently near the root of the mastoid process. Chromic acid was applied as already described, with very little resulting inconvenience, and was repeated once or twice weekly for several weeks. At the end of this time the sinus had closed completely, and the soft tissues were firmly cicatrised. Her general health, assisted by tonics, was completely restored, and she returned to her duties in perfect health and spirits.

Although the author can recall some five or six cases where a like good result has followed this plan, there are others in which the area of necrosis, both from its size and situation, defies the eliminating effect of the acid. Thus, while this treatment will in some cases take the place of a severe operation, it is not intended to suggest that it will in every instance render unnecessary recourse to mastoidectomy, or even Schwartze's operation, or some modification of it.

#### FOREIGN BODIES IN THE EAR.

Various foreign bodies which, either by design or accident, find admission into the external meatus, are common causes both of Tinnitus and Vertigo.

In every instance in which there is reason to suspect the presence of a foreign body in the external ear, the first care of the surgeon should be visually to inspect it, and thereby to ascertain to his own satisfaction that it is actually there. The second, of almost equal importance, is to ascertain the nature of the object seen.

To accomplish the first of these it is necessary to throw into the meatus, through a suitable speculum (and for this purpose a Kramer's speculum or the ordinary funnel-shaped speculum will answer), a reflected beam of light. The reflection of the beam of light (whether sunlight or that furnished by a sufficiently strong lamp) is secured by the use of a handglass reflector or a forehead mirror. It should be carefully noted that the use of a direct light is the frequent cause of failure in ear diagnosis; such light does not sufficiently enter the canal to permit of any judgment being formed on the points to be decided. The author cannot too strongly insist on the importance of these details being carried out, before any attempt is made to explore the foreign body

blindly with a probe, which can only result in pushing the offending substance farther into the canal, and, by thus adding to the difficulties of its subsequent abstraction, become the starting point in the long story of blundering which usually ends in the death of the patient; the records of which occurrences are annually reported in the Press.

Having ascertained by actually seeing it that a foreign body is present in the ear, the operator will be in a position to determine the exact nature of it. This is the more important as the method of its removal will largely depend upon this point having been fully recognised.

The question of the length of time during which the foreign body has been lodged in the canal is the first point to ascertain, because—and this is especially the case with such small objects as beads, peas, seeds, buttons, &c.—these are apt to become coated with cerumen, whereby their identification is obscured, after a comparatively short period from their introduction.

In such instances it will be necessary to inject very gently, with a small (2 oz.) finely nozzled syringe, a stream of warm solution of soda bicarb., always in this proceeding being careful to direct the stream into any chink or opening that may be found to exist between the foreign mass and the boundary walls of the canal. Obviously this cannot be done without a good light to guide the steps of the operator, when it may fortuitously happen that the obstructing mass will in this way be expelled; but, the object being to cleanse its surface, no force should be exerted on the presenting aspect, which could only drive it deeper into the canal. If the foreign object be bulky, a very little gentle syringing with the soda solution will suffice, first to melt down the ceruminous coating, and then to remove it, so that the bare surface of the intruding object will be exposed to the

surgeon's view. It should then be very carefully explored with a probe, and this, assisted by its appearance, will enable him to make out its shape, and, coupled with the history, to determine at any rate approximately, whether it be slate-pencil, small pebble, or such an organised body as a pea, bean, or other seed.

Bearing in mind that it is chiefly in young children that these accidents occur, that in them the external auditory canals are comparatively short, and that therefore the foreign body may readily be pushed against the membrane, near which the canal dips downwards and forwards, thereby rendering its exit more difficult—remembering, moreover, that in these young subjects irritation of the middle ear is more prone to be accompanied with meningeal complications, arising out of the peculiar anatomical relationships of the tympanic cavity which obtain at this period of life—it cannot be too strongly insisted upon that the utmost care should be exercised to avoid any crude attempts at extraction or of examination which should in the slightest degree carry the object deeper into the canal.

The details of this subject will be best considered under the three heads into which foreign bodies naturally group themselves.

First Group—*Unorganised bodies*, such as stones, slate-pencils, beads, buttons, &c.

Second Group—*Organised bodies*, capable of intrinsic change—*e.g.*, *vegetable seeds*, peas, beans, and seeds generally.

Third Group—*Living animals*, chiefly insects and their larvæ.

*First Group.—Unorganised Bodies, such as Stones, Slate-pencils, Beads, Buttons, etc.*

Amongst the simplest of these are *very small particles* diffused through the atmosphere, and which are the

product of the trade or occupation of the sufferer, and which may therefore be looked upon as his peculiar environment. Of such the following is an instance:—

An iron-moulder presented himself at the hospital, for relief of Tinnitus of a severely distressing tidal character, without deafness. On examination, several small black patches consisting of foundry dust and secretion were seen scattered upon the membrana tympani. These were readily removed by gentle syringing with the warm alkaline solution, and with their removal the noises ceased likewise.

It is true that nature has provided a sort of *chevaux de frise* of short bristly hairs to guard against the entrance of like offending matter. What was intended as a defence becomes occasionally a source of the very mischief it was designed to safeguard. Such a *mal-adaptation* of means to ends happens when one or more of these stiff bristles gets lodged upon the drum membrane, where their presence is indicated by the production of Tinnitus. These hairs may be readily picked off by means of fine forceps, either before or after syringing with the above-named lotion.

The majority of the cases belonging to this category are best treated by syringing, under the conditions already mentioned, and more fully described when treating of the removal of cerumen. Should the first attempt fail, and it has been ascertained that the substance is one that does not swell from contact with water, and if there is no pain or evidence of pressure, further proceedings should be deferred to the next day, rather than irritate the passage by prolonged syringing.

The use of forceps is usually harmful, unless the object present itself very near the orifice. A small scoop, such as is used in ophthalmic practice, may occasionally serve the purpose of a lever to ease outwards the offending body; or a loop of wire might be passed beyond the

object, and so made to pull upon it from behind. All such proceedings, however, pre-suppose the existence of a space for their admission, in which case the end in view would be much more surely and safely brought about by the judicious use of a syringe. Usually there is most space above the object—*i.e.*, between it and the roof of the canal. Pneumatic suction, by means of the author's "Tractor," might prove serviceable, especially if the nozzle be provided with a short length of india-rubber tubing, which could be adapted to the presenting end of a solid body.

Failing these resources, and especially where, owing to crude attempts at extraction, the foreign body has become impacted in the deeper portion of the canal, or has been pushed into the middle ear, the question of recourse to further surgical measures must be considered.

One method of dealing with such cases is to detach the auricle from the mastoid by a posterior incision separating the cartilaginous portion of the tube from the osseous portion. Should this not suffice to afford the required space, the mastoid may be gouged or chiselled away so as to enlarge this portion of the canal; but great care must be exercised to keep well within its anatomical limits. The bleeding attendant on this proceeding will favourably affect any tendency to inflammation of the meninges.

The records of such proceedings are not, however, satisfactory, the majority of cases so treated having ended fatally, notwithstanding the foreign body was extracted by means of the operative proceedings adopted. A knowledge of this fact guided the author in his management of a recent case, of which the following are details. A child between three and four years of age was brought to the London Hospital, having pushed a pebble into her ear. As this presented at the orifice, a dresser attempted to seize it with forceps. A

portion of the stone seized was crushed, the remainder becoming tightly wedged in the fundus, where it resisted every effort for its extraction. Two days afterwards the case came into the author's department.

The treatment adopted was a modification of that above recommended, that is to say, the cartilaginous part of the tube was separated from the osseous portion; the enlarged space so afforded did not, however, suffice for the manipulation of any instrument strong enough to remove the pebble. As there were no urgent symptoms about the case, it was thought preferable to await results without attempting to enlarge the bony cavity by gouging away the outer wall. The patient was taken into the hospital, and the wound allowed to heal, after which she was made an out-patient; no symptoms in the meantime showed themselves. Some three weeks afterwards she was brought back to the hospital, with a statement that the stone could be seen at the outer orifice. This proved to be the case, and it was readily removed by the surgeon in attendance. From all which it would appear that considerable shrinkage of the canal must have attended cicatrisation of the wound; at any rate, the stone, which previously was firmly impacted in the fundus of the canal to an extent which defied every legitimate attempt to remove it, subsequently to the operation escaped outwards, and was finally removed with great ease.

This case suggests the propriety of non-interference, for a time at any rate, with any inorganic foreign body which simple means fail to abstract; provided, that is, that the impacted body occasions no symptoms whatever. Such cases should, however, be carefully watched throughout. In these instances a masterly inactivity often serves our purpose, whereas too much surgical zeal may end in thwarting it.

*Second Group.—Organised Bodies capable of Intrinsic Change—e.g., Vegetable Seeds, Peas, Beans, &c.*

The special characteristic of this group is their capacity for absorbing moisture, and in consequence becoming enlarged, and thereby more liable to impaction. Notwithstanding this proclivity, syringing, under the restrictions already mentioned, should in the first place be adopted, because it will most likely prove successful. Should it not do so, instillations of sp. vin. rect. should be made into the ear, with the object of absorbing moisture, advantage being taken of the well-known affinity for water of pure alcohol. In the case of children it is always advisable to have the patient thoroughly anæsthetised before adopting further manipulations. It will then be quite easy to adopt the recommendation of Voltolini, and apply a fine caustery electrode to the foreign body, by which means it may be broken up, or an opening made into it sufficient to admit the introduction of a sharp hook, by means of which the object can be withdrawn. The author cannot speak from experience of these plans, the syringe having in his practice sufficed every purpose of removal.

*Third Group.—Living Animals, chiefly Insects and their Larvæ.*

A good illustration of these intrusions is afforded in the now classical case of the louse, whose peripatetic wanderings over the drumhead were accompanied with as much noise to the sufferer as if he were standing close to the monster drum at a popular concert. In such cases Tinnitus, though a prominent symptom, is not the only one, there being usually a strong sense of horror pervading the patient, and at the same time so much giddiness that he is compelled to fall to the ground.

These points are graphically illustrated in an instance related by Wylde. He states: "I remember being out shooting in a plantation with a friend, who, suddenly exclaiming, 'Oh, an earwig!' and throwing aside his gun, fell on the ground, making the most piteous moans, and rolling about in convulsive agony. Finding that some small insect had got into his ear, I procured some water from a neighbouring ditch and poured it into the meatus. As I watched for the result, a little animal, well-known among anglers as the hawthorn fly, crept out, and the gentleman was immediately relieved."

Flies may be attracted by the offensive discharges of a neglected otorrhœa, and will even deposit their eggs (or larvæ) within the meatus; finding in the warmth and moisture of this locality a congenial habitat. Under these circumstances large maggots have been known to develop in the external canal. These are furnished with an apparatus for holding on to the surface, and also a movable hook with which they rasp and tear the tissues, thereby exciting pain, as well as reflex symptoms. Needless to say, such disgusting occurrences are rare, and only likely to be met with in remote districts inaccessible to medical aid.

The treatment of this class of case is indicated in the narrative of Wylde's patient. In the instance of flies entering the meatus—by no means a rare accident in country life and in foreign travel—the pouring of water into the ear will suffice to cause their exit. A like contribution from the spirit flask of the traveller would prove an even more efficacious and equally safe expedient. Indeed, spirit of some kind, whether alcohol or benzoline, is necessary to destroy attached larvæ, which it does by penetrating their tracheæ and so suffocating them. Even then they may require to be detached by suitable forceps.

Before closing these brief accounts of the diseases and accidents to which the external ear is liable, the author would again call attention to the feature belonging to them which chiefly bears upon the point of view of this treatise. It is that the explanation of the reflex symptoms accompanying these affections of the external ear runs parallel with that which has been already found satisfactory in elucidating exactly the same symptoms arising under quite diverse circumstances and in altogether different localities. It is a case of what logicians call varying the experiment; and as each variation leads to the same conclusion, it is obvious that all the conditions are present for a complete verification of the author's thesis.

## CHAPTER X.

### SOURCES OF EAR AFFECTIONS IN INFANCY AND CHILDHOOD.—DENTITION.—EAR COMPLICATIONS OF DENTITION A CAUSE OF INFANTILE CONVULSIONS.—EAR AFFECTIONS DEPENDENT UPON DISEASES OF THE TEETH.

THE interdependence of the ear and the adjacent organs, which has already occupied our attention in preceding chapters, is responsible for many anomalous and unexpected symptoms which may arise in the progress of certain ailments not originally implicating the ear. Those ailments, after complication with the ear, sometimes assume such grave importance as to involve thereby the issues of life and death.

It is on the very threshold of life, in the early months of infancy, in fact, that the conditions alluded to are liable to occur. Apart from the dangers above referred to, the field of inquiry thus opened also possesses interests which appertain to the special sense of which the ear is the organ. Thus, loss of hearing caused by destructive processes in the ear occurring as complications of infantile disease may produce *deaf-mutism*. For a child who becomes deaf before it has learned to speak will be dumb also, producing the pitiable object of an intelligent being deprived of two channels of communication with the outside world.

The importance of this twofold aspect of Ear Disease in early life is further emphasised by the constantly recurring instances of varying degrees of deafness in adults, dating

from this period of their existence, and in whom no subsequent exercise of skill may suffice to restore the functions of an organ thus early destroyed by what is, for the most part, preventible disease.

The consideration of the subject will be facilitated by examining a case in point—*e.g.*, an infant in whom dentition is in progress, and whose behaviour tells us it is suffering acutely. How is it possible to localise the *ear* as the seat of this suffering, seeing that the child cannot speak? Anyone accustomed to watch these little patients carefully will scarcely fail to recognise in the troubled face, the resting of the head on the nurse, the thrill of pain which passes across its features accompanied with piteous cries when its position is changed, especially if this be done suddenly, and more than all in the constant raising of the little hand to the side of the head, the symptoms of the most agonising of all the sufferings of early life—*earache*.

Now the point which the author wishes to emphasise is this: the pain thus experienced is not what we vaguely call neuralgia, but is due to a definite trophic change, an inflammation taking place in the deeper-seated tissues of the ear, beginning with congestion and tension of an acutely sensitive region, passing on to exudation and suppuration, and capable of being recognised as such if proper means are used. If these symptoms be recognised sufficiently early they may be removed by a free incision of the swollen gums. But it often happens that the pathological changes just alluded to have set in before the practitioner sees the patient. The gums are, however, duly lanced, and very properly so, because reflex irritation is thereby lessened. But to the disappointment of practitioner and parents the little patient is not cured. Then commences the orthodox routine of treatment. Cold to

the head, hot baths, mustard plasters, and perhaps a calomel purge, followed by enemata. Still the condition gets worse, convulsions set in, and the child dies. Meanwhile the organ really responsible for the imported gravity of the symptoms, the *ear*, has perhaps not been thought of as a factor in the case, while the inflammatory processes taking place in it have extended to the brain or its membranes, an occurrence for which every facility is afforded by the intimate communications which, in the infant especially, exist between the organ of hearing and the brain. Or it may happen that the symptoms suddenly abate, and the child is well; a little discharge takes place from the ear, or the friends say an abscess has broken in the child's head during the night, and usually no more is thought about the matter. Perhaps the practitioner does not believe in "abscesses in the head," and ignores the circumstance altogether. Should the discharge continue and his attention be called to it, he is careful to inform the friends of the danger attendant upon checking such a useful derivative! At any rate, the disease is let alone. Meanwhile the middle ear is undergoing suppurative inflammation; its delicate textures are breaking down, and soon irreparable mischief has been done. Happy is it for the child if one ear has escaped, which, fortunately, is often the case. Otherwise the child will be deaf, and, as a consequence, dumb also. This is no fancy portrait evolved out of the inner consciousness of the author. It is one he has often seen; and those who are accustomed to aural out-patient work will support him in the statement that the condition he has sketched—one of advanced disorganisation of the middle ear in children for which "no cause can be assigned"—furnishes a large proportion of the cases of deafness that come before us for treatment in that department.

But a child has by no means escaped ear trouble arising from the teeth, although it may have safely passed over the period of their evolution. Professor Böke, of Buda-Pesth, has distinctly traced otitis in children to the existence of a carious tooth; and even in later life a decaying tooth will indicate its presence by prolonged ear-ache, and will even establish an otorrhœa. Hilton records an example in his work on "Rest and Pain," and the recognition of such cases will doubtless be more frequent when the possibility of the association referred to is more generally recognised. Hilton's example is typical: "A professional friend," he said, "had an enlarged gland below the external ear. The real cause of this was not quite apparent, and so he requested me to look at it. There was a slight discharge of morbid secretion in the auditory canal. We argued the case together. I said very likely it may be the result of a decayed tooth. Irritation from it may be conveyed to the auditory canal and induce this morbid secretion; that morbid secretion may produce slight excoriation, and that excoriation, aided by lymphatic absorption, may explain the existence of an enlarged gland. The tooth was extracted, all the other local morbid conditions disappeared, and there was no recurrence of the local symptoms."

Now the question before us is to find the explanation of the train of symptoms just detailed. We have the phenomena of pain, inflammation, and suppuration occurring in an organ widely separated from the recognised exciting cause, and in tissues histologically distinct from those manifesting the morbid changes. The only obvious connecting link between the regions interested is the continuity of nerve fibre. The simple continuity of sensorimotor nerves is, however, insufficient to produce the conditions under review, and we must seek yet further

for the true medium by which they are brought about. This will be found in the relations of the vasomotor nerves, and the functions which it is their office to fulfil.

The mechanism of the congestion and inflammation of the auditory apparatus arising from the irritation of dentition, or in later life from the presence of a decayed tooth, is readily intelligible in the light of the doctrine as to the correlating function of the sympathetic ganglia, which has already been set forth in detail. Here it is desirable to point out that aural authorities are singularly unanimous in discarding *otalgia*—*i.e.*, neuralgic ear-ache, as a distinct nosological entity from the catalogue of affections of the ear, on the ground that, when proper search is made, this symptom will be found associated with a hyperaemic condition of the drumhead or some contiguous region. In this conclusion the author's own experience leads him in the main to concur. The question now before us is to ascertain how a congestion of the ear sufficient to give rise to the severe symptoms which have been referred to, can be caused in a reflex way by irritation originating in the teeth and gums.

A considerable portion of the blood supply of the membrane of the drumhead is derived from an artery which leaves the internal carotid in the carotid canal, and proceeds by a very short course directly to its destination. Being thus closely connected with a large arterial trunk, this small *tympanal branch* of the internal carotid artery is in a position particularly favourable for the speedy augmentation of its blood supply.

Now the *nervi vasorum* constituting the carotid plexus at this part of its course come largely from the otic ganglion. The inferior dental nerve supplying the decayed tooth or gums, as the case may be, also communicates with this ganglion. We thus arrive at a

direct channel of nerve communication through the otic ganglion, the tooth, and the vascular supply of the drumhead. The effect of the irritating impression proceeding from the decayed tooth or swollen gum will be to excite waves of vessel dilatation in the correlated area, the drumhead. Its vessels become widely distended, acute congestion is thus established with consequent stretching of the tense and sensitive structure in which it occurs, and causes the pain felt by the patient. One may often see, when examining the ear, the vessels of the drumhead swell up so that the membrane becomes more or less injected in consequence of the simple irritation of the speculum introduced into the external auditory canal. Obviously it does not irritate the dental nerve, but those other branches of the 5th nerve found in the canal, the resulting engorgement being induced by a mechanism analogous to that just described. If the irritation be sufficiently prolonged, effusion into the tissues takes place, and this under favouring circumstances will pass on to suppuration, and constitute a veritable otorrhœa. This result is promoted by the free inosculation of the vessels of the drumhead with those supplying the tympanic cavity. Should the accumulation not escape by the Eustachian tube, which, however, owing to the comparatively large size of that passage in infancy, is very likely to take place, it will press the drumhead outwards, causing it to bulge, while a similar pressure will be exerted upon the membranes closing the foramen ovale and foramen rotundum on the inner wall of the cavity, thereby producing a state of tension within the labyrinth, and consequent disturbance of the equilibrating function. Apart from this pressure, however, the pain already experienced would be sufficient to give rise to convulsive symptoms, by the irritation it excites in the sensitive cerebral centres of the infant.

Even before suppuration has been set up, there is great danger of the inflammation extending to the membranes of the brain from certain structural arrangements already alluded to, and to which special attention should be given. The dried preparation of an infantile cranium, from which the accompanying illustration (Fig. 5) is taken, shows one of these sources of danger very clearly. It is constituted by the petro-squamosal suture, at the line of junction of the petrous with the squamous portions of the temporal bone, which are developed separately; the division being exceedingly well marked in the preparation. At this

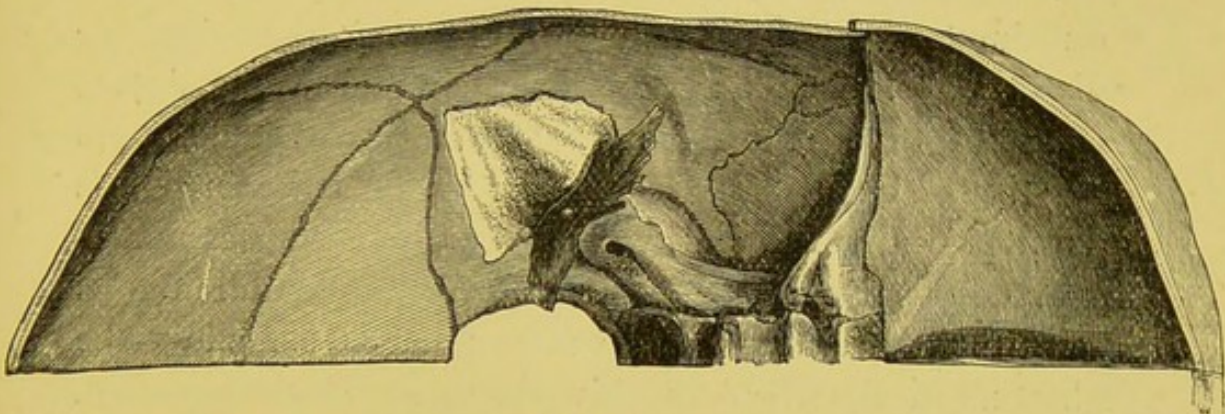


FIG. 5.

fissure the dura mater dips down into the tympanum, becoming continuous with the muco-periosteal lining of that cavity. This process of dura mater carries with it a supply of vessels derived from the middle meningeal artery, which are the vessels proper to the cavity. In the progress towards adult life this fissure becomes more or less obliterated, though the continuity of vessels persists.

From these anatomical considerations—and there are others pointing in the same direction—the conclusion is obvious that, when brain symptoms are manifested in an infant, it is to the *ear* that attention should be primarily directed. We have seen how readily during

teething congestion and inflammation may, in certain cases, arise in the drumhead and cavity; how, by continuity of vessels, this may spread to the cavity of the cranium; and how readily this latter condition becomes meningitis.

Here it is necessary to draw attention to a fact which is apparent to all observers—viz., that while every child in the community undergoes the process of teething, only a certain portion of them suffer from these severe forms of ear affection now under discussion. The question, therefore, naturally arises, What is it that makes the difference? It is the author's contention that a certain portion of the community *inherit* the sclerosing diathesis, by which is meant that their mucous membrane, or, to be exact, the sub-mucous connective tissue, is so constituted by heredity as to take on rapid hyper-plastic development, which under favouring circumstances undergoes destructive processes; that it is the children thus constituted hereditarily who most frequently manifest the phenomena described in this chapter. This suggestion, if substantiated, will show a uniform chain of causation operative through the entire series of morbid phenomena discussed in this book. This subject having been fully dealt with in former pages, it is here only referred to in order to show the chain complete.

As regards the frequency of ear diseases in young children, it is, as has already been said, much greater than is ordinarily believed. Out of eighty infants under fourteen months examined by Dr. Wreden, of St. Petersburg, more than 80 per cent. had some form of ear affection. Von Tröltzsch, in calling attention to this fact, reflects severely on the practitioner who sees in all brain symptoms exhibited by children during the period of dentition only the dental aspect of the case. The true

import of the symptoms can be realised only by the recognition of those sympathetic relationships of the ear established through its complex associations which have just engaged our attention. When these relationships are fully grasped, the two-fold meaning of the symptoms will be apparent; and while not neglecting the teeth, the *fons et origo mali*, the practitioner will direct immediate attention to the more vital organ, the ear, which has become involved in the disease.

In *treating* an infant, the subject of inflammation of the ear, an object of primary importance is to secure for it a comfortable position. This is best done by placing it on a large pillow across the knee of the nurse, who must be instructed not to rock it, as every movement will aggravate its suffering. The head may be raised somewhat by a small horsehair cushion placed under it. The room should not be very light; it should be free from noise, and the temperature should be cool. The affected ear, which will usually correspond with that side on which the gums are swollen, should be uppermost. The child should be fed with a spoon, as the act of sucking increases the pain. Attention to these details will add greatly to the ease of the sufferer, and in proportion promote recovery.

It is taken for granted that the gums have been lanced, supposing that indications for this proceeding are present. Those who have followed the physiological observations already made will appreciate the importance of this measure, as thereby the waves of irritation proceeding from the gums to the vessels of the ear are stopped, and the dilatation of these vessels consequent thereon will gradually subside, provided that no trophic changes have already commenced.

This observation will serve to indicate the sense attached by the author to the expression *reflex irritation*. It means

a definite vascular condition, usually, though not necessarily one of dilatation, originating at a greater or less distance from the point of vessel disturbance, and propagated by vaso-motor nerves in the manner described. This definition will assist in getting rid of some of the vagueness frequently attached to the term in question when applied to the trophic processes of disease.

It is assumed that by this time an examination of the drumhead will have been made, a proceeding which, with the aid of appliances presently to be described, should not be difficult. Chloroform may be given for the purpose, and no hesitation need be felt on this point. The appearances present will be as follows:—The pearly lustre of the membrane will be exchanged for redness caused by the injection of the vessels of the membrane, and occasionally, if its transparency be not impaired and the disease have advanced so far, the lining membrane of the cavity of the tympanum will also look red. These appearances should satisfy the observer that a very grave state of things is before him; the gravity of the situation will impress itself upon his mind more forcibly if he remember the continuity of the membrane lining the tympanal chamber with the dura mater of the cranium.

It should by this time be perfectly clear to the reader that Ear-ache, under whatever circumstances it may occur, is never a trivial matter, to be treated with a boiled onion or warm oil, if not entirely neglected, as is too frequently done by those who regulate the therapeutics of our nurseries. The author is more and more convinced that many obscure and often fatal illnesses in children, which, from their affinities, are regarded as acute cases of hydrocephalus or "brain fever," would, if examined from an aural point of view, be found either to originate in the ear, or be due to the implication of that organ in a reflex way; and he cannot

too strongly insist on the importance of such an examination being made whenever brain symptoms arise, and the cause of them is in any respect obscure. The diagnosis being confirmed by actual inspection, treatment will be carried out with less hesitation.

The first step in the treatment should be the *abstraction of blood* from the ear. This is best effected by the application of two leeches within the concha, a little plug of cotton-wool being first neatly inserted into the meatus to prevent blood from trickling into the canal. There need be no difficulty about this step; but, if the concha is for any reason unsuitable for the application of leeches, the space in front of the tragus, or behind the ear, may be selected instead. Whatever may be thought of bleeding generally, there can be no doubt that acute inflammation of the auditory apparatus imperatively demands the abstraction of blood. The confined space in which the process goes on, the rapidity with which the disease passes to destructive stages, as well as the neighbourhood of vital organs which are readily implicated, are facts which should impress the practitioner with the necessity for the prompt adoption of measures that will cut short the disease.

After the bleeding has ceased, the plug of wool should be removed; hot water should then be gently run into the external canal (it may be squeezed from a small piece of sponge), and this should be repeated at short intervals. This simple application is more soothing than any other. Poultices should be avoided, as they promote suppuration. Bromide of potassium, gr. iij., should follow.

At the same time, drop doses of Tr. aconiti. (B.P.) should be given to lower the heart's action, and lessen the sensitiveness of the peripheral nerves. Phenacetin is useful in allaying pain and inducing sleep.

The treatment just described, if commenced under the

conditions given, will cure the patient in a comparatively short time.

Should the symptoms continue either from the case having advanced beyond the congestive stage before treatment is begun, or if the child be the subject of struma or syphilis or some other dyscrasia favourable to the rapid formation of pus, it will be necessary to make a very careful examination of the drumhead for indications of distension. It is probable that in the progress of the case some convulsive conditions, as just intimated, will have existed, such as the thumbs being turned into the palms of the hand, the great toes being tightly adducted, and occasional startings of the entire body. These may be regarded as due to disturbance of the sensorium caused by the febrile condition, and though they must not be disregarded, they have not the grave import which attaches to others which may supervene. One of the most suggestive of these is *rolling of the head* from side to side, because it points unmistakably to labyrinthine mischief. By this is meant that the expansion of the auditory nerves in the internal ear has become involved in the disease, to the extent of disturbing the equilibrating apparatus. The fact that the organ of equilibration is an integral part of the auditory apparatus gives to the diseases of this region an importance far beyond that attaching to mere deafness.

The symptom just mentioned, *rolling of the head from side to side*, the author regards as the counterpart of *Vertigo* witnessed in later life, when the intrinsic circulation of the labyrinth is deranged, or its contents are pressed upon from without. Why the disturbance of the equilibrating organ should find expression in these semi-rotary movements has not, so far as the author knows, been explained. In connection with this symptom, the following observations occur to him as containing a possible explanation of it.

The faculty of co-ordinating muscular movements, which is largely regulated by the semi-circular canals, is one that is developed by slow degrees, *pari passu* with the growth of the child; its influence extends from above downwards, being first manifested in the muscles which move the head. Those who have watched this muscular control developing in a very young infant will support the assertion that it is first exercised over the motions of the head; that while the hands are moved vaguely to seize an attractive object, the head is turned towards it directly and with precision. The lips of the child are its first prehensile organs, and the earliest efforts of muscular co-ordination are exercised to guide these to the sources which supply the means of subsistence. Thus it happens that the muscles of the neck are the first which are trained to act in concert, and being the only ones that do so in very early life, it is reasonable to expect that any disturbance in the organ which regulates this co-ordination should declare itself most markedly where it is most in force. In older children affected with grave lesion of the internal ear, *sobbing* has been noted. It has already been shown that this is a recognised symptom of labyrinthine disease in adult life. The author wishes to insist on the crucial significance of these symptoms. They guide us to the real seat of the mischief, the ear, which unfortunately is the last region thought of in connection with them. This rolling of the head should therefore at once arrest attention. It may mean simply that pressure is being exerted on the intra-labyrinthine contents, or it may imply that the morbid process has extended through the membranes closing the orifice of communication with the middle ear, and has thus gained access to the auditory nerve. This symptom is perhaps the last note of warning uttered in time to be of service. If relief be not now afforded, paralysis and coma

will shortly place the patient beyond the reach of medical art. This relief is to be procured by incising the membrane of the tympanum in the manner shortly to be described.

Before resorting to this proceeding, it will be right to see that the Eustachian tube is pervious, and that the nasal passages and the post-nasal space are free from mucus. For it is to be observed that the indications of accumulations of fluid in the middle ear are of most frequent occurrence in the exanthemata, where the post-nasal regions are largely involved in the disease. In the instances of simple reflex otitis from teething, which have occupied so much of our attention, the danger is rather from extension of congestion or inflammation to the brain; the type of the disease being more decidedly sthenic in character, and likely, therefore, to yield to the therapeutic measures already described. It is not probable that in these cases puncture of the drumhead would be called for, or that if indicated it would succeed in saving the patient, as, before the formation of pus occurred, mischief would have advanced intracranially, and matter would be found there concurrently with its appearance in the ear. Nevertheless, though not *likely* to be called for, the possibility of operative interference being demanded should not be lost sight of even here, as it holds out one more chance of saving life. Certainly, if the doubt arise, the patient should have the benefit of it, the more so as the proceeding, if properly executed, can do no harm.

## CHAPTER XI.

### SOURCES OF EAR AFFECTIONS IN INFANCY AND CHILDHOOD.—EAR COMPLICATIONS IN THE EXANTHEMATA.

As intimated in the preceding chapter, it is in the *exanthematous diseases* of childhood, as well as in those of later life, that the question of puncturing the drumhead most urgently confronts the practitioner, but unfortunately the necessity of such interference is scarcely realised once in a hundred cases. The lamentable neglect of ear complications in these diseases arises from a twofold cause: on the one hand, aural specialists as a rule have very little opportunity of seeing them; on the other, the family physician usually ignores *ears*, and, therefore, does not recognise the meaning of what is going on in these organs in exanthematous patients. In support of this assertion it will suffice to quote the following incident which occurred in the author's experience:—A lady, a deaf patient, asked his opinion of her brother's condition, who, she stated, was suffering from typhoid fever, and respecting whom the prognosis had been given by the medical attendant that he "must be going on well as he was getting deaf"! a kind of *non sequitur* which carries its own comment; its absurdity was shown in this instance by the fatal issue of the case. It is, however, fair to add that this occurred some years ago, and it may be presumed that a better understanding of the subject prevails at the present day than was the case at the time when the incident referred to occurred.

The author's experience of these diseases, including some

four or five epidemics of scarlet fever and the usual amount of measles, small-pox, etc., has afforded the opportunity of observing a number of such patients dying with symptoms which he now knows to have been distinctly *aural* in their origin, but respecting which the text-books give no clue. The comprehensive term, "oppression of the sensorium, due to intensity of the blood-poison," includes most of these conditions, which a more exact analysis proves to have their origin in lesions of the middle ear, implicating the meninges, or giving rise to embolism, thrombosis, or septicæmia.

These remarks are not made with reference to the results of ear complications in the diseases under consideration as a source of subsequent deafness, respecting the neglect of which during their progress the writers of aural works animadvert with justice. The object is rather to call attention to the fact that not so much the future *hearing power* of the patient, but the immediate issues of life or death depend upon the recognition of the mischief going on in the recesses of the auditory apparatus from the *beginning* of the illness.

On this point it is necessary to lay some stress, because it is customary for the symptoms in question to be referred to the progressive invasion of the ear, owing to continuity of tissue from the throat or nose. But when we remember that the rash is present on the mucous membrane of the respiratory and digestive tracts from the very commencement of the attack, the fact that a similar membrane lines the middle ear indicates that this region is obnoxious to a like eruption. This is palpably the case in the conjunctiva, and if a small-pox pustule can occur there, why may it not in the tympanal cavity? The same remark applies to measles, to scarlet fever, and throughout the entire category of the exanthemata.

It is true that such mischief going on in the tympanal cavity may require some time for its development—because it is not until corresponding processes occurring in the post-nasal space, by producing swelling and closure of the orifice of the Eustachian tube, cut off this way of escape for the increased secretions and inflammatory products formed in the chamber to which this appendage forms a natural safety valve—that such development becomes manifest. Thus it happens that the patient, who, to all appearance has been progressing favourably through the early part of the illness, will, about the end of the second week or earlier, manifest very serious symptoms. He will become restless and will cry out as if in pain, while his manner becomes dogged and obstinate when roused from the semi-stupor in which he is otherwise disposed to remain. At the same time there may be no corresponding rise of temperature indicative of fresh inflammatory mischief. In a very short time, however, there will commence that rolling of the head from side to side which has already been referred to pressure on the intra-labyrinthine fluid.

The faintest indication of any of these symptoms should call immediate attention to the ear. First of all the nasal passages should be cleared of mucus by gentle syringing with the warm alkaline lotion. After this it will be well to use Politzer's method of inflating the ear, but gently; no harm can come of this, because if air can be forced into the tube, the other contents will be expelled. Moreover, it is not necessary in very young children to use water, or any of the various methods for confining the air of the douche to the post-nasal space; the simple condensation of the air which occurs during the process is sufficient to cause it to enter the tubes.

These precautionary measures should, however, be adopted from the commencement, and, if carried out firmly

and dexterously, will (especially the syringing) prove so comforting to the patient that, however fractious he may at first be under them, there will soon be no difficulty in getting him to submit.

From the commencement of an attack of any exanthem, the drumhead should be kept under observation, just indeed as the conjunctiva would be under similar circumstances, with the view of subjecting it to suitable treatment. As already intimated, the early application of a leech will prevent trouble, and may obviate the necessity for the step we have now to consider, that of *puncturing the membrane*.

In this, as in every other surgical interference in the region of the ear, the first point is to obtain a good view of the exact spot to be operated upon. With suitable appliances this will not be difficult. In children the external canal is much shorter than it becomes in later life when development is complete, the deficiency in length being due to the absence of the inner bony section of the canal which is in very young children represented by the osseous ring only into which the tympanic membrane is fixed. The external canal being thus shorter, the drumhead is proportionately nearer the observer than in the adult. The advantage arising from this is counterbalanced by the almost horizontal plane which the membrane now occupies with reference to the passage by which it is approached; hence, though it is nearer, less of it is seen. It is also to be remembered that it is the inferior segment of the membrane which may be opened without risk or injury to the contents of the tympanum.

These facts being borne in mind, the patient should be placed in such a position as admit of his being held firmly, and of a *good light* being thrown into the ear. He should then be placed under the influence of an anæsthetic. Various *specula* have been introduced for facilitating a view

of the deeper-seated tissues of the ear. For operating purposes they are all more or less defective, and in choosing one the surgeon must be guided by individual preference. To illuminate the aural fundus a good lamp should be placed near the patient's head, the light from which is reflected from a frontal mirror. Aided by this arrangement, a glance will show up the now bulging and opaque membrane, when the knife can be introduced and the membrane

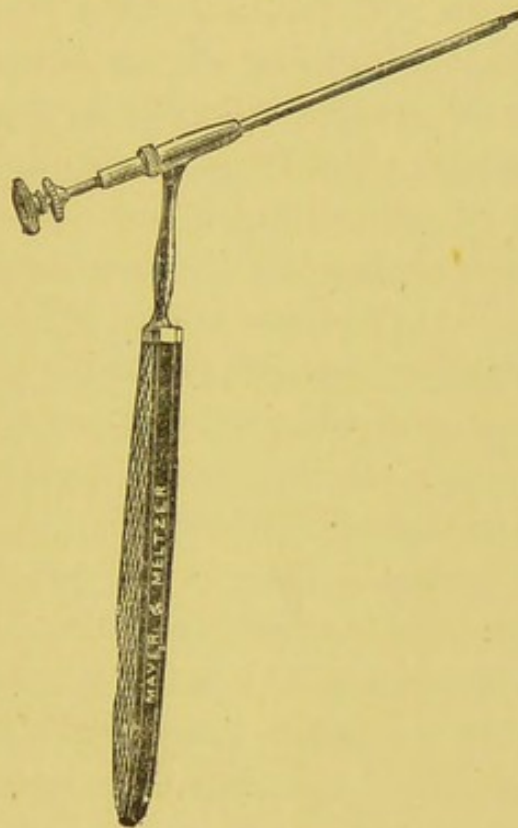


FIG. 6.

incised; this incision, as already stated, should by preference be made through the inferior segment of the membrane; and if possible in front of the manubrium. As regards the *kind of knife*, the one here figured (Fig. 6) has some advantages, which may recommend it to those surgeons who are unaccustomed to operate in the fundus of the external ear. It is contained in a guarded sheath, the blade being propelled by pressure on a spring, so that

the right moment may be seized for completing the operation. The length of the blade can also be regulated beforehand. Its entire diameter does not exceed one and a half millimetres.

The head should be held firmly by a reliable assistant. At the moment of the incision a creaking sound will be heard as the tense membrane gives way.

The advantage of making the puncture as far forward as possible is that in this position the wound in the membrane is nearest the opening of the Eustachian tube, a circumstance which enables the after-treatment to be most advantageously carried out. It is also furthest removed from the chain of ossicles, which incur no risk of damage when the anterior segment of the membrane is selected for the operation. Apart from these considerations every surgeon would choose the most projecting point for incision when his object, as in the present instance, is simply the evacuation of pus, and myringotomy performed for this purpose offers no exception to the rule.

The *after-treatment* consists of very gently syringing the ear with a solution of bicarbonate of soda in warm water to remove the fluid accumulated in the tympanic cavity. In this way not only the cavity, but the mastoid cells may be washed out, the fluid escaping both by the meatus and through the Eustachian tube into the mouth, or it may run out by the nose. The latter remark applies more especially to older subjects for whom the operation has to be performed. In syringing under these circumstances, in very young infants, no force must be used, or the injected fluid will press upon the membranes closing the labyrinth, and produce the effect which the operation is intended to obviate. The syringing must be repeated several times daily to prevent the establishment of an otorrhœa, and for this purpose no better application can be employed than

the alkaline lotion already recommended for simultaneous use in the nose.

Irrespective of the ease with which this operation can be performed under the conditions described, the surgeon who may adopt it will have the double satisfaction of rescuing a life from imminent peril, and of preventing the prospect of a greater or less degree of permanent future deafness which will be sure to ensue should the patient recover without its performance.

Incision to be of service should be made early. The process of disintegration of the ear is occasionally extremely rapid in the exanthemata; even older children who direct attention to the earache as soon as it occurs will exhibit a discharge within twenty-four hours of so doing, with, of course, perforation of the membrana tympani.

The instances just referred to of rapid breaking down of the tissues of the middle ear demand a passing comment, both because they occur not infrequently, and because the type of exanthem which they complicate is not necessarily of the severest kind. For these reasons it would appear that the subjects of them must possess some diathetic peculiarity which has already become deleteriously active in the ears of those who manifest the proclivity in question. It is the author's conviction, formed by observing the later developments of many of these patients, that this pre-existent condition is the same mucoid deterioration of the lining membrane of the tympanum which, under the term *fibrosis*, has been seen to enter into the causation of much of the ear disease already discussed in these pages.

## CHAPTER XII.

### POST-NASAL GROWTHS.—PATHOLOGY, ETIOLOGY, DIAGNOSIS. —TREATMENT.

THE disease which, next in order of frequency to those discussed in the preceding chapters, is most operative in causing deafness in early life is the presence of growths in the post-nasal space; the vault of the pharynx, together with its posterior and lateral walls, being included in this region.

The affection was first described in this country by W. Meyer, of Copenhagen, in 1869,\* in a paper presented to the Royal Medical and Chirurgical Society in that year.† An exhaustive monograph on "Adenoid Growths of the Nasal Pharynx" was published by Loewenberg, of Paris, in 1879; and at the International Medical Congress, in London, in 1881, this affection formed the subject of a discussion, in which the author gave the result of his own experience founded on the study of one hundred cases.‡ Relatively frequent as the disease is, and disastrous as its effects often are—not only on the organ of hearing, but on the physical and intellectual development of the sufferer—it may be doubted whether the medical profession, as a whole, is even yet sufficiently alive to the importance of early recognition and prompt treatment of this condition.

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\* Hospitals. Tiende, November 4th and 11th, 1868.

† Trans. Med. Chir. Soc., 1870, Vol. LIII., p. 191, *et seq.*

‡ Trans. Intern. Med. Congress. Seventh Session. London, 1881. Vol. III., p. 291, *et seq.*

The disease consists in the presence of a number of growths or vegetations occupying the post-nasal, or pharyngo-palatine, space. They may be confined to the vault of the pharynx, or be scattered indiscriminately over the boundary walls of the region. They are pedunculated or sessile, the former being nodulated or flattened masses, varying in size from a horse-bean to a split-pea; some are even smaller. The sessile growths are found chiefly upon the posterior wall of the pharynx. The stalked variety are seldom situated so low down as to be visible, unless the soft palate be raised or the rhinoscopic mirror be used. They may be few or scattered, or so abundantly developed as completely to fill the post-nasal space. They vary somewhat in consistence, some being soft and gelatinous; while others are firm and unyielding to the touch. They usually bleed when subjected to palpation, a circumstance which has an important bearing on their histological character.

*Pathology.*—The growths are spoken of by nearly all writers on the subject as hypertrophic developments of the glandular structures proper to the post-nasal space, and the term “adenoid growths” has for this reason been applied to them. They are usually described as multiple developments of the follicles of the pharyngeal tonsil, plus a considerable increase of the adjacent connective tissue. From the commencement of his acquaintance with the disease, the author entertained doubts as to the correctness of this view, and suspected the growths to be warty rather than glandular in origin. The circumstances leading to this impression were: first, the extremely wart-like appearance of many of these growths after removal; second, their tendency to bleed when handled—a feature characterising papillary growths in the bladder and other parts where mucous membrane forms the structure in which they are found; third, their tendency to spontaneous dis-

appearance after the completion of adolescence, as evidenced by their extreme rarity in adults. These considerations, together with absence of any trace of true glandular structure in the growths, led the author, in the paper submitted to the London Medical Congress, in 1881, to maintain that they are papillomatous; though, owing to the peculiarities of their situation and general environment, they acquire a more pronounced mucous character than papillary developments in other situations.

The starting-point of the morbid process appears to be in the epithelial strata; the papilla in some cases becoming hypertrophic to a considerable degree. This is evidenced by the fibrillar structure of the centre of the growth which immediately surrounds the artery and vein entering at its root; this modified connective tissue structure is continued through the excrescence to within a short distance of its periphery. Outside this, and passing insensibly into it, is a stratum of mucous membrane proper. Although proper mucous cells are met with in this outer layer, the author has never been able to trace anything like a real follicle, such as would imply the presence of gland tissue, in any specimen examined. This fact goes to prove that the starting-point of the disease is not in the follicles or any special gland structure to be met with in the post-nasal space. Rather its origin is to be referred to a pathological development of the epithelial tissue elements as above stated; while the abundant fibrous stroma, interspersed with small inflammatory cells, recall the structures seen elsewhere, especially in the nose, and which have already been alluded to as examples of sclerosis, fibrosis, or mucosis—whichever name the reader may prefer.

This seems to the author at once the most important and interesting fact in connection with the pathological relations of the disease. Two considerations may be noted

in support of this association. The first is the universally accepted fact that post-nasal growths have a marked tendency to disappear with the attainment of adult age; to account for which many ingenious hypotheses have been advanced. If the fibrosis view of the disease just stated be accepted, this disappearance of the growths runs parallel with all that we have seen of the tendency to atrophy in those forms of the disease which have occupied our attention up to this point.

The second consideration is that fibrosis of the middle spongy processes, such as indicate a commencing ethmoiditis, are frequently met with in children whom we are called upon to treat for post-nasal growths. Since the author first noticed this simultaneous occurrence, he has become accustomed to look for it, with the result of finding the nasal complications of these growths more often than not. Further, patients who have been operated upon as children for the removal of post-nasal growths, not seldom in a few years' time again become patients, suffering from ethmoidal disease. The author has met with this sequence of events with sufficient frequency to suggest to him that the post-nasal affection is an early, perhaps the earliest, intimation that the subject possesses the fibrosing tendency.

Some such conviction would seem to have been present to Bosworth when he speaks of "that general predisposition by which in young children a morbid process develops, and has its *highest activity in the epithelial and lymphatic structures, which disappears at puberty, and changes to a tendency to activity in connective tissue structures.*" Again, "A frequent condition with which it is associated is hypertrophic rhinitis. In four cases it was met with in connection with atrophic rhinitis, three of these having reached the stage of ozæna."

Corresponding excrescences are not unknown in other situations. Ziegler points out that, as the result of catarrhal inflammation in mucous membrane containing glands—particularly in the stomach and in the uterus—papillary outgrowths covered with epithelium may be produced which depend more on fibrous than on glandular hyperplasia. These often resemble tumours, and have been incorrectly described as adenomata. The epithelial outgrowths here referred to by Ziegler appear to bear a close relation to the structure under consideration. Whilst, therefore, rejecting the term “adenoid vegetations,” so long as we recognise the epithelial affinities of the disease, it seems both convenient and sufficient for descriptive purposes to make use of the term “post-nasal growths.”

Coincidentally with the growths there is, in a large proportion of cases, a marked development of the mucous membrane of the region affected by them. This hypertrophied mucous membrane is usually found on the posterior and lateral walls of the pharynx, immediately behind the soft palate, where it occasionally is seen to assume a corrugated condition, the folds thus caused encroaching largely on the orifices of the Eustachian tubes.

*Etiology.*—The author is inclined to believe that the disease is, at any rate in some instances, congenital, having found it well developed in an infant aged nine months, and having operated on another just over two years of age, who had exhibited symptoms of its presence—viz., snuffles, impeded nasal respiration, and disturbed sleep—since birth.

#### *Diagnosis.*

The symptoms exhibited by the patients who have come under the author's care, though similar in kind, have

been very variable in degree, the difference depending upon the extent of the growths, but more especially on the particular part of the naso-pharyngeal space from which they proceed. The symptom most likely to attract attention is modification of the voice. In slight cases only the natural *timbre* of the voice is lost, while in those in which the tumours encroach upon the choanæ (posterior nasal meatus) the voice is much altered, acquiring a nasal twang specially characterised in the pronunciation of the consonants *m* and *n*, which become respectively *b* and *d*. Thus "common" is pronounced "cobbod," a modification with which everyone is familiar as the result of a common cold.

*Mouth breathing* is not always present, even when the disease exists to a considerable extent, as it requires for its complete production the occlusion of the lower meatus of the nose. This is a point of some importance, because inability to breathe by the nose, being generally regarded as a collateral indication of the presence of the vegetations, their absence might be inferred if the patient can so respire. As a matter of fact, nearly all the author's cases have been able to do so when tested in the ordinary way—*e.g.*, by placing the mirror beneath the nostrils, and instructing the patient to pronounce the letters *m*, *n*. The mirror will be dimmed by the moisture of the expired air, the area of dimness being proportionate to the freeness of the passage. Even in the normal state it is frequently different for each side.

The reason of this ability to breathe through the nostrils is that the growths abound most freely in the pharyngeal vault, and, while in this position they tend to occlude the superior openings of the nasal passage, the inferior meatus is left comparatively free. It is important to note that it is along this lower passage that air chiefly passes in

ordinary nasal respiration. In the upper ones the air, though set in motion by the lower current, is comparatively tranquil, except in forced efforts, as in sniffing or smelling. (*Vide* Fraenkel, art. "Nose," in Ziemssen's *Cyclopaedia of Medicine*.) If this fact be borne in mind, it will be apparent that the ability to perform nasal respiration by no means precludes the possible existence of *growths*, and in no way obviates the necessity for a complete examination in the manner subsequently advised.

Where the occlusion of the choanæ is complete, *mouth breathing* necessarily follows, associated with all those inconveniences to the lower portion of the respiratory tract, resulting from the inspiration of air which is "drier, cooler, and more unclean" than it is when warmed, moistened, and filtered during its transition through the nasal channels. Provision for these influences upon the air is supplied by the peculiar vascular tissue with which the mucous membrane covering the turbinated bones is furnished. The credit of discovering this tissue is claimed for Kohlrausch, who described the structure minutely in Müller's "Archives," 1853. But the following note in Toynebee's "Diseases of the Ear" would seem to transfer the merit to our countryman. He says: "Many years ago I pointed out the peculiar erectile tissue of which the nasal mucous membrane is composed, not only in man, but in most mammalia; this tissue is a most efficient natural 'respirator'" (page 200, *op. cit.*). Judging from Löewenberg's insistence on this point, it would appear that mouth breathing obtains in these cases to a much greater degree on the Continent than in this country. Where it does occur to any extent, the expression of the patient is markedly changed from the mouth being always open, by which a very stupid appearance is imparted to the physiognomy. But it must not be inferred that every

patient showing buccal respiration, or even the majority of them, demonstrate its presence by any such marked deformity as in those extreme instances above described; the fact being, where even pronounced disease exists in the post-nasal space, the patient may show only a slight parting of the lips, which may easily escape observation, and which will only be detected by the practised eye, though immediately recognised when attention is drawn to it. Obstruction of the nasal air passages may be increased by the accumulation of muco-purulent secretion in the post-nasal space, from which it escapes by the anterior nasal meatus as well as by the pharynx. The discharge is a source of great annoyance to the sufferer, whose excoriated nostrils testify to its irritating character. At the same time he is frequently unable to blow the nose.

*Impeded nasal respiration*, from whatever cause arising—and it has many others besides that at present under review—produces important modifications in the functions of the Eustachian tube, so that its influence in the causation of deafness cannot be too strongly insisted upon.

*Snoring* is a symptom which usually attends the presence of growths in the post-nasal region. It appears to be due to the depression of the soft palate and its diminished pliability caused by the presence of the tumours. Its free margin is thus pushed into the midst of the breathway, and vibrates, like the reed of a wind instrument, with each act of expiration. Even when snoring is absent, the sleep is apt to be disturbed by the obstacle to free nasal respiration. The child is restless, turns constantly in bed, and, as the friends say, “makes gurgling noises in the head.” The author has not noticed any special *loss of taste or smell* in his cases, though these senses are likely to be prejudiced in extreme instances of the disease.

"*Snuffles.*"—It has already been seen that post-nasal growths are probably often congenital, and that they increase *pari passu* with the growth of the body generally. In the author's experience it is between the ages of five and eight years that the disease becomes of sufficient urgency to induce the friends to seek for operative relief. It must not be overlooked, however, that in infancy the disease may become so developed as to require professional aid. The following case will illustrate the important bearing which post-nasal growths may have in this relationship. The author was asked by a surgeon to see his child, a little girl aged nine months, respecting whom he had come to entertain the conviction that she was the subject of syphilis, on account of "snuffles," to which she had been subject in a marked degree from birth. Having been absolutely free from this taint himself, his mind was becoming the prey of disquieting suspicions. The child was the picture of health, and though the respiration was unmistakably "snuffling," there was no other indication of syphilis. On passing the finger into the post-nasal space, a crop of excrescences was discovered, and the true significance of the suspicious symptom at once cleared up. This was the youngest patient in whom the author has verified the presence of the disease, but there can be little doubt it would be oftener found if sought for.

*Deafness* is undoubtedly the symptom which, more constantly than any other, is associated with post-nasal growths. It is also that for which the patient is most frequently brought under medical observation. Lucae refers its occurrence to the exhaustion of air from the tympanic cavity, consequent upon the suppression of nasal respiration, the mechanism of which is imitated in Toynebee's experiment—*i.e.*, when swallowing is performed with the nostrils closed. It is the reverse of the Valsalvan

process, for while the latter distends the middle ear and pushes the membrane outwards, the former by exhausting this chamber draws the drumhead inwards. The persistence of the altered state of intra-tympanic tension implied in complete nasal obstruction causes very serious interferences with the hearing power of the patient. But marked degrees of deafness may exist, although nasal respiration is only partially suppressed by this disease.

One explanation of deafness occurring under these circumstances consists in the growths having made their habitat in the lower segment of the choanæ, thus obstructing the inferior nasal meatus, which is the main channel for the passage of air into the Eustachian tube. Further, the irritation produced by the growths occasions inflammation of the glands of the mucous membrane of the region, and this, from its chronic character, may spread to corresponding tissues of the fauces, pharynx, and Eustachian tubes. In some cases this catarrh spreads by continuity of tissue into the tympanic cavity, and may eventually induce otorrhœa, with perforation of the memb. tympani, polypus, and the gravest of all complications, necrosis of the walls of the tympanic cavity. Indeed, it is a common experience in the Out-patient Department to have a series of cases illustrating all the stages of the disease, from simple alterations of intra-tympanic tension, to otorrhœa and polypus; all of them associated with, and starting from, post-nasal disease. Thus to the patient's other troubles are added chronic otorrhœa and deafness. Frequently the affection of the ear is, as just stated, of a more passive type, *i.e.*, non-suppurative inflammation of the tympanum, with more or less depression and injection of the membrane.

These remarks teach the futility of treatment directed against disease of the ear, so long as the *fons et origo*

*mali*, the post-nasal disease, is allowed to remain intact and probably unrecognised.

The severity of the ear mischief will depend to a large extent on the situation of the growths. Thus, a very extensive development of these in the vault of the pharynx interferes less with the function of the Eustachian tubes than a smaller amount seated on the posterior wall of the pharynx. In the latter situation a single growth will frequently be complicated with the hypertrophic thickening of the mucous membrane already referred to.

The author has seldom seen the deformity of the chest walls, which is described by some writers as a frequent consequence of the disease. *Deformity of the hard palate* has been described by various writers; and Gronbech,\* of Copenhagen, who recently investigated this point, found that in seventy-seven cases of post-nasal growths, the shape of the hard palate was normal in only ten. The deformity consists in an abnormal increase of the palatine arch, a section through it forming either a polygon or a Gothic arch; there was also in many cases a diminution of the distance between the right and the left alveolar process with irregularity in the position of the teeth, especially in front. This abnormality of the upper jaw is believed to be caused by deficient development of the nasal cavity. The mouth breathing is also thought to have some influence, the expired air pressing against the child's palate and thus increasing the arch of the vault.

*Diagnosis.*—The diagnosis of post-nasal growths is by no means difficult. If a patient with symptoms of nasal obstruction be examined, the soft palate will usually be seen to project somewhat forwards. In the case of young

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\* Hospitals—Tidende, 1893, No. 10.

children, rhinoscopy is, as a rule, unsatisfactory; it is best, therefore, at once to explore the post-nasal space with the forefinger. If performed skilfully this proceeding is not very painful and occupies but a few seconds. Instead of a clear space, with its well-defined landmarks, a soft, irregular mass is encountered, and more or less fills up the region, and bleeds on contact with the finger.

*Treatment.*—Constitutional treatment is entirely useless in dealing with post-nasal growths. Whatever depreciation the system may have undergone, owing to their presence, cannot be remedied till the mechanical obstruction to respiration consequent thereon has been removed. The only satisfactory means of effecting this is by operative interference. For many years the author has made it a rule to have the patient placed under the influence of an anæsthetic before operating. In young children the author prefers chloroform for this purpose; in children over the age of ten, an antecedent saturation of the system with ether is desirable. An excellent way of giving chloroform is to commence the administration with Skinner's mask, and to continue the process during the operation by means of Junker's apparatus as ingeniously modified by Dr. F. Hewitt. It is essential that the patient should be fully under the influence of the anæsthetic. During the last fifteen years the author has performed considerably more than 2,000 of these operations under these conditions, the administrator often being not a specially skilled anæsthetist, but merely a qualified student; yet no accident has occurred. The patient, fully anæsthetised, should be placed in a nearly recumbent position, the head being thrown somewhat backwards, and the jaws distended by means of a gag.

A liberal supply of sponges and sponge-holders should be kept in readiness; the sponge-holders should be straight.

The author always details one of his assistants especially for the duty of handing sponges, as required, to prevent the blood collecting about the larynx. The most generally serviceable instrument, in his experience, is the forceps (figured below), the curves and angles of which he arrived at as the result of long practice, and for the last ten years

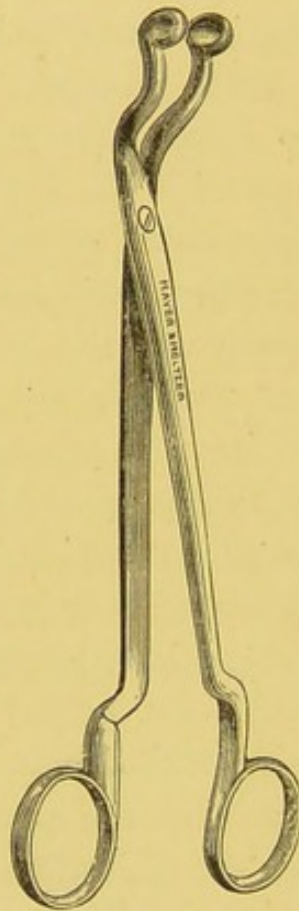


FIG. 7.

AUTHOR'S FORCEPS FOR REMOVING POST-NASAL GROWTHS.

he has used no other. They are made in various sizes to adapt them to the requirements of the patient.

The forefinger of the operator's left hand having been introduced behind the velum, as a guide for the forceps, the growths should be removed one after the other. After all the larger growths have been got rid of, there are often some left behind, which spring from the margin of the

choanæ beyond the reach of any instrument. It is important that these should be thoroughly removed, as, if left behind, they block up the choanæ and negative the result of the operation. After everything that can be taken away with the forceps has been removed, the post-nasal space should be explored and completely cleared of excrescences with the finger nail. On the completeness of the operation its success largely depends; too great stress cannot, therefore, be laid on using the finger as a guide to every step of the proceeding.

The only danger arising directly out of the operative procedure is the possibility of blood coagulating about the larynx, and so impeding respiration. Against this the operator must guard with special care by the use of sponges.

These should be passed behind the epiglottis, and made to sweep the upper opening of the larynx at frequent intervals during the operation. If the patient is fully anæsthetised, the soft palate is perfectly flaccid and allows of the introduction of sponges behind it; in this way the space can be completely packed with sponges in holders, where they form an efficient tampon. Free hæmorrhage is not, in the author's opinion, an unmixed evil in these cases. The presence of the growths gives rise to a good deal of congestion in the surrounding parts, and brisk bleeding lessens the risk of subsequent inflammation. It is often useful, when the operation is completed, to place the child with his head hanging sideways over the edge of a couch, so as to let the blood flow into a basin beside him.

Even if some blood does find its way into the windpipe, as it certainly does to a greater or lesser extent in the best-conducted operations, it appears to the author to be open to doubt whether this is of any real importance. It is of course, clear that a copious gush of blood into the air

passages, when the laryngeal reflex is in abeyance, would be likely to cause death by suffocation, but that a few drops of blood trickling into the lungs can do much harm is difficult to believe. The risk of pneumonia from this cause, so much insisted on by some writers, is altogether at variance with the author's experience. In his series of operations—numbering, as already stated, between 2,000 and 3,000—pulmonary complications have occurred in only three. In each of these cases, however, the patient had suffered from influenza within a few months of the operation; and, moreover, each of them when operated on was, although the fact was unknown to the author at the time, the subject of some form of lung trouble, accompanied by cough. In none of these cases did a fatal result ensue, but in one of them a tedious illness followed. This sequence of events suggests the advisability, before an operation for the removal of post-nasal growths is undertaken, of ascertaining whether the patient has recently suffered from influenza, in which case the operation should be postponed.

With regard to *after-treatment*, the author considers it important that every patient from whose post-nasal space excrescences have been removed, however slight the operation may have been, should be sent to bed as soon as possible and kept there for at least three days. In some cases it will be well that he should remain in bed for four, five, or even six days. The parts should be left absolutely undisturbed for forty-eight hours; at the end of that time the post-nasal space should be washed out with warm alkaline lotion. The best way of doing this is to have the patient sitting up in bed and to syringe the solution very gently through his nostrils. This should be done twice daily. While the patient is in bed, he should be kept on milk diet; after the fourth day ordinary food may be

allowed unless there be any special indications to the contrary.

*Complications.*—In the very early days of his experience in the treatment of post-nasal growths, the author met with several instances in which suppuration of the middle ear followed the operation. He is unable even now to point to any detail in his method of operating that would account for this result; but from the fact that with increasing experience the complication referred to ceased to occur, it seems fair to infer that it was due to something which greater skill now enables him to avoid. So far from suppuration of the middle ear following the operation now, it frequently happens that children operated on during the progress of an otorrhœa are freed from the latter complaint from that date. Such a result cannot always be looked for as the immediate consequence of the removal of post-nasal growths; and if the patient be the subject of a co-existing otorrhœa, it will be well to make the friends understand that further treatment for the aural condition may be required.

After-hæmorrhage is sometimes a troublesome complication, though, when proper care is used, it is very rare. In the author's series of operations, after-bleeding has occurred in only two cases. Before the patient is removed, the fauces should always be carefully inspected. The most satisfactory mode of inspection is to pass a sponge into the pharynx and observe its condition when withdrawn. Should there be any sign of active hæmorrhage, it can readily be checked by passing a sponge, attached to a holder and steeped in Ruspini's styptic, into the post-nasal space and leaving it there for five or ten minutes.

*Recurrence.*—The question of the recurrence of post-nasal growths after operation has occasioned the author a considerable amount of thought. No doubt recurrence does

sometimes take place, though this is rare. It may arise from several causes, of which the chief is probably incomplete removal at the time of operation. — The most careful exploration of the affected area with the finger when the region is sodden with blood may fail to detect some of the smaller excrescences, which are likely subsequently to be the starting-points of fresh growth. It is possible also that in very young children some portions of the mucous membrane, which have already produced a crop of growths, may have a tendency to again go through the same proliferating process. The fact remains, however, that as a general rule the thorough removal of post-nasal growths carried out as described modifies the condition of the parts in such a way that recurrence is very exceptional.

As far as the author's experience goes, the proportion of cases in which recurrence takes place is not more than 1 in 500.

A word may be said about the application of caustics or galvano-cautery to the seat of operation after removal of post-nasal growths. This practice cannot be too strongly condemned.

## FORMULÆ.

---

$\mathcal{R}$  Calomel                    }  $\bar{a}\bar{a}$  ...   ...   ...   ... gr. iij.—gr. v.  
       Quin. sulph.            }

M. ft. pulv. h.s.s.

*Vide p. 52.*

---

$\mathcal{R}$  Ac. hydrobromic, dil.   ...   ...   ...    $\mathcal{M}$  xx.— $\mathcal{M}$  xxx.  
       Potas. bromid.       ...   ...   ...   ... gr. x.  
       Quin. sulph.         ...   ...   ...   ... gr. ij.  
       Syr. zingib...       ...   ...   ...   ...  $\bar{3}$  j.  
       Aq. chlorof. ad.     ...   ...   ...   ...  $\bar{3}$  j. Misce.

Ter. d. s.

*Vide p. 53.*

---

### ALKALINE LOTION.

$\mathcal{R}$  Sodii bicarbonat. ... ..  $\bar{3}$  ij.  
       Ac. carbol. ... ..  $\mathcal{M}$  v.  
       Aquam ad. ... ..  $\bar{3}$  viij.

A tablespoonful to be mixed with an equal quantity of hot water and sniffed up the nostrils night and morning.

*Vide p. 127.*

---

### ALKALINE LOTION WITH IODINE.

Tr. Iodi ... ..  $\bar{3}$  ss.

To be added to the above formula.

## IODOL SNUFF.

℞	Bismuthi subnit.	...	...	...	...	℥ ss.
	Pulv. ac. boric	...	..	...	...	℥ ss.
	Iodol.	...	...	...	...	℥ j.
	Morph. hydrochlorat.	...	...	...	gr. ij.	Misce.

A pinch to be used with an insufflator two or three times daily.

*Vide p. 128.*

℞	Hydrarg. ammoniati	...	..	...	...	℥ j.
	Ac. carbolic	...	...	...	...	℥ ij.
	Ung. zinci benzoat.	...	...	...	...	℥ j. Misce.

To be applied twice daily.

℞	Ung. hydrargyri nitrat.	...	...	...	...	℥ ij.
	Vaselin. alb.	...	...	...	...	℥ vj. Misce.

To be applied twice daily.

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