

**THE EAR,**  
**Its Diseases and their Treatment.**

**ILLUSTRATED BY ENGRAVINGS.**

"It is only by computation, founded upon large averages, that truth can be ascertained, and hence the danger of founding a general practice on the experience of a single case, or a few cases."

SIR GILBERT BLANE.

"It is not from ingenious reasoning, or fine-spun theories, that we should estimate the value of a remedy, but from the effects actually produced by it in a majority of cases."

NATHAN SMITH.

"THROUGH medical statistics lies the most secure path into the philosophy of medicine."

SIR HENRY HOLLAND.







*F. A. von Moshziske*

THE EAR,  
ITS  
DISEASES AND THEIR TREATMENT.

Illustrated by Engravings.

BY  
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TO  
OLIVER WENDELL HOLMES, M.D.,  
IN APPRECIATION OF HIS  
INDEPENDENCE AS A MEDICAL MAN,  
AND HIS  
GENIUS AS A POET,

*This Work*  
IS DEDICATED BY HIS SINCERE ADMIRER,  
THE AUTHOR.

“BEFORE man had ever drawn a musical sound from pipe or string, the chambers where the royal harmonies of his grandest vocal mechanism were to find worthy reception were shaped in his own marvellous structure. The organ of hearing was finished by its Divine Builder while yet the morning stars sang together, and the voices of the young creation joined in their first choral symphony.”

OLIVER WENDELL HOLMES, M. D.

## P R E F A C E.

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THE book which we are about to present to the reader is the first original work of this kind ever published in America. Those hitherto issued by the press of this country being merely republications of English or translations of French and German works. Some small treatises, proceeding from the pen of so-called aurists, might perhaps seem to form an exception, but the evidently personal purpose which prompted their authors, and the superficiality with which they are written, precludes their entering into competition with any systematic work on the subject.

In calling our book original, we do by no means pretend to say that everything contained in it is entirely our own, either as to substance or to form. We freely confess that we have largely availed ourselves of the labors of others, whenever our own experience or judgment coincided with theirs; and when we found our own thoughts already expressed in a form

which we felt we could not improve, we have not hesitated to adopt even the very words of our predecessors.

We have made it our task to search through the whole range of aural literature, and there is probably no work of any importance on this subject that we have not consulted and the sum of whose teachings will not be found incorporated in our own book.\*

The works to which we are most indebted, and of which, consequently, we have made the most frequent use, are those of *Kramer* (1st and 2d edit.), *Wilde*, *Pilcher*, *Williams*, *Toynbee*, *Harvey*, and *Yearsley*. *Tolsch's* work, of which the second edition (published only six months after the first, 1863) has only reached us as our own was just going to press, we have still had time to peruse, but it has furnished us no matter for making any changes or additions.

More, however, than to any other work, either German, French or English, we are indebted to that of *Rau*. His "*Lehrbuch der Ohren Heilkunde*" (Berlin, 1856) is undoubtedly the most thoroughly scientific work on the subject of ear diseases published in any country. Wherever we could do so consistently with our own judgment and experience, we have taken *him* for our guide. Only in very few cases (especially in

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\* A complete Catalogue of the best works on Diseases of the Ear, published since 1600 up to date, is given at the end of this work.



his chapter on "Polyps") we have found cause to deviate from him. Not so in the systematic form of his work, which bears the impress of a thoroughly logical mind. The only fault we have to find with Rau's work, in all other respects so excellent, is a defect which probably has been the cause of its not having been translated, viz., his style. Nothing but a thorough acquaintance with the genius of both idioms could enable a translator to unravel his involved periods, and to reduce them to plain, intelligible English. In this connection, we may remark that we should ourselves perhaps apologize for an occasional tautology in the course of this work, but need scarcely remind the critical reader that the English is not our vernacular tongue.

A few words more concerning the purpose and arrangement of our book. Our principal intention in writing it, has been to supply the medical student and the young practitioner with a trustworthy guide to the treatment of ear diseases. Sir Astley Cooper used to complain (and this complaint, though made many years ago, is still at the present day not entirely unfounded) that "a knowledge of the ear is by no means general in the profession, and still less are its diseases understood." It is the purpose of this work to contribute to a more perfect understanding of both. As no satisfactory insight into the nature of morbid ac-

tions is possible without a thorough acquaintance with the condition of the affected parts when in a state of health, we have deemed it expedient to commence our work with a brief account of the normal structure (Anatomy) and functions (Physiology) of the organs of hearing, before proceeding to a detailed description of the abnormal changes produced in them by disease (Pathology), and the treatment which they require in order to be restored to health (Therapeutics).

But besides the professional reader, we have, in writing these pages, kept constantly in view the *general public*. Our treatment of the subject, we tried, therefore, to make popular, as well as scientific. We have endeavored to express ourselves as clearly and intelligibly as possible, avoiding, as far as it could well be done, all technical nomenclature, and where we could not avoid it, at least adding an interpretation. For the same purpose we have annexed a most elaborate Glossary (which will be found at the end of the book), in which all medical terms not already defined in the body of the work, together with many other words from foreign languages, will be found translated and explained. We have no doubt that, by this means, we have considerably increased the usefulness of our book for the common reader.

A particular reference to the general public was rendered doubly necessary by the fact that there are

still various prejudices afloat with regard to ear diseases and their supposed incurability. Owing to these prejudices, it has but too often happened that a cure, when it was possible, has been *made* impossible by the fatal belief that ear diseases, and particularly deafness, cannot be cured, and that it is dangerous "to tamper" with the ear at all. An attentive perusal of the present work will, we feel assured, contribute much towards removing these injurious notions.

Fifteen years of daily occupation in the treatment of aural complaints, furnished by an extensive practice, together with a careful study of the older and newer literature on this subject, and a sincere and earnest desire to learn from the experience of others as well as his own, entitle the opinion of the author, as he believes, to the attention and consideration of the profession; and while he has, by no means, the pretension to set himself up as an oracle, he feels that he can, without presumption, present the results of his studies and experience with the words of the Roman poet:—

"Si quid novisti rectius istis,  
Candidus imperti; si non, his utere mecum."

1027 Walnut St., Philadelphia.

January, 1864.

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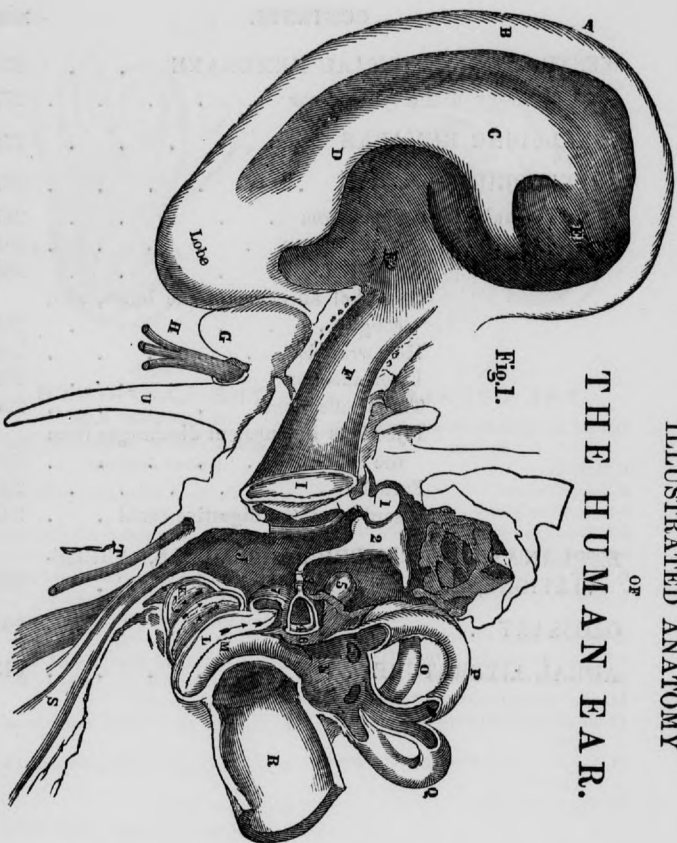
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# ILLUSTRATED ANATOMY

OF

## THE HUMAN EAR.

Fig. 1.



### EXPLANATIONS.

Fig. 1.

- A. Pinna.
- B. Helix.
- C. Anthelix.
- D. Antitragus.
- E 1. Scaphoid Fossa.
- E 2. The Concha.
- F. Meatus Auditorius Externus.
- G. Mastoid Process.
- H. Portio Dura.
- I. Membrana Tympani.
- J. Cavity of the Tympanum.
- K. Cupola.
- L. Scala Tympani.
- M. Scala Vestibuli.
- N. Vestibule.
- O. Horizontal Canal.
- P. Superior Semicircular Canal.
- Q. Internal Semicircular Canal.
- R. Meatus Auditorius Internus.
- S. Eustachian Tube.
- T. Corda Tympani.
- U. Styloid Process.

Fig. 2.

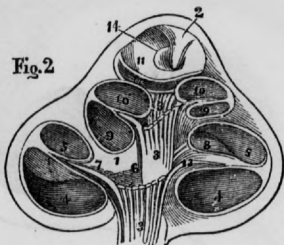


Fig. 2.

## THE COCHLEA.

*Divided parallel with its axis through the Modiolus.*

1. Modiolus.
2. Infundibulum.
- 3-3. Cochlear Nerve.
- 4-4. Scala Tympani of 1st turn of Cochlea.
- 5-5. Scala Vestibuli of 1st " " "
6. Section of Lamina Spiralis.
7. Membranous portion of Lamina Spiralis.
8. Loops of Cochlear Nerve.
- 9-9. Scala Tympani of 2d turn of Cochlea.
- 10-10. Scala Vestibuli of 2d " " "
11. Scala Tympani of remaining half turn.
12. Remaining half turn of Scala Vestibuli.
13. Lamina of bone, forming floor of Scala Vestibuli.
14. The Helicotrema.

Fig. 3.

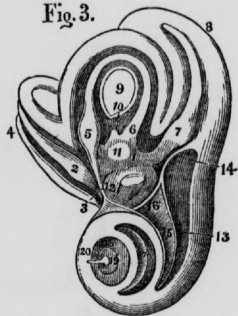


Fig. 3.

## THE LABYRINTH

*OF THE LEFT EAR,*

*laid open to show its Cavities and Membranous Labyrinth.*

1. The Cavity of Vestibule opened anteriorly.
2. Ampulla of Superior Semicircular Canal.
- 3-4. Superior Semicircular Canal with contained Membranous Canal.
5. Ampulla of Inferior Semicircular Canal.
6. Termination of Membranous Horizontal Semicircular Canal in Sacculus Communis.
7. Ampulla of Middle Semicircular Canal.
8. Middle Canal with Membranous Canal.
9. Common Canal.
10. Membranous Common Canal ending in Sacculus Communis.
11. Otoconite of Sacculus Communis.
12. Sacculus proprius.
13. First turn of Cochlea.
14. Extremity of Scala Tympani.
15. Lamina Spiralis.
16. Opening of Scala Vestibuli into the Vestibule.
17. Second turn of Cochlea.
18. Remaining half turn of Cochlea.
19. Lamina Spiralis.
20. Infundibulum.



"Let a man be the most correct and minute anatomist; if he have not long and laboriously attended to the appearance and the treatment of diseases, however minutely he may know on the processes and functions of life, and explain their interplay and modifications, which constitute health and disease, his knowledge will be but the vain speculation of the theorist; he will be practically more ignorant

**ON THE**

**ANATOMY, PHYSIOLOGY, PATHOLOGY, AND**

**THERAPEUTICS OF THE EAR.**

"The most common causes of obstruction, associated and situated in the canal of their subject; not only durable improvements in practice be established on less fall and hazardous evidence."

By J. H. H. H. H.

"It is medicine as a scientific and not as a thing."

London.

“LET a man be the most correct and minute anatomist, if he have not long and laboriously attended to the appearances and the treatment of diseases, however plausibly he may reason on the processes and functions of life, and explain their interruptions and modifications, which constitute health and disease, his knowledge will be but the vain speculations of the theorist, he will be practically more ignorant than many an uneducated nurse in an hospital.”

BACON'S *Life of Jenner*, Vol. II., p. 95.

“THE materials of just pathology can be drawn only from large masses of observation assembled and arranged in the order of their subject; nor can durable improvements in practice be established on less full and luminous evidence.”

EDWARD PERCIVAL.

“LA medecine ne s'enrichit que par les faits.”

BROUSSAIS.



## INTRODUCTION.

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THE mind of man enters into communication with the outward world by means of the *senses*. They are, as it were, the *bridges* which connect his individual being with that of other existences. Without them, he would be an *insulated* monad. All the knowledge he has, he derives directly or indirectly through them. We believe indeed with *Aristotle* and *Locke*, that, "*nihil est in intellectu quod non antea fuerit in sensu*," (there is nothing in the intellect which has not previously been in the senses), though, of course, we are compelled to add with *Leibnitz*: "*nisi intellectus ipse*," (except the intellect itself). But though the intellectuality of our nature necessarily precedes and underlies, and forms the *conditio sine quâ* non of all our sensational perceptions, still, without these perceptions, the mind would remain empty and could never attain its full development. Of these indispensable organs of perception, by far the most

important and precious are the *eye* and the *ear*. In popular estimation, the *eye* has always occupied the first place, and, to a certain extent, deservedly so. Without it, the world to us is dark and colorless, and all the bright hues and varied beauties of the universe are gone. Without it, we are, as it were, shut up in the gloomy prison of our body, at once "a dungeon and a tomb." We can, therefore, fully sympathize with the pathetic lament of the immortal poet, when he describes the dreary condition entailed upon him by the loss of his eyes:—

"\* \* \* \* \* Thus with the year  
Seasons return, but not to me returns  
Day, or the sweet approach of even and morn,  
Or light of vernal bloom, or summer's rose,  
Or flowers, or herds, or human face divine;  
But cloud instead, and ever-during dark  
Surrounds me, from the cheerful ways of men  
Cut off; and for the book of knowledge fair  
Presented with a universal blank  
Of nature's works to me expunged and razed,  
And wisdom at one entrance quite shut out!"

But though the *eye* is the first sense by means of which we obtain a consciousness of the outward world and a perception of its phenomena, and though, for every-day uses, it always may be felt as the most important, still, on a nearer consideration, it will appear that the *ear* occupies a still higher rank. If

the eye opens to us the rich treasures of the *material* universe, the ear does the same for the *spiritual* and *intellectual*. It is by the ear, that the child first receives from his mother's lips, an answer to those inquiries of curiosity, which the objects perceived by the eye have raised. It is by the ear, that he receives his first instruction, his knowledge of the laws of the world and the God that made it. It is by the ear, that he first realizes the intensity of a mother's love, who, watching by his cradle, with songs and stories, draws slumber on his eyelids. It is by the ear, that we enter into living intercourse with other intellectual beings, and gain additions to our inward treasures. It is by the ear that we receive the vows of love, the protestations of friendship, the congratulations and condolence of sympathy, the instructions of wisdom, the warnings and consolations of religion. It is by the ear, the world of sound and harmony is opened to us, and feelings, "all too deep for words," are quickened in our hearts by the magic power of *music*.

And in proportion to the importance of the possession of the sense, is, of course, the importance of its *loss*. The deaf is, indeed, not so helpless as the blind; he can find his way without a guide, and can attend to his wants without assistance. He is not, like the blind, shut off from the enjoyment of all the infinite variety of picturesque and plastic beauties, presented to him

by nature and art; he is not surrounded "by cloud and ever-during dark;" the "holy light, offspring of heaven first born," still exists for him; he can distinguish day from night, eve from morning; he can see the faces of his beloved ones, and speak and understand *their* heart's language, even without the interpretation of words.

But the human world in *general* is as much of a blank to him as the material universe is to the blind. Yea, he is more "from the cheerful ways of men cut off," than is the latter. Unable to understand the ordinary tones of voice, unwilling to draw attention to his defect by asking for a louder repetition of the words not understood, he is and feels unqualified for social intercourse, and the consciousness of this unfitness preying on his mind makes him averse to all society, and is apt to give rise to a suspiciousness which makes him believe that what he cannot hear is purposely spoken so low that he may not hear it, and to a consequent irritability of temper which, in a short time, renders him as unpleasant to society as society is to him.

In this respect the deaf is very different from the blind, who, from the very fact that the material world is closed to him, and from his very helplessness, draws more closely and lovingly to the world of men. The gloomy, suspicious, misanthropical temperament that

generally accompanies deafness is a well-known fact, and the character of *Beethoven*, during the latter years of his life, when his deafness had become well nigh complete, and he could no longer direct the performance of even his own immortal works, affords an only too famous and too melancholy illustration. And though the loss of the organ which opens to us the world of harmony can, of course, not be to every one as immense as it was to the great composer, still its misery will be keenly enough felt and appreciated by all who have a soul for *music*.

The preciousness of a sense, to which we are indebted for so many and so exquisite enjoyments, and the loss of which subjects us to so many deprivations, and exercises even such an injurious effect upon our very character, must, of course, impart a corresponding importance to an art and science that is able to heal it when diseased, and to restore it when lost. We should consequently expect that *aural medicine and surgery* would have been one of the most early developed branches of medical science. We should likewise expect, that, when developed, it would have occupied a rank corresponding with its importance, in popular and professional estimation. But neither one nor the other of these expectations, however justifiable, has been quite fulfilled.

From Celsus, who first treated of ear complaints as

independent forms of disease, to Duverney, who gave a new impulse to this long neglected branch of the healing art, that is for more than 1500 years, hardly anything was done to advance aural medicine, and it is only since the beginning of this century, that the ear and its diseases have received, at the hands of medical literature, the attention to which they were entitled. It was particularly Mr. (afterwards Sir Astley) Cooper who gave a new impulse in the right direction, by the publication of two essays in the "*Philosophical Transactions*" of 1800 and 1801. His example was followed by others, and aural medicine and surgery has at last, particularly in Germany, been carried to that perfection which gives it a commanding position among its sister branches of the healing art.

If this position is not always sufficiently appreciated either by the general or the professional public, it is no doubt owing to the fact that perhaps no other department of medical science has been so much invaded by *quacks*. Utterly devoid of the indispensable prerequisites of a successful treatment of the diseases in question, namely, a thorough and accurate knowledge of the anatomical structure and physiological functions of the ear, with unblushing effrontery, they mercilessly attack the delicate organ with all imaginable kinds of drops and oils and ointments, which, for the most part, are so irritating and injurious to the ear that you can-

not help associating these ear poisoners with the treacherous king, who, in the words of Hamlet's father,

“\* \* \* \* \* Stole

With juice of cursed hebenon in a vial,  
And in the porches of the ears did pour  
The leperous distilment.”

It is said, that, on account of these incompetent intruders, Sir Astley Cooper, with whom diseases of the ear have been a favorite study, during the early part of his career, gradually withdrew from the prosecution of a subject which he had done so much to illustrate, and that he was at last ashamed of being called an “aurist.” But the celebrated surgeon, it seems to us, did not act in this case in a manner quite worthy of his deservedly high reputation. Better, it appears to us, would he have done, if, instead of yielding from pride and fastidiousness the field to those illiterate pretenders, he had continued his useful labors. While ennobling thereby the name of aurist, he would have contributed in a far more effective manner, than by the way which he has chosen, to enlighten the public as to the difference between empirics and men of science, and to drive those unblushing ignoramus from a most important and useful department of medical science, which, by their incompetence, they disgrace.

As for us, we feel proud of belonging to a profession

which has been practised and illustrated by so many distinguished names, and which contributes so much to the enhancement of human enjoyments and happiness. Our anxiety is only that we may prove worthy of our noble calling, and, if the unassuming pages which we now are about to place before the reader, should contribute, in however small a degree, to lead the public to a more adequate appreciation and a fuller understanding of this most important subject, we shall feel more than compensated for the labor bestowed upon this treatise.



## ANATOMY OF THE EAR.

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The human ear is divided into three parts:—

1. The *external* ear.
2. The *middle* ear.
3. The *internal* ear.

### 1. THE EXTERNAL EAR

Includes the *auricle* and the *external auditory passage* (*meatus auditorius externus*). The *auricle* is that part of the ear which projects beyond the skull. It is composed of several portions of fibro-cartilage covered by common integument, and is attached to the side of the head by muscles and ligaments. It is divided into a large superior portion, called *pinna*, and a small inferior portion, the *lobus* or earlap. The *pinna* has various *eminences* and *depressions*, each of which is distinguished by a different name. The most exterior eminence which forms the circumference of the auricle is called *helix*; the parallel eminence within the *helix*, and next to it, is called *anti-helix*. The eminence seated immediately before the

auditory passage bears the name of *tragus*; the opposite one is called *anti-tragus*.

Of the *depressions* of the pinna, the one which lies between the helix and the anti-helix is denominated *scapha* or *fossa navicularis*; the one between the two exterior extremities of the anti-helix bears the name of *fossa innominata* or *triangularis*. The *concha* or earshell is the immediate opening of the external auditory passage, into which all the sinuosities of the pinna terminate.

The *external auditory passage* forms the second division of the external ear. It is a sort of funnel, extending from the concha to the membrana tympani. It is partly cartilaginous and partly bony, and varies in length and in diameter. In some individuals it is only three-fourths of an inch long; in others it reaches to one and a half inches. It is elliptical in its form, and somewhat serpentine in its course. The lining of the canal is a continuation of the integument of the auricle, but in proportion as it approaches the membrana tympani, it becomes thinner and more delicate, and assumes the character of a mucous membrane. Beneath it are the ceruminary glands, whose secretion (the *cerumen* or earwax) is useful in keeping the passage and the tympanic membrane in a state of moisture.

The *membrana tympani* is a thin, delicate membrane which closes the meatus externus; it forms the parti-

tion between the external and the middle ear. It is placed obliquely in an osseous groove, at the termination of the external bony meatus. It is oval in shape, and dry and semi-transparent. It consists of three layers: an *external* or articular, being a prolongation of the lining membrane of the meatus externus; a *middle*, fibrous and muscular; and an *internal*, derived from the mucous lining of the tympanum. It is extremely vascular and sensitive, abundantly supplied with nervous fasciculi from the tympanic nexus, which render it sensible to the impulse of the slightest undulation of the surrounding atmosphere. It is, in fact, the drumhead, which vibrates in accordance with the atmospheric waves, and, by its vibrations, communicates to the auditory nerves the sensations called sounds

## 2. THE MIDDLE EAR

Comprises the *tympanum* and its contents. The tympanum is an irregular cavity, situated between the squamous and petrous portions of the os temporis. Its length and breadth are nearly equal; that is, about one-third of an inch. It is bounded *externally* by the tympanic membrane, *internally* by the labyrinth, *posteriorly* by a short canal which leads to the mastoid cells; and *anteriorly* by the opening of the Eustachian tube, which connects the ear with the throat. The *Eustachian tube*, so called from its

discoverer Eustachio, is a canal which commences at the anterior and lower part of the tympanum, and proceeds obliquely forwards and inwards until it opens in the superior and lateral part of the pharynx (throat), above the velum palati mollis. It is composed of bone and cartilage. The bony portion is lined with the same membrane as the tympanum; the cartilaginous with a reflection of the membrane of the pharynx. The cartilaginous portion affords a surface for the origin of two muscles, the levator palati mollis and the circumflexus palati. The Eustachian tube is about an inch and three-quarters in length. Its width varies in different portions of its course: at its termination in the pharynx, it is large enough to admit a goose-quill.

The functions of the Eustachian tubes are still a subject of mere conjecture; but that they must have an important influence upon the economy of hearing must be inferred from the undoubted fact that when these tubes are closed, deafness ensues.

Besides the Eustachian tubes, there are two other short passages opening into the tympanum: one called *fenestra ovalis* (oval window), leading to the vestibule, the other called *fenestra rotunda* (round window), leading to the cochlea. Both are closed by membrane. Between the two windows there is a projection of bone, arising from the floor of the cavity, called the *promon-*

*tory*. Opposite the lower margin of the fenestra ovalis, on the posterior wall, there is a small protuberance called *eminentia pyramidalis* or *papillaris*.

Within the cavity of the tympanum, there is a chain of four delicate little bones: the *malleus*, the *incus*, the *os orbiculare*, and the *stapes*. They are so called from their shape. The malleus, for instance, from its resemblance to a *hammer* or *mallet*; the incus, from its resemblance to a blacksmith's *anvil*; and the stapes, from being shaped like a *stirrup*. The malleus is divided into three portions: the *manubrium* or handle, the *caput* or head, and the *processus gracilis*. The manubrium adheres to the centre of the membrana tympani, and may be distinguished through the meatus externus. The incus is joined to the head of the malleus, and connected with the stapes by means of the os orbiculare.

All four bones are articulated to each other by capsular ligaments, so as to form an uninterrupted chain between the membrana tympani and the membrane of the fenestra ovalis.

### 3. THE INTERNAL EAR.

The intricate and complicated structure of the internal ear well justifies the name of "Labyrinth," which has been given to it. It may be divided into three parts: 1. The *vestibule*. 2. The *semi-circular* canals. 3. The *cochlea*.

The *vestibule*, into which open the two *fēestræ* (windows) of the tympanum, is an irregularly-shaped cavity in the centre of the labyrinth; its upper floor having a semi-elliptical, and its lower a hemispherical, depression, thus forming a kind of whispering gallery, communicating both with the semi-circular canals (lying in the extreme point of the petrous portion) and with the cochlea (lying towards the mastoid cells).

The *semi-circular* canals are three in number. They are placed, one vertically, another obliquely, and the third horizontally. They are of a very small calibre, about the size of a common pin. They open into the vestibule by five apertures only, for the smaller extremity of the vertical canal joins the smaller extremity of the oblique, and their orifice is common. The openings are of a larger diameter than are the canals, and are therefore called *ampullæ*.

The *cochlea* is so called from its resemblance to a small snail-shell. It is constructed of a central pillar, called the *modiolus*, on which the *spiral tube* (*canalis spiralis*) is wound. This spiral tube is divided into two compartments by a septum, called the *lamina spiralis*, composed of two thin plates of bone. One of these compartments begins at the fenestra rotunda, and is called the *scala tympani*; the other begins at the fenestra ovalis, and is called the *scala vestibuli*.

The labyrinth is lined by an exceedingly delicate

membrane, which secretes a clear fluid called the *acqua labyrinthi*. In the vestibule, in addition to this membrane, there are two small sacs, called *sacculi vestibuli*, inseparably connected with each other, and firmly attached to the former, at the termination of the meatus internus, by nerves. These sacs contain a clear fluid and some cretaceous matter, analogous to the otolithes in animals. There are also three membranous sacs lying in the semi-circular canals containing fluid, and themselves floating in the *acqua labyrinthi* (also called liquor cotunni and perilymph).

The *meatus internus* is a bony canal, about one-third of an inch in length, through which passes the *auditory nerve*. When the latter reaches the extremity of the *meatus internus*, it divides into two branches: 1. The larger, or anterior to the cochlea; 2. The smaller, or posterior to the vestibule and semi-circular canals.

The *anterior* branch divides into a number of minute filaments, which pierce the base of the cochlea, and expand in its mucous lining; others enter the modiolus, which is hollowed into canals to receive them, and pass off through small openings in its circumference, to expand in the mucous membrane covering the lamina spiralis.

The *posterior* or vestibular portion of the nerve divides into three branches, which are distributed, 1. To form the utriculus communis and the membranous

tubes of the perpendicular and horizontal canals; 2. To form the sacculus proprius; 3. To form the membranous tube of the oblique canals.

The *arteries* of the ear are derived both from the external and internal carotid, but chiefly from the basilar, from which arises the largest artery—*arteria auditoria interna*.



## PHYSIOLOGY OF THE EAR.

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THE form in which phenomena of the outward world present themselves to the perception of the organ of hearing, is as *sounds*.

A *sound* may, therefore, be defined as an effect produced upon the sensorium, through the organ of hearing, by certain *vibrations* of the particles of a more or less *elastic* and movable medium.

Sound is propagated through a *fluid* medium, by means of undulations or waves of the medium. The manner in which sound travels, is not inaptly illustrated by the circular waves produced in still water by a stone falling perpendicularly into it, the waves being deep and powerful in proportion to their proximity to the stone, and to their small circumference, each circle increasing in extent and diminishing in power, until, by the influence of friction and attraction, they cease altogether.

The *atmosphere*, in virtue of the great elasticity and the extreme mobility of its particles, is a conductor of

sound, admirably adapted to the delicate structure of the ear. The *rapidity* with which sound travels, is, according to Sir John Herschel, about 1090 feet per second. The *distance* to which sound will be conveyed, depends upon a variety of opposing or favoring circumstances. In consequence, no doubt, of the diminished elasticity of the air, it happens that fogs, rain and snow obstruct the progress of sound; whereas, the presence of quiet water and ice, increase its clearness and depth. It is well known that by the side of a canal, sound may be heard at an astonishing distance. Thus, Dr. Hutton heard distinctly a person read on the Thames near Chelsea, 140 feet distance, while he would hear the same voice on land, only 76 feet. Lieutenant Foster, in the Polar Expedition, held a conversation with a man a mile and a quarter distant, across the frozen harbor of Port Bowen. Dr. Young says, at Gibraltar, the human voice was heard 10 miles off. According to Derham, guns fired at Carlscrona were heard at Denmark, 80 or perhaps 120 miles distant. Dr. Hearn heard guns fired at Stockholm, 180 miles off. The cannonade of a sea-fight between the English and Dutch in 1672, was heard, across England, at Shrewsbury and Wales, upwards of 200 miles from the scene of action. The fact that sounds are more distinct and clear, and can be heard at a greater distance by night than by day, appears to be

due, not only to the greater stillness then existing, but also to the greater homogeneity of the atmosphere.

In describing the physiology of hearing, it is necessary, in order to be quite explicit, to allude to a most important law to which sound is subject in a manner very similar to *light*; namely, the *law of reflection*. This law requires the especial attention of the physiologist, as the eye and ear of the higher animals are adapted to produce these reflections, without which the function of neither organ would be accurately accomplished. This reflection of sounds is termed *catacoustics*, in contradistinction from *diacoustics*, which relate to sounds directly striking the ear.

The *auricle* seems to be constructed with peculiar reference to this law. The sound, striking upon its eminences, is thrown into its cavities and grooves, and, increased in strength by reflection from the parietes, is conducted to the bottom of the concha (earshell). The ear therefore is indebted to the auricle, not only for receiving a larger quantity of sound than would fall upon the meatus without it, but also for the condensation of the sonorous rays towards a focal point.

The sound thus received by the auricle, passes along the meatus auditorius externus, and strikes upon the surface of the membrana tympani. As in any other tube, the sonorous rays will be reflected from the surface of the canal, and consequently increased

in power by condensation. And it is evident that the peculiar curved direction of the meatus will occasion the reflections to be such that they shall fall with the greatest advantage upon the *tympanic membrane*, whose obliquity of position admirably adapts it to receive them. The *cerumen* (earwax) has the effect to diminish the reflection, which otherwise might amount to an echo.

The *membrana tympani* receives the sonorous rays prepared by the outer ear, and exercises an important influence in propagating their effect to the sensorium. It is not a regular concavity, and hence probably does not possess a focus of reflection. Its reflecting power is also limited by its fibrous irregularity, and it is therefore well adapted for vibration. Stretched between two layers of an elastic medium, that is, the air without and that within the cavity, the membrane, receiving its oscillations from the one, must freely communicate them to the other. Those excited in the inner stratum of air may react upon the membrane, by which reaction the membrane is merely returned to its state of quiescence.

The *ossicula auditus* (the four little bones in the tympanum), with their ligaments, forming an elastic chain, are well arranged to receive the motions from the membrane, and the impulse having been conveyed onwards to the labyrinth, they will react upon the

membrane to the degree only of normal replacement. Thus, an excellent provision appears to be made to prevent the membrane from being driven too far outwards, and to preserve it in a condition to be influenced by new sounds, as rapidly as they can be conveyed to it. This membrane, therefore, is a modified *drum-head*, and, like that instrument, has a mass of air occupying the interior, furnished with an aperture, the Eustachian tube, and, like the drumhead, it can be tightened and relaxed, possessing, however, the very great advantage of its relaxation and intenseness varying according to the note falling upon it, and as rapidly as it receives it. It is most likely that the number of vibrations of which the membrane is capable, vary at least from sixteen to twenty-four thousand in a second. Of course, the muscles have an important influence in adapting the membrane to this great variety, as this power depends upon its degree of tension. It appears that when the mind is intent upon catching every minute impression, the tensor tympani and stapedius, by drawing the ossicula, tense the membrane, and thus fit it to receive the slightest influence. On the contrary, when the note is oppressively loud or discordant, the laxator tympani, aided by the levator tympani, relaxes the membrane, and thus lessens its vibratibility.

The *ossicula* are so articulated that they form not

only a vibratile, but also an elastic *chain*, and, being firmly articulated to each other, are admirably arranged to transmit the rapid and tremulous motions from the membrana tympani to the membrana fenestræ ovalis. They assist also in increasing the power of the impression, as nearly the whole vibration of the membrane is concentrated in the manubrium of the malleus, and is further augmented in its head by means of its leverage. This augmentation of vibratory power is still increased in its transmission along the different levers, and, at last, is condensed upon the membrane of the oval window (fenestra ovalis), which thus, small as it is in comparison with that of the tympanum, receives the same influence, much augmented. This increased vibration is thence transmitted to the fluid of the vestibule. Some physiologists are of opinion that these little bones are of secondary importance in transmitting the oscillations; others, to whom particularly Pilcher belongs, consider them the chief means of occasioning the undulations of the aqua labyrinthi. It is true that the ossicula, not even excepting the stapes (stirrup), may be lost, and hearing still continue, but the function is then imperfect, and the more minute sounds are imperceptible. Most probably it is through the agency of these small bones that the infinitely delicate, minute, and rapid vibrations of the membrane of the tympanum occasioned

by speech, music, and all slight sounds following in quick succession, are increased sufficiently to produce effective undulations in the labyrinth. Thus therefore, there is great reason to esteem the middle as the musical portion of the ear. *Savart* concludes his observations on the ossicula by saying: "In fine, I believe that the chain of small bones is to the ear the same as the bridge to the violin."

Many physiologists regard the *air* in the tympanum as the chief means of transmitting the vibrations from the membrana tympani to the labyrinth, by exciting similar oscillations in the membrana fenestra rotunda. The use of the ossicula, according to this theory, is principally limited to supporting the membrane, and, in some degree, to assist in affecting the labyrinth through the medium of the fenestra ovalis.

The function of the *Eustachian tube* is to supply the tympanum with a constant renewal of fresh air. This renewal is necessary, because the air in the tympanum becomes rarified by the temperature of the part, and in proportion as it becomes expanded by the heat, may be absorbed, and consequently will cease to afford the requisite counter pressure, and suffer a diminution of its vibrating capability. The closure of the Eustachian tube is invariably attended with loss of hearing. As for the *mastoid cells*, the chief use, as far as the ear is concerned, seems to be to con-

tain a larger quantity of air, which is thus prevented from becoming too rapidly rarified.

We come now to consider the functions of the *internal ear*. No doubt can exist that the first, and perhaps the most important, undulations, take place in the *vestibule*, and as the large sac of this cavity is in direct contact with the membrane of the fenestra ovalis, which is set in action by the ossicula, it may be presumed that the influence of this membrane is much greater than that of the fenestra rotunda. The fluid of the vestibule is thus agitated into undulations, corresponding to the vibrations of the membrane of the fenestra rotunda. These waves extend around the semi-circular canals, commencing from and terminating in the sac of the vestibule. The aqua labyrinthi, flowing thus over the highly-excited nervous membrane, excites an impression which is conveyed by the auditory nerve to the brain, and the consequence of this is the *perception of sound*.



## GENERAL PATHOLOGY OF EAR DISEASES.

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### a. GENERAL SYMPTOMATOLOGY AND NOSOLOGY.

THE ear, in which the various tissues of the organism are repeated, condensed in a narrow space, is subject to numerous morbid affections. But the diseases which assail it are by no means such as peculiarly and exclusively belong to this organ, but, on the contrary, are the very same that appear in the corresponding tissues of other parts. What seems *peculiar* lies exclusively in the *form*, in as far as this latter, owing to the particular structure and function, is liable to various necessary deviations. Owing to the fact, however, that many morbid processes do not make themselves directly perceptible and sometimes effect an objectively perceptible alteration only by their products, whereas, in the beginning, they produce merely *subjective* disturbances corresponding with the functions of the affected parts—owing to this fact, it is, indeed, possible

that they may easily be overlooked, misinterpreted, and mistaken for other processes which resemble them in form, but which are altogether different in essence. Mistakes of this kind had to occur the more easily, so long as the form was looked upon as the pure expression of the morbid process, and so long as the diagnosis could not be established objectively.

While clinging exclusively to what was externally perceptible, and taking this for the disease itself, it very often happened that the *symptom* was mistaken for the entirely overlooked *fundamental* disturbance, as is sufficiently proved by the fact that so many purely symptomatic conditions figure in the list of particular forms of disease. A still worse success necessarily attended any attempt to found the diagnosis on purely subjective symptoms. Thus it very often happened that common symptoms of the most different diseases, such as dulness of hearing, noises in the ear, &c., were looked upon as particular forms of disease, while the fact of their existence would have been a stimulus for the rational otologist (ear physician) to find out the causes that produced them.

Though pathological anatomy has recognised and removed many of these mistakes, still it is not always able, by correcting the diagnosis, to contribute to a due appreciation of hidden diseases, which, in the living body, can very often be recognised solely by

their reaction upon the function, which thereby gains its abnormal appearance.

This holds good at least of diseases that are inaccessible to immediate perception, such as those of the labyrinth, while the influence of pathological anatomy upon a more exact knowledge of the diseases of the external, and partly also of the middle ear, has made itself felt in a most gratifying manner by the correction of a number of antiquated errors. It is, therefore, doubly surprising that there should still be some who take so little notice of the results of pathological anatomy even in the external ear, which is immediately accessible to examination, that they still continue to look upon mere symptoms of disease, such as otorrhœa for instance, as independent diseases.

Since it is impossible for the present consistently to carry out a physiological pathology of ear diseases, and since pathological anatomy, owing to the inaccessibility of many parts of the ear during life, cannot always serve as a safe guide, as it always comes too late with its disclosures, the physician finds himself often compelled to have recourse to *analogy*, particularly in cases where no objective diagnosis can be formed. In order that he may not lose himself in the labyrinths of this uncertain domain, he will do well to use this principle as his Ariadne thread—a principle which we have already laid down, viz.: *that the ear*

*has no diseases that are peculiarly its own ; and that each disease is attached to a certain substratum, in which it is particularly apt to develop itself.* Diseases which extend themselves to the ear from other parts, will therefore always manifest themselves in the substratum corresponding to themselves, let the form be whatever it may. In this respect, we often get some directing hints from ætiology, and still more from the simultaneous continuance of other diseases, of which the ear complaint is simply the reflection. With a due degree of circumspection, a discreet use of analogy will often guide us so safely that our diagnosis receives a confirmation from physical examination, for instance, in affections of the mucous membrane of the middle ear in connection with other catarrhal disturbances, angina, &c. For the most part, it is only the substratum of the ear disease which, in this way, can be ascertained with more or less probability, while the seat of the disease is yet to be determined by other means of examination. But where the latter prove inadequate, we can still less dispense with the help of analogy for the purpose of harmonizing the phenomena of the disease with the fundamental morbid process.

Like all other diseases, the affections of the ear are to be looked upon as abnormal vital processes, attached to a certain substratum. Deviations of organization and function can only be separated in idea, so that

so-called organic and dynamic diseases form no direct antitheses, but are the end points of one and the same process, with imperceptible transitions. In every functional disturbance, we may presuppose an alteration of organization, and vice versa, though both may not always make their appearance at the same time. Diseases of the ear manifest themselves, as a general rule, by a disturbance of hearing. Exceptions from this rule are more apparent than real. Seeming exceptions find their explanations in the fact that trifling affections of the hearing—which in no case is determined by an absolute normal measure—can the more easily escape the notice of an inattentive observer, as, in the case of a one-sided affection, the sound ear, to a certain extent, supplies the deficiencies of its suffering mate. Real exceptions may indeed occur, when the disease attacks those parts of the ear which have no direct connection with the hearing, such as the ear-shell, for instance.

A derangement of hearing may be caused in different ways:—

1. *By a disturbance of the function of the auditory nerve*, where the conveyance of sound may possibly not be affected.

2. *By a disturbed sound-conveyance.* The most important instances that come under this head, are contraction; obstruction; closing up of the external meatus

auditorius (auditory canal); the cessation of a renewal of air in the middle ear, owing to a contraction and closure of the Eustachian tube, by the collection of solid and fluid matter in the cavity of the tympanum; condensation and obduration of the tympanic membrane; closure of the fenestra ovalis (oval-shaped window) of the labyrinth; abnormal insertion or want of the tensor tympani, the ossicula auditus (small bones of the tympanum), particularly the stapes (stirrup), &c. In other instances, the sound-conveyance is not disturbed as to its mechanism, but the sound produces a confusing impression, on account of a too strong resonance, together with dryness of the external meatus (auditory canal); or, by irritating the sensible nerves of the inner ear, it produces painful sensations, with, at least, a transient affection of hearing. We must make a particular mention of the fact that many of these abnormities may be found in combination with each other; as, for instance, obstruction of the Eustachian tube, with an altered receptivity of the auditory nerve.

According to their nature, the numerous, and often arbitrarily multiplied diseases of the ear, may be reduced to a few principal forms:—

*a. INFLAMMATIONS,*

including cases of congestion and irritation. They

are not only the most numerous, but also most important affections of this organ, for they appear in all tissues of the ear and in all degrees. It very often happens that their products are looked upon as particular forms of disease, without reference to the fundamental derangement. As the greater part of the ear is proportionately poor in blood-vessels, it seems almost incomprehensible that it should be particularly liable to inflammation. Nevertheless, it is a fact that the far greater number of ear diseases is of an inflammatory character. The most important are the membranous inflammations, which make their appearance in the most different degrees and under the most different character, in all parts of the ear, and exercise such a striking influence upon the hearing that many have been led to reduce almost all diseases of the ear to an inflamed condition of the membranous parts, particularly the mucous membranes. Many forms of dysacusis (dulness of hearing) that are considered of a nervous character, are only symptomatic accompaniments of an overlooked lingering inflammation of the internal mucous membranes, which, by means of an increased secretion, particularly if it is attended with a difficult discharge, causes and keeps up a deranged state of hearing. Other effects of inflammation, such as excrescences, loosenings, &c., often continue an independent existence, after the inflammation has

ceased, and exercise a most injurious effect, particularly in the narrow parts, such as the Eustachian tube, by an approximation of the sides, by obstruction, concretion, &c. The external canal, from the fact that it is more immediately exposed to injurious influences is still more frequently the seat of inflammatory affections; and these latter here again assail principally the membranes, although they may appear simultaneously in the underlying parts.

Though all parts of the ear are liable to inflammation, still the latter occurs most frequently in the membranous clothing of the external auditory canal and in the tympanum. Phlegmonous inflammations, owing to the inconsiderable vascular development, and the not very loose state of the cellular tissue, occur proportionately but rarely; they are most likely to assail the external auditory canal, and almost exclusively its entrance, where the cellular tissue lies less firmly on the cartilage. Less frequently inflammations occur in the periosteal membrane, where they are characterized (as also in the cellular tissue) by a great tendency to suppuration, caries, and necrosis, whereby they can produce the most destructive effects. The deeper inflammatory affections either proceed from a diseased condition of the superficial parts, or, if the reverse is the case, the latter always suffer at the same time. As might be expected from the ana-



tomical character of the affected parts, but a small part of the inflammations of the ear attain great intensity. Many commence almost imperceptibly, and the greater part tend to assume a lingering character, which, however, does not exclude the formation of products that again exercise an injurious reaction upon the organs of hearing. But few forms of inflammations, generally those of the external and middle ear, are attended with any great degree of painfulness. Inflammations which remain confined to the surfaces, without attacking the sensitive nerves of the middle ear, very often pass away without causing hardly any pain, even in subjects that are by no means torpid.

The generally acknowledged fact, that the process of inflammation can attain a pure development in an organ and organism which otherwise enjoys the full energy of health, has very properly been made use of as an explanatory reason for the variety of its forms. When the affected organ and organism is in a state of highly increased sensibility, the inflammation, deviating from the pure form, will assume the so-called *erethic* character; the sensitive nerves being put into a state of predominant irritation, with proportionately great painfulness. When the state of the nerves is of the opposite character, the inflammation will, on the contrary, assume a *torpid* appearance. In the ear,

we encounter both forms; and the erethic form, which is comparatively of rare occurrence, reaches here a degree such as it does in no other organ.

### *β. NERVOUS DISEASES.*

The nervous diseases have long been considered as belonging to the darkest regions of medical science, and, until very lately, have been rather the subject of fantastic speculation than scientific investigation. It is consequently no matter of surprise, that with the exception of the nervous dysacusis (dulness of hearing), the nervous diseases are as yet but poorly represented in scientific medical literature. The nervous physiology of the ear is still in a very imperfect condition, a fact which forms a great obstacle in the way of aural medicine, since there can be no rational pathology which is not founded on an enlightened physiology. Nevertheless, a discreet use of the results of the latest physiological investigations will often enable us to form a more correct pathological judgment. Without entering into details, therefore, we shall content ourselves with presenting to our readers the most incontestable facts of physiology, which will serve us as a basis for a sketch of the nervous pathology of the ear.

Besides the auditory nerves which terminate in the labyrinth, the ear is abundantly provided with other

nerves. Though they have hitherto received but little attention from ear physicians, the fact that they exist in such large numbers compels us to believe that they are by no means unimportant. The auditory nerves have for their exclusive function the perception of vibrations produced in the ear by the impressions of the sense; consequently, we must believe that the other nerves, each according to its peculiar nature, have a different function. And, in fact, the ear, like other organs of sense, is endowed with particular sensory, motory, and nutritive nerves.

1. The *external ear* receives its sensory nerves from the ramus temporalis superficialis of the trigeminus, as also from the ramus auricularis of the plexus cervicalis, rising from the second and third cervical nerve. The former ramifies itself only on the anterior, the latter on the posterior half of the earshell (concha), and at the same time passes over into the lining of the auditory canal, which also receives a branch of the vagus. The motory nerves alone rise as ramus auricularis from the facialis, whereas the nutritive nerves take their origin from the ganglion cervicale supremum of the sympathetic nerve, accompanied by ramifications of the trigeminus.

2. The *middle ear*, like the external, receives sensitive nerves from the trigeminus and vagus; yet, besides, it receives some from the glossopharyngeus.

The *motory* nerves take their origin from the facialis, and, like the sensitive nerves rising from the trigeminus, they do this by means of the ganglion sphenopalatinum and oticum of the vagus, and glossopharyngeus nerves. From the same ganglia the middle ear receives its *nutritive* nerves, which are ramifications of the sympathicus and trigeminus.

The functions of the nerves of the external and middle ear can be easily inferred from the well-demonstrated fact that the primitive fibres of the nerves, each according to their origin, have either motory or sensitive functions, and that these latter never occur in one and the same fibre. The sensitive nerves evidently have the mission to put the ear into a degree of excitement favorable for hearing; the motory nerves, by their action upon the muscular parts, are made to change the position and tension of the little auditory bones, the tympanic membrane, and, to a certain degree, even of the earshell, according to the degree of distinctness of hearing that is required. The collective effect of these nerves stands evidently in relation to the accommodating faculty of the ear with regard to the perception of the various degrees of height and intensity of sound. For which reason they may well be considered as assistants of the auditory nerves. This view is supported by the fact that, when listening intently, we instinctively give a different tension to

the motory parts of the ear, and are thereby able to increase the keenness of the sense. Still, when we come to a more particular application, we meet with considerable difficulties, part of which are as yet insuperable.

The motory nerves of the middle ear, owing to the fact that they pass through the above-mentioned ganglia, are not influenced by the will, but receive their impulse from a reflex action by means of the sensitive nerves. On the other hand, it is, as yet, by no means perfectly clear in what manner the sensitive nerves of the ear are excited.

Without taking any notice, for the present, of the manifold combinations of the single forms, we may reduce the nervous diseases of the ear to the following fundamental forms:—

1. *Sensory* neuroses.
2. *Motory* neuroses.
3. *Nutritive* neuroses.
4. *Auditory* neuroses.

#### 1. THE SENSORY NEUROSES

appear in a twofold form. The sensibility is either so *excessive* that it becomes painful, or it is *diminished*, and even extinct. It is doubtful how far perverse perceptions of the sense are the effect of a qualitative

change in the sensory nerves, but it is certain that they can be produced by reflex action on the motory nerves, and by the derangement of the faculty of accommodation. Frequently, otalgia (earache) is not the disease itself, but only its symptom, as, for instance, in the case of an inflammation, and almost always it is accompanied by an abnormal activity of the motory parts in the middle ear. A neuralgia can never proceed from the *auditory* nerve, since it is no more liable to pain than the *optic* nerve.

We know of no well-attested cases of *primary* paralyses of the sensory nerves of the middle ear, but in a *secondary* character, they not unfrequently accompany paralysis of the auditory nerves.

## 2. THE MOTORY NEUROSES,

which here, as everywhere else, appear in the form of spasms and paralyses, belong, as far as their diagnosis is concerned, to the darkest subjects of aural medicine. As the well-ascertained result of the investigations hitherto made, we may say that, although the motory neuroses of the ear (which, as a general rule, are only secondary and symptomatic) may indeed exert a most decided altering influence upon the form of many diseases, they cannot as yet be treated as independent forms.

## 3. THE NUTRITIVE NEUROSES

seem to have their origin in the trigeminus and sympathetic nerve, since they are almost always attended with a greater or less degree of anaesthesia. Dryness of the surface of the auditory canal, a peeling off of the epithelium, and a diminished or suppressed secretion of earwax, are the objective symptoms, from which we infer that the nutrition in the *external* ear is deranged. As for the middle and internal ear, we have no objective phenomena to judge by, and only dissection can enlighten us as to its condition. As all these phenomena are hardly ever perceived except in company with dulness of hearing, particularly in old persons, they have only a symptomatic significance. They seem originally to be connected with an affection of the auditory nerve, on which account a return of the suppressed secretion of earwax may be looked upon as a prognostically favorable circumstance. As independent diseases, the nutritive neuroses deserve to be considered as little as the motory neuroses.

## 4. THE AUDITORY NEUROSES

are the most important of the nervous diseases of the ear. Though it would indeed be wrong to refer every affection of hearing to the auditory nerve, it is equally certain that a diseased condition of this nerve can manifest itself only by an altered perception of the

sense. On this account, we are obliged to found the diagnosis of the neuroses of the ear on subjective symptoms; but we ought only then have recourse to them when the objective examination has furnished merely negative results. It is, indeed, not to be denied that, in this way, we are unable to ascertain anything else but the *mode* in which the disease manifests itself, and that this may admit of a different interpretation of the process. Disorganizations of the auditory nerves in the places where it originates, as well as in the labyrinth itself, can no more be distinguished from a so-called dynamic disease of the auditory nerve, than abnormalities of the osseous parts which exercise an injurious effect upon the latter. As we have no other guide than the symptoms of the deranged action of the sense, we are under the necessity to infer from it the disease of the nerve itself, without being able always to correct our judgment with the help of other phenomena, such as the constitution of the patient, and so on.

The form of these diseases is generally so little complicated, that it is more easy to form a diagnosis with regard to them than to trace them back to their true source. There can only be three kinds of anomalies of the hearing perception. The latter is either *increased*, or *diminished*, or *altered* in its quality.



An *increased* activity of the auditory nerve appears in the form of morbid, almost painful, sensitiveness to even the most common noises. Whenever it proceeds from the auditory nerve itself, it is always merely transient, and by over-excitement, sooner or later produces dulness of sensibility. More frequently it is merely symptomatic of various excited conditions of the brain, inflammation in the ear, &c.; and then most principally produced by the instrumentality of the sensory nerves of the tympanic cavity. As a *morbus sui generis*, this on the whole rare form of disease has been treated by *Itard*, and later by *Schmalz*, but it is most properly considered as a mere precursor of the *erethic* nervous dulness of hearing, in which it generally terminates.

A *diminished* activity of the auditory nerve constitutes the nervous dysacusis (dulness of hearing), which may amount to complete deafness. In its pure form, it appears as *torpid*-nervous dysacusis, without any other symptoms than a uniform obtuseness of the auditory nerve. When combined with an irritated condition of the sensitive nerves of the middle ear, it becomes *erethic*-nervous dysacusis, and is characterized by an unpleasant sensitiveness to loud, shrill sounds, accompanied by occasionally impaired hearing. The *tinnitus* (singing in the ear) which generally co-exists with this form of disease, has no pathognomic signifi-

cance. As far as this form of disease manifests itself as excessive sensitiveness to sounds, it may, indeed, proceed from an irritation of the sensitive nerves; but whenever dysacusis takes place, we are compelled to believe that the auditory nerve itself is affected.

A *qualitatively* altered condition of the auditory nerve has only a symptomatic importance. It is almost always combined with morbid sensitiveness. Sounds are heard either prolonged, or double, or confused. *Paracusis*, in as far as it relates to one's own voice, is generally a symptom of an obstruction in the Eustachian tube; when it refers to other sounds, it is mostly attended with trifling degrees of dysacusis. The *echoing* of sounds generally presupposes an increased sensitiveness of the auditory nerve, but may also be caused by a too strong resonance of the tympanic membrane, in cases where the expanded auditory canals are in a state of considerable dryness. *Double hearing* is but of very rare occurrence. It is caused less frequently by an altered condition of the auditory nerve than by a want of harmony between the two ears. In this latter case, it disappears as soon as one ear is stopped.

### γ. ORGANIC DISEASES.

Organic diseases occur in all parts of the ear. They may best be classified under the following three heads: *Hypertrophy*, *Atrophy*, and *Paratrophy*.

#### 1. HYPERTROPHY

consists in one-sided excessive nutrition, without a material alteration of the affected part. It frequently occurs in the ear as the effect of inflammatory processes, and, according to the part where it is seated, has a different form and a different meaning. Many cases of expanded earshells, contracted auditory canals, thickened membranes of the tympanum, are simply the effects of hypertrophy.

#### 2. ATROPHY

is the direct antithesis of hypertrophy. It generally consists in an obliteration of the nutritive vessels, caused by inflammation, so that the affected part dwindles and decays from want of blood. It occurs principally in the little glands which produce the earwax, in the cellular tissue of the external auditory canal, and in the tympanic membrane; by way of exception, even in the auditory nerve.

#### 3. PARATROPHY

is generally characterized by an entire change of

organization and degeneration of the affected part. It is most frequently combined with hypertrophy, in which case it assumes a parasitic character, and appears in the form of various kind of excrescences, tumors, &c.

### b. GENERAL AETIOLOGY.

It is the object of aetiology in general to find out the *cause of a disease*, and to show its necessary connection with the latter. As it is not always possible to perceive the primary cause of an *ear* disease, and the latter very often manifests itself only by its symptoms, it becomes the task of aetiology to discover the various circumstances which may have had a remote bearing upon the formation of the disease, and which, in contradistinction from the primary cause, we may call *secondary* causes. These may again be divided into *predisposing* and *accidental* ones.

#### 1. PREDISPOSING CAUSES.

As general *predisposing* causes, we may consider the *unprotected* condition of the ear, its comparative want of blood-vessels, its continual exposure to all influences of temperature, the constant demand made upon it for the purpose of hearing. In addition to these, the various nervous combinations with other organs, by means of which the morbid condition of the latter finds a sympathetic response in the ear. Although

no age is safe from them, there are certain periods of life that are particularly liable to these diseases. Such a period, for instance, is that of *dentition*, during which otorrhœa (running from the ear) is so frequent, that with certain children it almost becomes a rule.

Sometimes the period of *involution* with the female sex is not altogether without a reaction on the organ of hearing. The same sometimes takes place during *pregnancy*.

*Old age* is almost always attended with difficulty of hearing, which is caused not only by the growing dulness of the auditory nerve, but to a great extent by the greater rigidity of the tympanic membrane, the dryness of the tissues, and particularly by the disordered secretion of earwax.

Among the unmistakable predisposing causes of ear diseases, we must also mention the *difference of sex*; males being much more liable to them than females. As the organization of the instrument of hearing is not different in the two sexes, we have to look for the explanation of the above fact in the difference of life and occupation, and also of head coverings, without being obliged to suppose that there exists originally a greater predisposition in one sex than in the other.

And, finally, we must not forget to mention the *hereditary* predisposition to diseases of the ear, which, in many families, shows itself through various gene-

rations, without always being attended by any perceptible organic alterations of the instruments of hearing. It is generally connected with other hereditary diseases, particularly dyscrasies, scrofulas, &c., and manifests itself as these latter develop themselves.

## 2. ACCIDENTAL CAUSES.

These are either *direct* or *indirect*. *Direct* causes are bruises, wounds, an unskilful use of instruments, of caustics, of medicines, of electricity, foreign bodies getting into the ear, draughts of air, cold water, powerful noises, and so on. People plying a noisy occupation, such as cannoniers, millers, or workmen in manufactories and iron foundries, are apt to be afflicted with difficulty of hearing. Cold the ear can bear less than any other organ, and no other accidental cause is at the bottom of so many aural affections as cold.

*Indirect* causes of ear diseases are so numerous that we can speak of them only in general in this place. In order to obtain a thorough understanding of their action, we must keep before our mind the anatomico-physiological relations of the ear to other parts. With the *cutaneous* system the ear stands in immediate connection, as the external auditory canal, together with the tympanic membrane, is lined with a continuation of the external skin, and the tympanic cavity with a mucous

membrane. By the auditory nerve, the inner ear is connected with the brain; the middle and external ear by the other nerves, partly with the brain, partly with the spinal marrow, and indirectly with all those organs which receive their nerve branches from the same trunk. From this it is easily seen that various derangements of the cutaneous system can extend themselves to the ear. It is in this way that colds act so great a part in aural pathology. Most of the ear diseases thus produced owe their origin to a transmigration of the morbid process. By this transmigration, irritations of the adjoining mucous membranes, with or without simultaneous swelling of the glands, are transferred to the middle ear. Hence, the tendency which an enlargement of the tonsils has to produce and to keep up affections of the mucous membrane of the middle ear. Small-pox, measles, scarlet-fever, produce an inflammation of the mucous membrane or irritation of the adjoining parts, which by reflex action is transferred to the ear. Chronic exanthems communicate themselves more frequently by passing from the external skin to the lining of the auditory canal and the tympanic membrane. They, however, rarely retain their characteristic form, but manifest themselves mostly as *otorrhœa*, that is, inflammation, with a tendency to increased secretion. Syphilis attacks the ear only indirectly, by means of inflamma-

tion of the throat. As a general fact, we may state that constitutional disorders, particularly dyscrasies, rarely affect the ear in a direct way, but, generally, by localizing themselves in neighboring parts.

Owing to the connection of the auditory nerve with the brain, affections of the latter reflect themselves in the labyrinth. An impeded development is very often connected with congenital dysacusis, as, for instance, in cretinism; while, on the other hand, a congenital deficiency of hearing does not always argue an affection of the brain, as is sufficiently proved by the intellectual completeness of many deaf mutes. Dysacusis in typhous fevers, which is often looked upon as prognostically favorable, is, by no means, always purely symptomatic, but very often caused by inflammatory affections of the middle and internal ear.

The consensual relation of the ear with other parts is a point of much importance for aetiology. Neuralgic affections of the middle ear are most frequently connected with similar affections of other branches of the sensitive nerves, particularly the trigeminus, are often nothing else but the accompaniments of prosopalgia (faceache), and in the far greater number of cases have some connection with neuralgia of the tooth nerves. That paralysis of the facial nerve react upon the ear, has already been stated. By means of the nervus vagus and nervus sympathicus, pectoral and abdomi-



nal disorders can be transferred to the ear, and vice versa, an irritation of the external auditory canal, in which there is a little branch of the nervus vagus, produces a tendency to cough. Abdominal complaints, being mostly connected with a disordered circulation, so-called plethora abdominalis, produce congestions which have a particularly injurious effect upon the ear, especially when the latter has derived its morbid disposition from nervous sympathy. The same may be said of anomalies of menstruation, of hemorrhoids, of pregnancy, of suppressed bleedings. A most unmistakable relation the ear sustains to the eye, on which account both organs, particularly those of the same side, are very liable to be attacked by the same disorders, and in old age to become simultaneously obtuse. That both ears are in the most intimate relation with each other is proved by the striking sympathy manifested in many diseases.

#### c. GENERAL COURSE OF EAR DISEASES.

Although not essentially different from the diseases of other organs, affections of the ear still present many peculiarities with regard to their course. They are mostly, from their very beginning, of a chronic character. Making their appearance first in so general a form that they very often escape the notice of the patient himself, many of these diseases pro-

gress, almost imperceptibly, to such a degree that they exercise a perceptible reaction upon the functions of the organ of hearing. Others show no trace of a reaction during their whole progress, while others again show it merely transiently. This is particularly the case in the inflammations of the cutaneous formations, particularly the lining of the external auditory canal and the mucous membrane of the Eustachian tube and the middle ear, which very frequently excite the attention of the patient only by their various products. Though there are cases when inflammations of the cellular tissue and the periosteum, particularly in the labyrinth, make their appearance suddenly with an acute, and even most acute, character, and accompanied with the most excruciating pains, still they are never of long duration. If these forms are not speedily attended to, they, no less speedily, assume an unfavorable turn, particularly that of suppuration whereupon, under a different character, they take a more lingering course. Owing to its want of blood, the ear is not capable of a prolonged reaction. The most important ear diseases, the paralytic affections of the auditory nerve, take, without exception, a lingering course.

## GENERAL PROGNOSIS OF EAR DISEASES.

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ALREADY, from the want of reaction exhibited by the greater number of ear diseases, we are led to infer that they are not likely spontaneously to take a favorable turn. And this supposition is only too well confirmed by experience. When left to themselves, most ear diseases develop themselves with irresistible power; in many cases to such a degree that art itself can no longer overcome them. As the first appearance of these diseases is generally so very gradual, even careful persons are apt not to notice, or to neglect them, and the help of the physician is only then invoked when they have already made considerable progress. This has contributed to give to these diseases, with the unprofessional public, a reputation of incurability, which they by no means deserve; for most of them can easily be cured, if the assistance of a scientific physician is called for.

We will give here a few of the more important *prognostic principles*. Ear diseases of an *acute* character, which, however, are extremely rare, generally have a better prospect of being cured, because the

violent pains connected with them lead the patient to call sooner for medical help. Diseases which appear to be purely *dynamic*, are more difficult to treat than those that are attended with perceptible *organic* alterations. *Hereditary* ear diseases are, above all others, characterized by their obstinacy and tendency to relapses, but even they are not to be looked upon as *absolutely* incurable.

Of greater *prognostic* importance is the *seat* of the disease. Diseases of the auricle, of the external auditory canal, of the tympanic membrane, are curable in most cases. Even the diseases of the Eustachian tube and of the middle ear, particularly the inflammations of the mucous membrane, cannot resist an energetic treatment, unless in cases where plastic depositions and concretions have taken place. More obstinate is *dysacusis*, when it appears without any demonstrable material alterations. Absolute deafness is to be considered as absolutely incurable. Nervous dysacusis, as a general rule, can more frequently be improved than thoroughly cured. But the least favorable prognosis is presented in cases where a reckless use of heroic remedies—electricity, galvanism, and electro-magnetism—has previously taken place. Congenital deaf dumbness, as a general rule, is absolutely incurable, unless in cases where it is caused by removable organic defects, such as the membranous concretion of the external auditory canal.

## GENERAL THERAPEUTICS AND SURGERY OF EAR DISEASES.

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THE principles of the general rational therapeutics equally apply to the treatment of ear diseases. Here, as everywhere, the *causal* indication takes the first place, though it must indeed be confessed that, owing to the unknown origin of many ear diseases, a causal treatment is not always possible. But a causal indication can only be used with success in connection with a thorough *objective* diagnosis. How often has an ear disease, the diagnosis of which has been formed from an illusory accidental cause, resisted a seemingly rational treatment for years, when the use of the ear speculum or the catheter, by discovering the true cause, at once removed it! How often has a supposed nervous deafness been instantly cured by the removal of hardened earwax, or of a plug of cotton wool that had stuck in the meatus! But in all cases, the causal treatment must be brought in harmony with the *direct* treatment, and in many cases this object is answered by one and the same remedy, as, for instance, in

dyscratic inflammations, by mercury or preparations of iodine.

The direct treatment is principally of a *local* character, but the local disease must always be viewed in its connection with the rest of the organism, in order that, in each individual case, that treatment may be employed which is most appropriate.

### 1. THE EXTERNAL EAR

has always been the particular subject of *local* treatment. This is owing not so much to rational indications as to the facility of the method. Without previously ascertaining the seat or the nature of an ear disease, remedies (often of a doubtful nature) are recklessly applied to the external auditory canal, and the result left to chance. Quacks and charlatans have found here an easy field for their operations, and the most various kinds of nostrums and panaceas have been imposed upon the credulity of the public. Extremely important as the local remedies applied to the *external* ear are in diseases of the earshell, the auditory canal, and the tympanic membrane, they are very rarely of any use in complaints of the *middle* and *inner* ear.

#### *a. Instillations.*

These are most generally made of fat or essential oils, naphthas, tinctures, and solutions of metallic salts.

In some cases the application of these remedies requires caution. The essential oils and tinctures easily cause irritation, and even the fat oils are apt to become rancid and to incrust themselves in the ear. During the operation, the patient ought to lie down on his sound ear, and care must be taken that the drops do not fall from too great a height. This is particularly necessary when the auditory canal is in a state of considerable irritation. The best way is to pour the drops from a teaspoon, pressed gently against the margin of the auditory canal, and then to close the latter with a plug of cotton wool or lint. When both ears suffer, it will be better not to make the instillation into both at the same time, so that the drops may stay longer in the ear.

#### *b. Injections*

are much less used for therapeutic purposes, than simply to cleanse the ear from accumulated secretions, hardened earwax, and sometimes also to remove foreign bodies. For this purpose it will be well to make them with an indifferent fluid. Lukewarm water is as good as any other fluid in use. The best instrument is a tin syringe, of moderate length, so that it can easily be directed by a single hand, capable of containing at least three ounces of water, provided with a stout conical nozzle, with a pair of loops attached to its

upper extremity, through which the fore and middle fingers are passed, and on the handle with a loop for receiving the thumb. The gum elastic bags may be used in its place, though they are less convenient. During the injection, the patient is placed in a sitting posture, and the water which runs off is received into a basin, the margin of which, covered with a sponge or a napkin, is pressed under the ear. Injections made with any degree of force always cause a disagreeable sensation, but as long as the tympanic membrane is uninjured, no danger is to be apprehended.

### *c. Vapors*

are frequently used for local applications. The most favorite are the moist vapors, which are often impregnated with various medicinal substances. No particular apparatus is required for their application. A funnel placed reversely on a pot is sufficient to direct the vapors to the ear. The latter ought to be enclosed by the hollow of the hand, as the feeling of the latter is the best means to prevent any burning of the delicate parts. Frequently the object intended by the application of vapors is merely to produce a soothing and relaxing effect, in which case mucilaginous decoctions are usually combined with them. The effect of these so-called emollient vapors is, however, merely founded upon a pretty general prejudice, since the



mucilaginous ingredients cannot be made to evaporate, and simple water vapors do quite the same service. When the object is to soothe, narcotic substances are to be employed; when the object is to excite, vapors impregnated with ethereal oils and aromatics are to be used. Among these latter, *camphor* occupies the first place. It is conveyed into the auditory canal, wrapped in cotton. The famous Pinter's ear-pills owe their effect to the camphor they contain. In some instances, when long carried in the ear, camphor will produce a violent irritation of the auditory canal, and even erythematous inflammation of the whole earshell.

*d. Fomentations and Cataplasms.*

Cold fomentations, except in very rare cases, are utterly out of place, as cold is almost always injurious to the ear. They are only admissible in traumatic injuries, and even then must be applied with great caution. It will be well to protect the auditory canal with a cotton plug, so that no water may get in. The greatest caution is required in the application of ice-fomentations, which it would be best to avoid altogether. *Warm* fomentations, on the other hand, either dry or wet, simple or medicinal, answer, on the whole, much better. Dry linen compresses, little flower-bags, and even the simplest bandages, are the most

appropriate remedies for many superficial affections of the earshell, or of the lining of the auditory canal, erythema, erysipelas, &c. Fomentations of warm water, best applied by means of fine linen compresses or a sponge (which are to be covered with a layer of water-proof substance, to prevent a too rapid evaporation or cooling), have an excellent effect in many diseases of the ear, and can be used in most cases as a good substitute for cataplasms. When these latter are used, they must not be made too heavy, and must be applied wrapped in a piece of fine linen. Warm fomentations and cataplasms are preferable to local vapor baths, because their effect is of longer duration.

*e. Unguents.*

Warmed cocoa butter, cerates, cold cream, &c., are often conveyed into the auditory canal, by means of a painter's brush, for the purpose of producing a soothing and relaxing effect. Still more frequently they are used as constituents for medicinal unguents, which are applied in the same way, in which case it will be well to have them gently warmed. The same objection, however, which has to be made to the use of fat oils, and in a still higher degree, applies to these unguents. They are very apt to cause incrustations and to become rancid, and are so little apt to combine with the fluid secretions of the ear, that they often exercise no influence whatever upon the diseased parts.

*f. Douche Baths.*

They are mostly used in cold water institutions, where they are applied by means of powerful apparatuses, and produce a most violent effect upon the ear and its surroundings. To render the effect of cold still more intense, and thereby to call forth a reaction in the ear, cold compresses are applied subsequently, and even little plugs of lint, dipped into cold water, are conveyed into the auditory canal. But this heroic treatment deserves no recommendation, and is only calculated, in cases of so called nervous dysacusis, to completely exhaust the little remaining sensibility. Least of all ought the stream to be directed into the auditory canal itself. The *warm* douche, on the other hand, applied by means of the air douche-machine, performs excellent services in carious affections of the processus mastoideus, by rinsing out the accumulated secretions, and by promoting the expulsion of the destroyed osseous parts.

*g. Local Bleedings.*

As active inflammations of the organs of hearing are extremely rare, there are, on the whole, but few occasions for bleeding. Scarifications are utterly inappropriate; cupping-glasses cannot well be applied in the immediate neighborhood of the ear, so that the only means for local bleeding are leeches. Unless, how-

ever, they are applied in sufficient quantity, and the after-bleeding is properly kept up, they produce rather an exciting than the contrary effect, when applied close to the ear. This is often speedily shown by the intensified character of the morbid symptoms. Active congestions towards the ear are more safely removed by bleedings from remoter parts, and in plethoric subjects by venesection. Most aural inflammations require neither the one nor the other, and many supposed congestive phenomena, tinnitus, &c., are, for the most part, only made worse by bleeding.

*h. Counter Irritants.*

Blister plasters, unguent of tartar emetic, &c., usually applied behind the ear, belong to the most popular local remedies. Their use is generally founded on the supposed rheumatic nature of the ear complaint, but the object of carrying off the inflammation from the aural organ is still less attained by these means than by local bleedings. They are utterly inappropriate in all cases of acute inflammations, as they only intensify the irritation, and increase the congestion when applied too near the suffering part. Owing to the prominent position of the mastoid process, embrocations of tartar emetic particularly require the greatest caution, or they are likely to produce injurious effects upon the periosteum. They therefore ought never to be prescribed

for patients that are not under constant medical inspection. Blister plasters, which by so many unscientific physicians are used on all possible occasions, are, for the most part, mere useless instruments of torture. If they are meant to do any good by causing a counter irritation, they are better applied on remoter parts, for instance, in the neck or on the arms. For moxas and hot irons there is no occasion in ear diseases.

*i. Caustics,*

when used by careful physicians, belong to the most effective remedies. They are used partly for the destruction of excrescences, polypi, &c.; partly, in a milder form, to produce an alterative effect in diseased parts. Fluid substances, mineral acids, antimonial butter, caustic kali, &c., are little appropriate for the external auditory canal, though they may be used for the destruction of many productions in the earshell. Nitrate of silver is justly in most frequent use, as its circle of activity can be most easily watched. For the most cases, a finely-pointed stick of it is perfectly sufficient. On account of the danger there exists of the point breaking off in the depth of the cavity, the method of *Pelletan* is the most proper. By means of a silver wire covered with a layer of argentum nitricum by dipping it in concentrated nitric acid, even the subtlest cauterizations on the tympanic membrane

are performed with perfect security. In order to prevent the effect of the caustic on the surrounding parts, it will be best, immediately after cauterization, to drop a weak solution of kitchen salt into the ear. No other caustics are required. The preparation of *Filhos*, however, may be employed against polypi.\*

*k. Electricity, Galvanism, and Electro-Magnetism*

act as the most powerful excitants upon the dormant activity of the nervous system, but produce only a transient effect, and are even apt, by over excitement, to completely exhaust the system. As effective as they show themselves in many neuralgias and paralyses of the motory nerves, so useless are they in paralyses of the sensitive nerves.

## 2. THE MIDDLE EAR.

There are three ways in which local remedies can be conveyed to the middle ear:—

1. Through the Eustachian tube.
2. Through the membrana tympani, which is either already destroyed or has to be perforated artificially.
3. By the verrucose process, which may be already corroded by caries, or has to be pierced by art.

As long as the tympanic membrane is intact, the Eustachian tube is the only way by which, at present,

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\* See Instrument Porte-caustic.

local remedies are made to act upon the middle ear. Indirectly, this can be done by gargarisms, cauterization of the pharynx and the tonsils, extirpation of the latter, by vapors introduced into the mouth and ear, by snuffs, and partly also by emetics. But it is not very often that any satisfactory results can be obtained by these means. In the best case they operate only on the orifice of the Eustachian tube, and therefore can only serve as adjuvants. The best among these are *gargarisms*, which, in many milder affections of the mucous membrane that lines the orifice of the Eustachian tube, produce a happy influence simply by their mechanic action, apart from the quality of their ingredients. They are the more valuable, as many affections of the mucous membrane of the tube have their origin in the throat. When combined with excitant medicines, they can in most cases be used in the place of cauterization of the pharynx, the palate, &c. *Extirpation* of enlarged *tonsils* produces an excellent effect by removing the irritation of the tubal orifice. *Vapors* which are not introduced directly into the tube by means of the catheter, remain for the most part without effect. Excitant *snuffs* are appropriate only in torpid affections of the mucous membrane of the middle ear, combined with increased secretions. In fresh inflammations of the mucous membrane, they are always decidedly injurious. Snuffs that produce

sneezing may be used with advantage in torpid affections, but their use always requires caution. This holds still more good of *emetics*. *Catheterism of the Eustachian tube* is the only reliable means to exert a *direct* influence upon the ear.

It is to *Guyot*, a postmaster of Versailles, who lived at the beginning of the last century, that we are indebted for the first idea of this important operation. It seems he had been afflicted with deafness for many years, and his anxiety to find out the cause of his infirmity, with a view to its removal, led him to study the anatomical structure of the ear. His attention was particularly drawn to the passages connecting the ear with the throat. These passages had been discovered nearly two hundred years before, by Eustachio, but their importance in the pathology of the ear had till then been entirely overlooked. It occurred to Guyot that possibly, in his own case, they might be obstructed, and that by removing the obstruction, the cause of his deafness might be likewise removed. With this idea, he invented an apparatus, and a complete success rewarded his ingenuity.

The value of catheterism of the Eustachian tube, both as a *diagnostic* and *remedial* agent, must be evident to every unprejudiced investigation. It must be apparent that, in many diseases of the ear, it constitutes the chief agent of cure, or at least an important



auxiliary to other remedies. It is therefore required for a variety of purposes:—

1. For the exploration of the Eustachian passages and tympana, by which their healthy or diseased condition can be determined.

2. For removing their obstructions, when filled with mucus, blood, or pus.

3. For their dilatation, when contracted from the thickening of their sides, or impermeable from adhesion or stricture.

4. For the introduction of medicated vapors or fluids to restore the torpid auditory nerve, or to allay its morbid sensibility.

5. To improve the condition of the mucous membrane.

From the time of Guyot, catheterism of the Eustachian passages, and injections into the cavities of the tympana, have undergone many modifications and improvements, in the methods by which they have been carried into effect.

The proposition of Guyot to arrive at the Eustachian tube *through the mouth* was soon rejected as impracticable, and the more natural and direct passage substituted, namely, *through the nose*; but the various surgeons who have distinguished themselves in the performance of the operation, although unanimous as to the route, differ widely in their views with regard to

the form of the instruments to be employed, as well as the necessary manipulations.

We shall confine ourselves to describing the method adopted by some of the most distinguished *living* aurists.

*Rau* gives the following directions for the performance of the operation:—

“Let the patient be seated in a chair, with his head bent a little backwards; take your position in front of him, either standing or sitting; seize the catheter, which must previously be oiled, with your right hand, in such a manner that the concave side is looking downwards, and thus introduce it into the lower nasal canal. At the same time, the index of your right hand draws down the upper lip a little. The instrument, carried lightly and quickly over the bottom of the nose, is pushed forward close to the septum, until it reaches the posterior paries of the pharynx. When arrived there, gently sink the beak of the instrument by slightly raising the hand, and while drawing the catheter back almost half an inch, carry it over the posterior protuberance of the tube; turn it a fourth part in the direction of the corresponding ear, and it will easily slip into the orifice of the tube. Then push it forwards until it allows no further rotation, and, in unchanged direction, sticks fast. When the nose is normally shaped, this seemingly complicated

operation is the affair of a moment. When the velum palati is raised, the instrument penetrates so easily that it seems to find the way of itself. If the posterior protuberance is too slight, then draw the catheter back from the posterior paries of the pharynx, and carry the beak up to the posterior margin of the hard palate, before giving it the quarter turn. In many cases this is the surest way of introducing the catheter. When the formation of the nose is abnormal, or when the septum has a transverse position, or when the conchæ are twisted, the catheter cannot always be introduced in the above manner, or, at least, it cannot, after having reached the pharynx, be turned in the required direction. Sometimes the instrument can be introduced by keeping the beak close to the septum, or by using the way of the middle nasal canal. If even this method does not succeed, then try catheters with a different curvature, and introduce the instrument through the other nostril. Though this is somewhat difficult, still the orifice of the tube can be found without employing a double catheter." So far Rau.

*Harvey* recommends the following mode of introducing the catheter:—

"The patient should be seated in a chair, with his head well supported. The catheter should be held in the right hand, and the patient being directed to open his mouth widely, the beak of the instrument, pre-

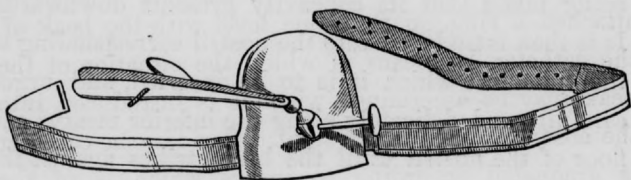
viously warmed, should be introduced into the nostril on the side affected, with the convexity upwards, and passed steadily over the floor of the nostril in a straight direction, until a depression be felt. The point of the instrument is then to be turned outwards towards the ear, and immediately afterwards a little upwards into the canal. The direction of the beak of the instrument will be best ascertained by observing the position of the ring of the handle. If the first attempt fails, which it may easily in inexperienced hands, it is better to desist for a time than to irritate the parts by repeated endeavors. That the beak has entered the tube may be ascertained by placing the othoscope over the external ear, and then blowing air through the catheter. The otoscope will tell whether any air has been forced into the tympanum. It is necessary that the patient should be perfectly quiet during the operation, as the slightest movement will derange the instrument, and may cause considerable mischief."

The following is *Yearsley's* description of the operation:—

"The patient being seated on a chair, the operator applies the frontlet of Kramer to the head, buckling the straps behind, and taking care so to adjust it that the extremities of the blades of the forceps shall reach to about a quarter or half an inch below the *alæ nasi*, so as to admit of their being readily lifted

over the catheter when inserted. Attention having been given to this precautionary measure, the forceps, which are held firmly by the ball and socket joint, may be turned on one side out of the way, whilst the operator proceeds to introduce the catheter into the Eustachian tube. The catheter, previously warmed (which may be readily done by running it briskly through the fingers), is laid hold of by the operator with the right hand at its socket extremity, care being taken that its concavity presents downwards. It is then introduced into the nostril corresponding to the tube into which it is to be inserted, and urged carefully and delicately along the inferior meatus and floor of the nostril until the beak strikes against the posterior surface of the pharynx. The tact and dexterity of the operator are now put to the test, to find the orifice of the Eustachian tube. Up to this time, the ring of the catheter, which indicates the position of the beak, presents downwards; the operator now makes a rotation of the catheter outwards and upwards, at the same time withdrawing it slightly towards himself. In the act of doing this, he may, in most cases, detect the beak of the catheter gliding over the rounded margin of the elliptic orifice of the passage, into which, with a gentle force, it should then be guided; with the left hand, the blades of the forceps are then lifted over the catheter, and screwed tightly upon it."

The frontlet bandage recommended by Kramer, consists of a middle piece made of metal, bent so as to fit the arch of the forehead, and slightly padded inside, to which are attached two straps, which fasten with a buckle. To the centre of this a pair of forceps is attached, which moves in a ball and socket joint, and the blades of which are brought together by means of a screw. Though highly recommended by



Kramer, and deemed indispensable by Yearsly, we rarely have an occasion for using it. Our own method of performing the operation most closely approximates to that of Rau.

Of the different *catheters* recommended by various writers, those adopted by Kramer are unquestionably entitled to the preference, not only as the most simple in construction, but as causing the least inconvenience to the patient on their insertion. They are inflexible, six inches long, and of calibre varying from the size of a small crow-quill to that of a large goose-quill.

Their extremity is well rounded, and they are curved only to the distance of five lines from the further extremity, exactly at an angle of  $144^{\circ}$ , so as to correspond with the lateral situation of the mouth of the Eustachian tube. They are of the same calibre throughout their whole length, and provided with a funnel-shaped dilatation at the proximal extremity, six inches in length, in order to admit the pipe of the injecting syringe, &c. To this dilated part there is attached a ring, on the same level with the beak of the catheter, by means of which the situation of the beak may be ascertained, when it is introduced into the nose, and thus out of sight. Besides, the catheter is graduated according to inches, which is of the greatest importance in repeated introductions of it. Rau recommends a catheter made of gutta percha, which he invented himself.

The introduction of the catheter produces a slight irritation in the nose, and in the orifice of the tube, but only in rare cases this irritation is sufficient to effect a momentary improvement of hearing; and every other mechanical action upon the ear, such as the introduction of a finger or an ear-spoon, pulling the earlap, &c., may produce a similar effect. We cannot, therefore, entirely agree with Yearsly, who seems to us to entertain a too exaggerated opinion of the value of catheterism as a remedial agent. We

are rather inclined to think with Rau that the chief, if not the only important, service we derive from the catheter consists in its being used as a *conductor* for various remedial agents, such as air, medicated vapors, water, powders, &c. And this leads us to speak of an apparatus, which we frequently have to use in connection with the catheter, namely, the *Air-press*.

#### THE AIR-PRESS,

which we shall again have to mention in a diagnostic respect, is also of great importance as a remedial agent. There are various ways of conveying air to the middle ear by means of the catheter. It is done in the simplest way by blowing from the mouth. In this case, nothing more is required than a flexible tube, about three-quarters of a yard in length, one extremity of which is retained in the mouth of the operator, whilst the other is loosely attached to the mouth-piece of the catheter, already inserted and fixed in the Eustachian tube of the patient. But this method, recommended as it is by its simplicity, is liable to various objections. In the first place, many fastidious patients dislike it; secondly, it is always rather troublesome for the operator; thirdly, it is hardly possible sufficiently to control the entering air by the auscultation of the ear. Besides, in many cases, the breath of the surgeon may not be sufficiently

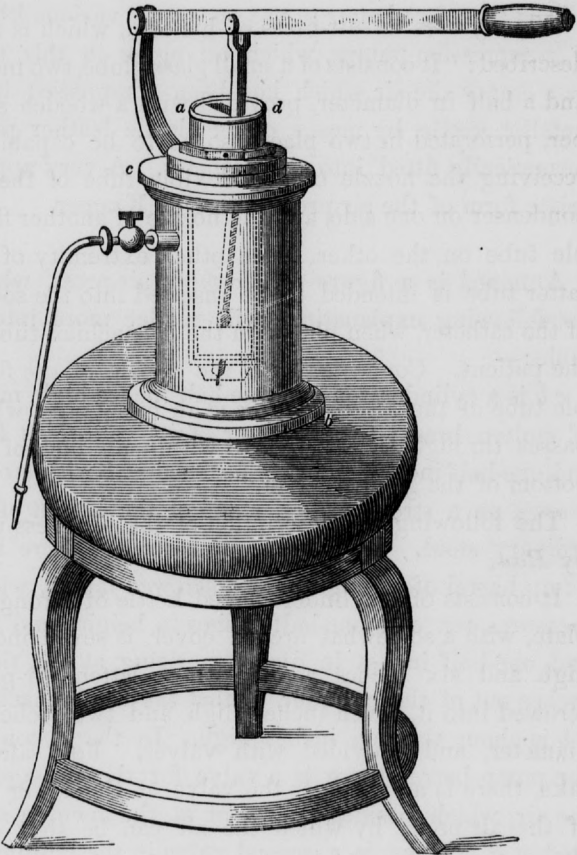


strong to remove certain obstructions in the Eustachian tube.

It is therefore better to use one of the various kinds of compression-pumps, which all agree in this, that they empty the air which has been compressed in a metallic kettle, by means of an elastic leather pipe, hermetically fitted into the catheter. A very appropriate form of the air-press is that of *Kramer*.

Annexed is a figure of *Kramer's* air-press, which the following explanations will render more intelligible:—

*c b* is a cylinder, ten and one-half inches high, made of molten brass; the diameter of its calibre is four and one-half inches, and it is fastened at *b* with strong screws, on a strong oaken stand of the height of an ordinary stool. Within the cylinder *c b*, there is a pump barrel of wrought brass screwed into it, which measures ten and one-half inches in height, and two and one-half inches in diameter, rising at *d a*, three inches out of the cylinder, so that the whole machine *a b* is about thirteen inches high. In the piston of the pump barrel, there is a valve for the passage of the air, which, besides, passes in at the opening situated at *d*. There is a second valve in the bottom of the pump barrel, through which the air is forced into the interior of the cylinder. Both valves must be



manufactured with care. The rest of the drawing requires no description.

*Yearsly* uses an air-press of his own, which is thus described: "It consists of a small glass globe, two inches and a half in diameter, provided with a wooden stopper, perforated in two places, so as to be capable of receiving the nozzle of the flexible tube of the air condenser on one side, and the nozzle of another flexible tube on the other. The other extremity of the latter tube is intended to be inserted into the socket of the catheter, when placed in the Eustachian tube of the patient. Connected with the nozzle of the flexible tube of the air condenser is an ivory pipe, which passes through the stopper to within an inch of the bottom of the glass receiver."

The following is a description of the air-press used by *Rau*.

It consists of a cylinder-shaped kettle of strong tin plate, with a somewhat arched cover, is seven inches high and six inches wide, with a latten air-press screwed into it, seven inches high and two inches in diameter, and provided with valves. For safety's sake, there is a cock over the valve at the lower end of the air-press, by which the air can be shut out. The other cock, which serves to let the air out, can be screwed in ad libitum, either close above the bottom or near to the cover, according as the ap-

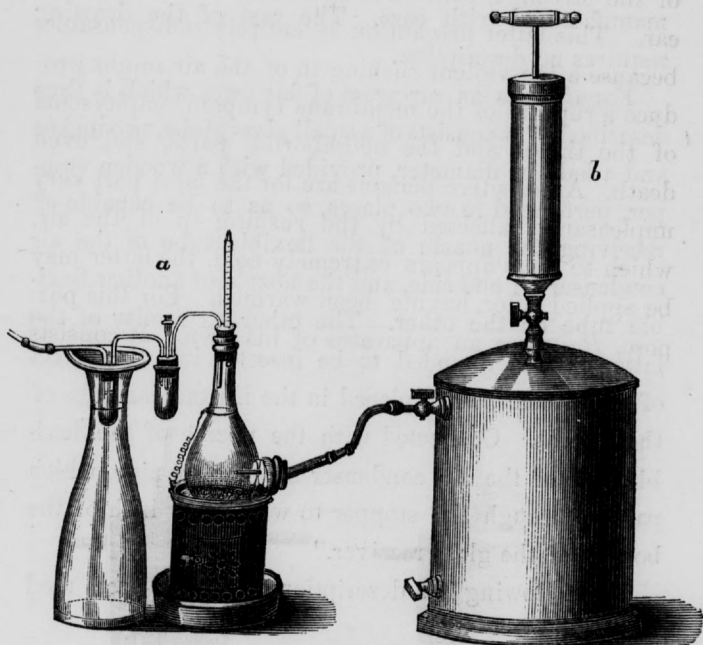


Fig. 1.

paratus is intended to be used, either for a water-douche or for the application of vapors. (See fig. 2, *b*.) To the cock is attached, by means of a female screw, a pipe of vulcanized India rubber, and the lower end of the latter, on which there is a goose-quill covered with gutta percha, is hermetically inserted into the mouth of the catheter. The cock is then cautiously opened, and the air let out, while the strength

of the stream is controlled by the auscultation of the ear. This latter precaution is entirely indispensable, because a too violent rushing in of the air might produce a rupture of the membrana tympani, emphysema of the throat and the neighboring parts, and even death. As sensitive persons are for the most part very unpleasantly affected by the rushing in of the air, which to them appears extremely cold, the latter may be applied after having been warmed. For this purpose, *Rau* uses an apparatus of his own. It consists

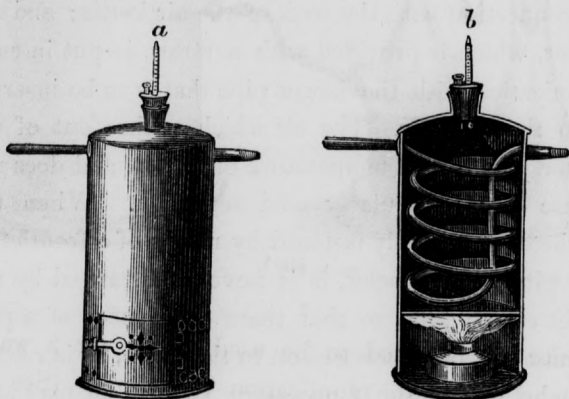


Fig. 2.

of a cylinder-shaped vessel of tin plate, of the same height as the air kettle, and having a diameter of four inches, the lower third of which is divisioned off and so arranged as to be able to receive a spirit lamp.

Within there is a long spiral tube of lead, the two ends of which are soldered together with two outward-projecting tubes of latten. The opening of the cover, which has a conical shape, can be stopped with a cork, which contains a thermometer with a scale etched into it, a somewhat large tube of glass to let the vapors escape. Only so much water is poured into the tin-plate cylinder as is sufficient to cover the bottom an inch high; it is heated to a temperature of steam of  $50^{\circ}$  R. The spirit lamp is then extinguished, and one latten pipe, by means of the front elastic pipe, is put in connection with the cock of the air kettle; and the other, which is provided with a straw, is put in communication with the larger pipe that is to be inserted into the catheter. The air which rushes out of the latter pipe is of a temperature of  $20^{\circ}$  R. and does not cause any particularly cold sensation. When the catheter is properly fastened by means of a frontlet or the pincette-spectacles, it is never disarranged by the light elastic tube, so that there is no need of a particular supporter screwed on to the table, as is recommended by some. If necessary, the patient may support the catheter with his hand.

Like the introduction of the catheter itself, the air-douche exercises, in the first place, only a mechanical effect. In a direct way, it can only remove the mucus accumulated in the pharyngeal part of the Eustachian

tube. More deeply seated masses of mucus, however, can be made by it instantly to lose their injurious effect upon the ear. For by the force of the air stream, they are compelled to expand themselves evenly, or are even driven into the tympanic cavity itself, without any more stopping up the orifice of the tube. It is evident that the air-douche, when frequently repeated, exercises an alterative effect upon the mucous membrane, and favors the voluntary discharge of the accumulated secretion, while it limits its reproduction. It is only thus that the undisputably lasting effect of this operation can be rationally appreciated, while its purely mechanical action, in most cases, produces only a temporary improvement.

## 2. *Extraction of Air.*

For the purpose of removing morbid accumulations of fluids from the tympanic cavity, Hubert-Valleroux recommends, in the place of the air-douche, air extraction by means of the catheter. This is done by hermetically inserting a compressed gum-bag into the larger opening of the latter, and allowing it to expand of itself. The mucus, sucked in in this way, enters with a gurgling noise into the orifice of the catheter, from which it can easily be blown away. The mucus is often streaked with blood, and has often considerable consistency. In order to render success more cer-

tain, it will be well to make use of the largest possible catheter, and to insert the gum-bag several times in succession before removing the catheter. If the bag is not immediately filled with air, the probable cause is that the catheter has penetrated too far, in which case it needs only to be drawn back a little, and the noise made by the mucus will be heard at once. Not so easily as from the orifice of the tube, can accumulations of mucus in the tympanic cavity be removed by suction.

### 3. *Injections of Water*

are not much used at present. Even if only tepid water is employed, it always produces an irritating effect upon the middle ear. The hearing immediately grows worse after injection, until the water is again discharged.

### 4. *The blowing in of Powders*

has hitherto been recommended only by *Pappenheim*. But as the powder form is least fit for a local application by means of the catheter, it has rarely, if ever, been adopted.

### 5. *Application of Vapors.*

Next to compressed air, vapors are most frequently used to produce a local effect upon the Eustachian tube and the middle ear. They are the fittest vehicle



for the application of medicinal agents upon the inner organs of hearing. According to the object in view, the substances used for vapors are either indifferent or medicinal. Various apparatuses have been used for this purpose by different operators. The one of *Yearsly* we have already described. (See p. 87.) *Kramer* has lately been using a so-called "dunstkugel" (vapor globe), which is a glass retort, heated with a spirit lamp, and provided with a thermometer, from which the volatilized medicinal substances are directly introduced into the catheter.

*Kramer* gives the following description of his apparatus. On a firm three-legged wooden stool without a back, a frame is fastened, which, on a sufficiently large wooden ring, supports a glass globe, half a foot in diameter, the lower half of which is covered with latten plate. The neck aperture of the globe, an inch high and an inch in diameter, serves to receive a tightly-shutting cork, in which a flexible tube of about a foot and a half in length is fastened, the interior end of which is connected, by means of a metallic joint piece, with the funnel-shaped end of the catheter. About an inch from the neck aperture end, on each side of it, there is a hole, one of which serves for the reception of a thermometer, and the other for the instillation of volatile substances which it may be desirable to vaporize. During each session, the latter is

stopped up with a cork, which is pierced by a narrow glass tube, through which, if it should be necessary, the vapors in the glass globe may be drawn out. Under the glass globe stands a spirit lamp for the purpose of heating the fluid contained in the globe to whatever degree is required.

## RAU'S VAPOR APPARATUS.

*Rau* employs the following apparatus. A tubulated glass retort, containing about five ounces, is fastened in a tin vessel with protruding margin, which is half filled with sand, and placed on a frame over a spirit lamp, in such a manner that the short lateral tube projects freely, while the neck, three-fourths of an inch long, assumes a vertical position. The latter is stopped with a cork, into which a little glass tube is inserted, with one of its two rectangular legs, while the other leg, turned down at the same angle, keeps suspended a little cylinder glass (containing about half an ounce), together with the cork. A similarly bent glass tube connects the first vial with a second, from which another geniculated glass tube projects. For various purposes, the second vial is put into a high glass filled with water, in which it is kept suspended by the glass tube, resting on the margin. A little glass funnel, which can be hermetically stopped, is inserted into the cork of the vial next to the little tube, and a thermometer, with the scale edged into it, is placed into the upper tube of the glass retort. The cork which closes the

lateral tube is pierced by a glass tube, into which a gutta percha pipe, connected with the air-press, can be hermetically inserted by means of a goose-quill wound round with waxed silk thread. The glass tube projecting from the second little vial is flexibly connected by means of a canal made of gutta percha, or, still better, of vulcanized India rubber, with a thin glass tube about two feet in length, which again, by means of a short elastic pipe, is hermetically fitted into the funnel-shaped end of the catheter.

The following is the instrument used and constructed by myself; it will be found very convenient on all occasions where vapors are required as a therapeutic agent.

- a*—A vertical section of the cylinder containing lamp (*b*), and supporting the reservoir (*d*), and perforated with holes at top and bottom to allow entrance and exit of air to support combustion.
- d*—A vertical section of reservoir with double sides (*c* and *f*), between which is placed water, which is heated by lamp to any desired temperature.
- g*—An inner space, the bottom of which is in immediate contact with the flame, and intended to contain the vaporizing material, such as sulphur or ether.
- h*—The hood, fitting on the reservoir (*d*) by a rim containing water, and intended to collect the vapors which are conducted towards the ear by the tube (*k*).
- k*—A tube fitting upon the hood, and terminating in a ground point, on which is fitted the cap of a vulcanized tube.

Fig. I.

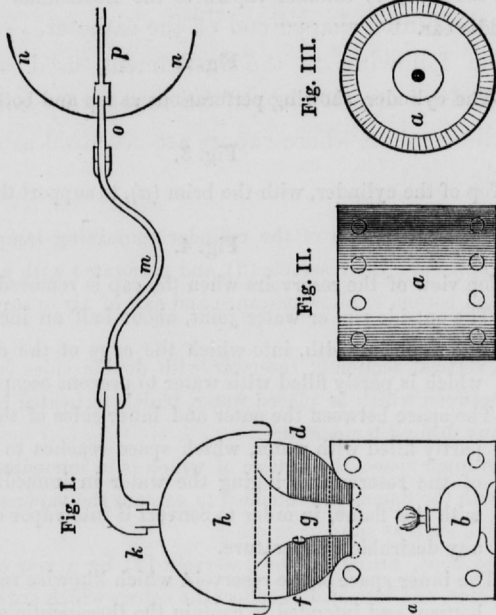


Fig. II.

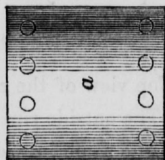


Fig. III.

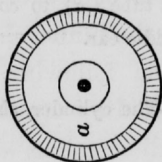
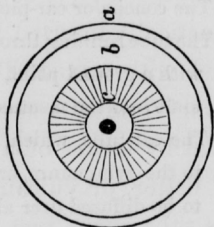


Fig. IV.



*m*—Vulcanized tube terminating in a ground cap, to fit on a pipe leading into the concha or ear-piece.

*n*—The concha or ear-piece.

*o*—The tube running through the centre of the concha, terminating with a ground point, on which can be placed the ear-tube (*p*) to fit into the meatus externus.

*p*—The ear-tube, which, when attached, conducts vapor directly to the tympanum, or can be detached, and allow the vapors to be diffused over all the ear and adjacent parts.

By detaching the concha (*n*), a catheter can be adjusted upon the tube (*m*), to conduct vapors to the Eustachian tube to the middle ear.

Fig. 2.

*a*—The cylinder, showing perforations at top and bottom.

Fig. 3.

Top of the cylinder, with the brim (*a*), to support the reservoir.

Fig. 4.

Top view of the reservoirs when the cap is removed.

*a*—The outside rim or water joint, about half an inch deep and the same in width, into which the edge of the cap fits, and which is partly filled with water to prevent escape of vapors.

*b*—The space between the outer and inner sides of the reservoir, partly filled with water, which space reaches to the bottom of the reservoir, bringing the water in immediate contact with the flame, in order to convert it into vapor of water, at any desirable temperature.

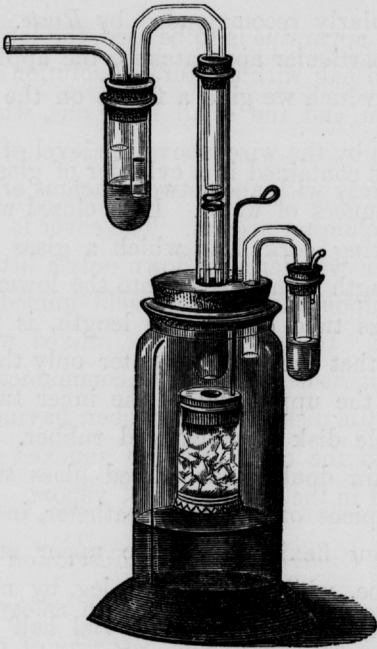
*c*—The inner space of the reservoir, which likewise reaches to the bottom, and intended to contain the therapeutic agents.

The entire instrument to be of copper; the reservoir to hold from twenty to thirty ounces of water, and the other parts in proportion to the reservoir.

6. *The Application of Gases.*

Only very few kinds of gases have as yet been employed in aural surgery. The one most frequently used is that obtained from carbonic acid, which has been particularly recommended by *Ruete*. *Rau* has invented a particular apparatus for the application of this gas, of which we give a figure on the following page.

The gas is contained in a cylinder of glass holding about ten ounces of water. It is closed with a hermetically-fitting cork, into which a glass tube four inches in length is inserted. Into the lower end of it another glass tube, of half the length, is puttied in such a way that the gas can enter only through the latter. On the upper end of the inner tube rests a movable little disk of vulcanized rubber. The long leg of a thin doubly geniculated glass tube is, by means of a piece of an elastic catheter, inserted hermetically but flexibly into the upper end of the exterior tube, while the shorter leg, by means of a pierced cork, supports a cylinder vial half filled with water, from which projects another short geniculated tube. Through the cover of the gas container passes a wire, to which, by means of a cork with a small aperture, a glass cylinder, whose lower end is closed with some porous substance, is attached in such a manner that it can be moved up and down. Next to





the wire, one leg of a bent glass tube is inserted into the cover, and the other leg bent downwards, by means of cork provided with another aperture, supports a little cylinder vial, while the free end dips into quick-silver.

When the apparatus is to be used, the long cylinder glass is filled half with a saturated solution of *Natrum bicarbonicum*, and the small inner one, which has to be drawn up by the wire above the level of the fluid, is filled entirely with about two drachms of coarsely-pounded *aricum tartaricum*. The cover is then shut, and the inner cylinder is let down only a little into the fluid, whereupon the carbonic acid immediately develops itself. In the beginning, mixed with atmospheric air, it rushes through the communicating tube, lifting the little disk of India rubber, having been introduced into the catheter by an annexed glass tube, such as used in the application of vapors.

#### 7. *The Cauterization of the Eustachian Tube*

can likewise be accomplished with safety only by means of the catheter. The best way of performing the operation is that of *Rau*. He uses gutstrings impregnated with a solution of lunar caustic, and dried in a dark place. By means of a catheter, the dry gutstrings, the ends of which must previously be rounded off with a delicate file, are pushed in till

they stick fast. By the natural moistness of the mucous membrane, the lunar caustic is dissolved, and cauterization takes place, while the gutstrings gradually swell and enlarge the cauterized part. This is easily seen from the fact that, on repeated application, the string penetrates further each time. The introduction of the string does not cause the least pain, and only after several minutes the patient experiences a certain scratching sensation in the throat. Somewhat later, he generally throws up a little bloody mucus. If the application is repeated after the scratching sensation in the throat has passed away, hardly any inconvenience is felt.

## I. INFLAMMATORY DISEASES.

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### A. INFLAMMATIONS OF THE EXTERNAL EAR.

#### a. INFLAMMATIONS OF THE AUDITORY PASSAGE.

##### 1. *The Catarrhal Inflammation of the Auditory Passage.*

(Otitis catarrhalis externa.)

The *acute* form of this disease is frequently accompanied with other catarrhal affections, such as cold in the head, cough, irritation of the mucous membrane of the throat, &c. It commences with a slight itching, afterwards burning pain in the auditory passage, which becomes most violent in the evening. In two or three days the pain subsides, and a yellowish discharge takes place, which, at first, is of a serous, afterwards of a creamy, character. This secretion when grown hard forms a yellow crust in the external ear, often erodes the orifice of the auditory passage and its surroundings, increases and decreases periodically, is most abundant at night, and disappears again, in milder cases after a few days, in severer ones after a few weeks, whereupon the secretion of the

earwax, which till then had been suppressed, returns again. The disease is very frequently attended with tinnitus, and always with a diminution of hearing. The examination with the speculum shows the lining of the auditory passage, at first, slightly reddened, particularly in the vicinity of the tympanic membrane, and the latter itself almost always injected in the parts nearest to the handle of the malleus. The inflamed membrane soon becomes lax, and here and there covered with pimples and pustules, flocculent and villose, and finally swells to such a degree that its parietes sometimes almost touch each other. This happens mostly during the time that the secretion is increased, when it is sometimes impossible to get a view of the tympanic membrane, even after the use of cleansing injections. The introduction of the speculum, then, not only causes lively pains, but very often bleeding from the excessively sensitive membrane, and the hearing is more disturbed than at any other time.

The *chronic* form (commonly called otorrhœa externa) commences either so gradually that, particularly in torpid subjects, the discharge is the first symptom that attracts attention; or it appears as the immediate consequence of the acute form, which, instead of subsiding with the increase of the secretion, gradually turns into a veritable blennorrhœa. According to

various, particularly constitutional, influences, the secretion either retains the above-mentioned character for a long time, or it becomes purulent, greenish-yellow, mixed with streaks of blood, extremely bad-smelling, and so acrid that eroded spots, pustules, and papulæ appear on the earshell. The secretion is still more changeable than in the acute form: sometimes it ceases for a time, suddenly returns in a greater degree, and in this way may continue for years. To a great degree dependent upon atmospheric influences, the disease sometimes disappears in summer, and returns again with the cold season. Ocular inspection shows the walls of the meatus excoriated, wherever they have been touched by the secretion, bleeding at the slightest touch, loosened, uneven, the tympanic membrane either injected or opaque, and sometimes so thickened that the umbo can hardly be distinguished. When the disease has existed for a longer time, polypous excrescences may form themselves partly on the walls of the meatus, partly on the tympanic membrane, when, of course, the hearing grows worse.

The disease originally rarely seizes both ears at once, but, afterwards, almost always passes from one to the other, or alternates between the two. The seeming periodical extinction often merely depends upon a decrease of the secretion, which causes the

discharge from the ear to stop. On examining the ear with the speculum, we find in this case, at the bottom of the meatus, instead of the earwax, the mucous purulent secretion which often covers the tympanic membrane.

#### ÆTIOLOGY.

A particular predisposition to this disease exists in scrofulous children, especially during dentition. In later years, the disease principally attacks dyscratic individuals with a tender, sensitive skin. Exciting causes are principally local colds, irritation of the auditory canal by foreign bodies, as also reflections of chronic eruptions by transmigration from the adjoining parts, more rarely by metastasis. Acute exanthemas and hooping-cough are very apt to leave this reflection behind. The catarrhal inflammation is the fundamental form of various affections of the meatus, which, according to particular exciting causes and combinations with other constitutional affections, has been called by the most various names, as otitis externa, scrofulosa, impetiginosa, scarlatinosa, varicellulosa, gonorrhoeica, &c. But all these varieties can hardly be looked upon as independent diseases.

#### PROGNOSIS.

Where the patient enjoys a good general health,

the acute form of the disease, provided it be not neglected, always passes off without any danger; and in milder cases, frequently disappears of its own accord, although there is always danger of relapse. In dyscratic individuals it is apt to become protracted and to return on the slightest occasion, but nevertheless it is curable even after it has existed for a considerable time, and the hearing can be perfectly restored, so long as no extensive granulations or no polypous excrescences have taken place. In the latter case, the prognosis is decidedly more unfavorable. For even after the removal of those excrescences, the lining of the auditory passage rarely recovers its normal state, the tympanic membrane frequently remains thickened, and the hearing more or less disturbed.

#### TREATMENT.

When the disease makes its appearance without dyscrasy, the treatment in simple, recent cases, is a very simple one. Before the discharge commences, it is frequently sufficient to cleanse the meatus repeatedly with tepid water, to cover the ear, and to avoid going out, particularly in bad weather. Where the pain is more violent, some leeches may be applied behind the ear; vapors and cataplasms will do excellent service, before the discharge has commenced.

Where there are feverish symptoms, an antiphlogistic-diaphoretic treatment is required. Nightly exacerbations are best assuaged by stimulating foot-baths, and a dose of Dover's powder before going to bed. In the cases of children, however, opium is to be avoided. Instead of it, a few drops of aqua laurocerasi with antimonial wine are to be given, and the ear is to be covered with wadding drenched in oil. Lying on a horse-hair pillow affords great relief to the patient.

When once the discharge takes place, the local treatment is essentially the same as that in catarrhal ophthalmic inflammation. The discharge is, in the beginning, always attended with a continual irritation of the lining of the auditory passage; this irritation has to be allayed, without directly checking the discharge. The simplest and safest means for this purpose are injections of tepid water, which ought to be repeated at least twice a day. The auditory passage ought not to be stopped up so tightly as to exclude the air, and to prevent the discharge from flowing off. The best thing is to insert a plug of loose lint, which absorbs the fluid better than cotton, and to renew it several times a day. In many cases this simple proceeding is sufficient. Should, however, the discharge not decrease, even after the irritation has ceased, then injections of weak solutions of *plumbum aceticum*, *zincum aceticum* and *sulphuricum*,



cuprum sulphuricum, lapis divinus, and where there is a tendency to granulation, and a stronger injection of the tympanic membrane, of nitrate of silver, ought to be used. After previous injections, the above-mentioned solutions are to be instilled weak enough not to cause any burning sensation, and, after a few minutes, are to be allowed to flow off. If they increase the irritation, they are instantly to be discontinued, and instillations of a decoction of malva, or of extract of opium, are to be substituted.

If, in spite of the above-stated treatment, the disease becomes protracted, it may be inferred that constitutional causes, particularly a scrofulous dyscrasy, combined with impetiginous eruptions, are at the bottom. In that case, alteratives are indicated. But, as long as there still exists a greater sensitiveness in the auditory passage, such ought always to be selected as are at the same time antiphlogistic and cathartic, particularly calomel. Afterwards the preparations of iodine and cod-liver oil are of excellent effect. Without the application of local remedies, it is hardly ever possible to put a stop to the discharge. The most effective are instillations of acetate of lead, one half-grain to an ounce of distilled water. If there are any granulations, they are best treated with a strong solution of nitrate of silver. Instead of the instillations, Wilde recommends to touch the auditory

passage every other day with a solution of ten grains of nitrate of silver to an ounce of distilled water, by means of a small painter's brush or a probe wrapped round with cotton, and in the intervals to cleanse the passage twice a day with tepid injections. As a general rule, half as weak solutions are perfectly sufficient. When the discharge smells badly, solutions of creosote, chloride of lime, tarwater, &c., are recommended. If it has been ascertained by a careful examination that there is no caries present, limewater, either alone or with corrosive sublimate (one grain to the ounce), does most admirable service.

If, after the discharge has ceased, the epidermis of the auditory passage is thickened, the larger flaps ought to be drawn out, if possible, with the forceps, and a solution of nitrate of silver to be pencilled in. As long as the secretion of the earwax has not returned, the patient is not to be considered well, though the discharge itself may have stopped. The last means to restore the ceruminous secretion is a solution of one grain of iodine in one ounce of cod-liver oil, instilled in the evening. The brownish incrustations of the passage, produced by the above solution, and which are easily confounded with earwax, are to be removed from time to time by injections of tepid water. The return of the ceruminous secretion, which at first has a yellowish, cheese-like appearance, is

almost always attended with a lively itching in the meatus.

2. *Inflammation of the Cellular Tissue of the Auditory Canal.*

(Otitis externa phlegmonosa.)

This inflammation is generally confined to one ear, and is principally seated in the anterior cartilaginous part of the auditory passage. It commences with a moderate itching pain, which, however, soon passes into a violent burning and stinging, combined with a sensation as if the passage was stopped up. It lasts without intermitting, extends to the neighboring parts, the jaws, the teeth, the neck, and is increased by every movement of the lower jaw-bone, as in eating, drinking, speaking, yawning, &c. The patient is always affected with considerable tinnitus, with derangement of the hearing, which become worse during the nightly feverish exacerbations. The entrance of the auditory passage is, in the beginning, equally reddened, dry, narrowed, so that the tympanic membrane can hardly be examined. Examination with the speculum, which is attended with a good deal of pain, shows the posterior part of the meatus much reddened, and the tympanic membrane injected. Soon a swelling takes place in the orifice of the meatus, which grows so

large that the sides of the meatus very often touch each other. Almost always, the inflammation spreads over the part of the earshell that lies nearest to the orifice of the meatus; sometimes even over the mastoid process. Already, after two or three days, a serous, often bloody, discharge takes place from the meatus; the swelling, under beating pains, is changed into an abscess. As soon as the latter opens itself, and the pus has run off, all pains are soon at an end.

This disease, which is comparatively of rare occurrence, is caused principally by local colds, foreign bodies, imprudent use of stimulant remedies. It is most frequent in youth and childhood. Though very violent, the disease is by no means dangerous.

In the first period of the disease, an antiphlogistic treatment is required. If there are any foreign bodies in the meatus, they are to be carefully removed. If the patient is robust and plethoric, some leeches are to be applied behind the ear. At the same time, the patient is to be put on a severe diet, and nitre and purgative salts, together with stimulating foot-baths, are to be administered to him. To moderate the nightly exacerbations, it will be well to let him lie upon a cushion of horsehair. Tepid oil of almonds may be instilled into the ear. But cataplasms are the principal remedy, continually applied to the ear and its surroundings. Where the inflammation is

moderate, *Kramer* recommends the popular remedy of a wedge-like piece of lard. If the abscess empties itself into the meatus, the curative process is much accelerated by injections of tepid water, and application of a slight bandage-pressure, or by collodium rubbed into the mastoid process. If the abscess empties itself in an outward direction, it suffices to continue the cataplasms. If the opening of the abscess at the orific of the meatus does not close, after the pus has all run off, it ought to be touched with nitrate of silver, and a bourdonnet is to be inserted into the meatus, in order to exercise a slight compression.

### 3. *Inflammation of the Periosteum of the Meatus.*

(*Periostitis meatus auditorii.*)

This disease commences with a very violent stinging or tearing pain in the meatus, which always extends to the neighboring parts, and grows more violent at night. The lining of the cartilaginous and osseous part of the auditory passage is moderately reddened, swells somewhat œdematously, and the ceruminous secretion is stopped. The tympanic membrane is always feebly reddened, the sensitiveness to loud noises is increased, and there is tinnitus and dulness of hearing. After a few days, the pains subside, and a serous discharge takes place from the meatus, which,

generally, indicates a favorable turn of the disease. Until the return of the ceruminous secretion, there always remains a disagreeable sensation in the auditory passage. After repeated attacks, the disease is apt to leave behind a swelling of the lining of the meatus, and a thickening of the tympanic membrane, together with dulness of hearing. This is the course of the disease, which is usually described as *otitis rheumatica*, and with which the so-called *otitis arthritica* is the more easily confounded, as it presents no peculiar symptoms.

A much worse form of this disease commences with such trifling complaints, that it is hardly known in the beginning. A purulent discharge, together with symptomatic dulness of hearing, is usually the first symptom which excites the attention of the patient. After the meatus has been cleansed by injections, an ulcer with red, swollen margins is discovered; and, where the disease has existed for a longer time, a red, wartlike excrescence, with a small opening in the middle, through which the probe touches a rough, osseous part. Amidst a continuous, offensive discharge, the carious bone either exfoliates itself in the form of sandlike little grains, or larger splinters are pushed off, which may be drawn out with the forceps. If the disease remains confined to its original seat, it often ends only after many years, with incurable

destructions, most frequently with a total concretion of the meatus. In other cases, osseous excrescences are formed in the meatus. In the course of time, however, the disease frequently migrates farther, attacks, after the destruction of the tympanic membrane, the periosteum of the tympanic cavity and the mastoid process, and combines itself with the periostitis auris mediæ, of which we shall speak below.

*Acute* periostitis of the auditory passage is almost always a reflection of a disturbed action of the skin in persons who are inclined to goutic or rheumatic complaints. *Chronic* periostitis is almost always a consequence of acute exanthemas, particularly small-pox and scarlet fever.

The rheumatic inflammation of the external ear is an entirely harmless complaint, if early taken care of and rightly treated. More obstinate is the *goutic* form, which is very apt to produce otorrhœa. Fortunately it is of much rarer occurrence. More dangerous than either is the periostitis, on account of its easily turning into caries. The *rheumatic* inflammation of the external ear requires, like the acute catarrhal form, an antiphlogistic-diaphoretic treatment. Where the pains are very violent, calomel ought to be given alternately with the antiphlogistic salts, and mercurial salve rubbed into the mastoid process. In

cases where there is no fever, the *vinum seminis colchici*, combined with tincture of opium, renders the most excellent service. In entirely fresh cases, counter-irritants applied to remote parts are of very great use. A vesicatory applied to the neck, very often has cut short the disease in the beginning. Of local applications, warm compresses are mostly sufficient. When the pains make their appearance periodically and with great violence, they are most easily allayed by an instillation of a mixture of half a scruple of chloroform with an ounce of almond oil. If the disease is treated energetically from the beginning, it sometimes disappears without producing a discharge from the meatus. When the latter takes place, all astringents ought to be avoided in the beginning, and merely cleansing injections of tepid water be used. When it lasts longer, it is to be treated according to the principles laid down in *otitis catarrhalis*. After the disease has ceased, great care is to be taken not to provoke a relapse by exposure to cold.

The *chronic* inflammation of the periosteum would require an antiphlogistic treatment, if it could be recognised early enough. As soon as the purulent discharge takes place, frequent cleansing injections ought to be made, a strong solution of nitrate of silver instilled, and osseous splinters removed with the for-



ceps. The best means to promote exfoliation is a solution of 10-12 grains of cuprum sulphuricum in one ounce of water, to be instilled twice a day. Where there are any granulations in the meatus, covering the exfoliating bone, they are first to be destroyed by cauterization with nitrate of silver. So far the local treatment. That the constitutional condition is to be taken into consideration at the same time, and that a constant counter-irritation is to be kept up most efficiently by a fontanella on the upper arm, is a matter of course. Where there is no demonstrable dyscrasy at the bottom, the prolonged use of cod-liver oil, on account of its beneficial influence upon the whole system, deserves more confidence than the much-praised specifics, phosphoric fluid and assafoetida.

#### b. INFLAMMATION OF THE MEMBRANE OF THE TYMPANUM (MYRINGITIS).

*In an acute form*, this disease commences without any characteristic *subjective* symptoms, in the same way as most of the inflammations of the external meatus. It makes its first appearance suddenly, most generally at night, sometimes with moderate, sometimes with very violent pains, which extend to the contiguous parts, grow more violent at night, and are combined sometimes with sleeplessness, feverish

excitement, even with delirium, and always with dulness of hearing. The pain is increased by the entrance of air into the tympanum.

The *objective* symptoms of the disease are so characteristic that the diagnosis can easily be formed by means of the speculum. Immediately after the pains have made their appearance, the tympanic membrane already presents an altered appearance. It has lost its shine, is opaque, and along the manubrium (the handle of the hammer) is streaked with one or two red threads, formed by smaller blood-vessels. As the inflammation increases, thick bundles of vessels are seen running across the membrane, and the latter assumes a striking resemblance to an artificially injected drumhead. It gets swollen, loses its natural concavity, and the point of the insertion of the manubrium can no longer be distinguished. The auricle and the auditory canal remain for the most part unaffected.

The disease already after a few days reaches its point of culmination. If it is properly treated, the membrane again assumes its natural form, the hearing returns, the noise in the ear gradually loses itself, and for the most leaves no bad effect behind.

But when left to its own course, or if treated by the common remedy of quacks, acrid and irritating injections, often suppuration takes place, and the

secretion of cerumen (earwax) is at once stopped. One or more perforations of the size of a pin's point or as large as a pea, are observed before and below the insertion point of the manubrium.

Slighter cases of inflammation of the *membrana tympani* generally do not last longer than a few days; severer cases may last for weeks.

The chief exciting *cause* of the disease is cold, caught either by draughts of air or by diving into cold water. Drops, injections, acrid salves, foreign bodies in the ear, or an unskilful handling of instruments in trying to remove them, hot vapors, directed against the *membrana tympani* by means of a funnel, the too frequent introduction of an ear-pick, electricity, galvanism, also frequently produce the same effect.

The *prognosis* is usually favorable, when appropriate remedies are employed before suppuration takes place.

The *treatment* in slighter cases is very simple. All that is necessary is to protect the ear well against the cold air, and of course to abstain from any irritating local applications. A weak solution of acetate of lead dropped into the ear, is the only medical remedy required in such cases.

If, however, inflammation is of a more violent character, a strict antiphlogistic treatment becomes necessary. Ten or more leeches ought to be applied round the ear, and the bleeding kept up by fomenta-

tion with a sponge dipped into warm water. When the bleeding has ceased, emollient cataplasms (poultices) ought to be applied, and warm almond oil may be dropped into the ear. Internally saline purgatives are to be given, alternating with strong doses of calomel. The patient ought to be kept in bed, and on no account allowed to leave the house, as long as cataplasms are employed. When a purulent secretion takes place, the auditory canal ought to be cleansed several times a day by cautious injections of tepid water, whereupon a tepid solution of one or two grains of acetate of lead in an ounce of distilled water is to be dropped in. At the same time, tartar emetic ointment is to be rubbed in either below the mastoid process or on the neck. If the membrana tympani is perforated, the acetate of lead instillations are to be continued; the greatest caution is to be used in making the injections, and the patient must be warned against making any effort in blowing the nose. The edges of the perforations in the membrane should be occasionally touched with nitrate of silver, whereby the process of granulation will be accelerated.

Much more frequent than the acute is the *chronic* form of myringitis. It appears but very rarely as the immediate continuation of the acute form, but most generally as a primary disease, with dulness of hearing and a purulent discharge. It is not attended by

either very violent or constant pain, and the principal diagnostic signs are to be discovered by the speculum. There will be found a deficiency or total absence of cerumen, a red and granular appearance of the mucous lining of the meatus, a thickened condition of the membrane of the tympanum, a collapse of the membrane, which is drawn inwards, presenting externally a concave surface, and showing the manubrium (handle) of the malleus (hammer) with unusual distinctness. In this case the inflammation generally commences *within*, probably in the throat or Eustachian tube, and thence extending to the tympanum, terminates in the deposit of lymph in or about that cavity. The deafness and tinnitus (noise in the ear) often increase and decrease as the weather changes, the patient hearing better in dry, clear weather, and worse in the reverse.

*Chronic* inflammation occurs most frequently in children, and more often in man than in woman. Scrofulous individuals are particularly liable to it. It owes its origin most generally to acute and chronic cutaneous diseases, especially scarlatina, which are apt to develop inflammatory affections of the membranous structures of various organs, and among them also of the membrana tympani.

The *prognosis* is generally altogether unfavorable. Owing to the slight degree of pain which, in most

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cases, attends its first appearance, the disease is very apt to be neglected by both patient and physician, until it has obtained too deep a hold upon the part to be extirpated. If the disease receives the proper treatment, during the period of its first development, a radical cure may be confidently expected. But if, as generally happens, the disease has existed for a long time, it will be found, even after the removal of all inflammatory symptoms, that permanent disorganization of the membrane, such as thickening, cartilaginous induration, ossification, and even perforation or entire destruction, has taken place.

The treatment of this disease must be at once *local* and *constitutional*. The latter will vary according to the condition of general health. In some, an alterative course of mercury is required, in others, tonics may be necessary. The salt-sponge bath, with subsequent friction, is extremely useful.

The *local* treatment ought to consist in instilling a solution of acetate of lead, either cold or tepid, into the ear, twice or thrice a day. Harvey recommends, in cases where there exists a granular appearance in the mucous membrane of the throat, a frequent fumigation of the latter with iodine and guaiacum, followed by astringent gargles. He also recommends to keep the meatus moistened with the steam of warm water, and at night to drop into it a little nitrate of mercury

ointment dissolved in almond oil. When the membrane is perforated, the organs ought to be protected by a pellet of cotton wool.

## B. INFLAMMATIONS OF THE MIDDLE EAR.

### 1. *Inflammation of the Mucous Membrane of the Middle Ear.*

(Otitis catarrhalis interna.)

The *acute* form of this disease is almost always connected with catarrhal affections, such as cold in the head, cough, hoarseness, &c. It makes its appearance for the most part quite suddenly, attended with dulness of hearing, noises in the ear, a feeling of fulness in the same, and heaviness of the head. While swallowing or humming, a stinging sensation is felt that extends from the throat to the ear. When the disease exists in a milder form, these symptoms disappear after a few days, while the mucous secretion of the nose and the throat increases. When it exists in a more violent form, the disease is attended with greater painfulness in the ear, and stronger tinnitus, sometimes even with feverish excitement. But even these symptoms sometimes disappear of their own accord, the general derangement being removed by increased perspiration, and the local one by the increased secretion of the irritated mucous membrane

of the nose, the fauces, and, no doubt, even of the Eustachian tube. But such a favorable issue is not always to be looked for, the disease being often protracted by additional derangements, particularly colds. If the mucus collected in the tympanic cavity is prevented from flowing off by a swelling of the mucous membrane of the tube, the dulness of hearing is increased. Fortunately, the disease confines itself for the most part to the ear.

The *chronic* form, where it is not the immediate consequence of the acute, makes its appearance, for the most part, so imperceptibly, that the patient gets aware of his disease only by a diminution of hearing. The patient complains of a certain fulness in the ear, and of a sensation as if the auditory canal were filled with water. His own voice appears to him changed, mostly deeper. These are generally the only subjective symptoms. A never-failing objective symptom is dulness of hearing, which often borders on complete deafness. It varies according to the changes of the weather, being mostly worse in the morning than in the other parts of the day, and better in clear, dry air, than in cold and humid. A particularly injurious effect upon the hearing is exercised by fresh catarrhal affections.

More important than all these symptoms (which may be partly wanting, and partly may occur also in other affections of the ear) are those gained by an



examination with the speculum, or by auscultation, with simultaneous application of the air-douche.

The external meatus generally appears unchanged, the ceruminous secretion undisturbed; even the membrana tympani is, in most cases, transparent, without vascular injection.

When the disease has lasted for some time, the membrana tympani assumes a dull bluish color. The throat shows marks of irritation, redness, and looseness of the pharynx, of the velum palati, sometimes swelling of the tonsils and the uvula.

But positive information is only to be gained by the *air-douche*. In the *acute* form, it produces an unpleasant sensation in the ear, but almost immediately improves the hearing, as soon as the air penetrates into the tympanic cavity. This latter takes place with a peculiar noise, caused by the mucus. In the *chronic* form, the noise has a stronger, more gurgling sound. As in the acute form, an immediate improvement of hearing is the effect of a successful air-douche.

The disease is emphatically a disease of childhood and youth, and is mostly connected with a scrofulous constitution. The most frequent cause is cold, but it may also be produced by any of the causes that bring on myringitis (inflammation of the tympanic membrane). The climate also exercises a great influence:

the disease occurs most frequently in cold, damp regions, and in spring and autumn.

The *prognosis* is favorable. Even when the disease has been neglected, and has become firmly rooted, from having lasted for years, a complete cure or very material improvement may be effected by submitting the patient to a proper treatment. The only hopeless case is that of a concretion of the Eustachian tube.

In quite recent cases, in which the mucous accumulation is very loose, and rather confined to the Eustachian tube, nature itself effects a cure, by the unusual muscular contractions and violent movements of the body that take place during forcible gulping and vomiting, when the Eustachian tube is again opened with a sudden pop. But this independent aid from nature never occurs when the disease has already been firmly established, and especially when the disease has become seated in the mucous membrane of the cavity of the tympanum. There is, besides, in old cases, a great tendency to relapse. With regard to the *treatment*, we may establish, as a general principle, that a one-sided fulfilment of the *causal indication* is as much to be rejected as an exclusive topical treatment.

The *acute* form is easily cured by an antiphlogistic-diaphoretic treatment. Ammonia, spiritus Mindereri, tartar emetic, in small doses, antimonial wine, sulphur antimoniatum, &c., are appropriate remedies. The

patient ought to be guarded against all obnoxious influences, particularly cold air, by staying in bed. Leeching is only required in cases of violent angina, and scarifications when there is a strong swelling of the tonsils. In cases of moderate angina, mucilaginous gargles are the all-sufficient local remedies, and if the nostrils are stuffed, water-vapors are to be applied. Emetics, so highly recommended in cases of deafness arising from the stomach, do excellent service in recent cases of a subacute form, even if there is no stomachic derangement, by promoting the loosening of the phlegm and perspiration. The most appropriate remedy for this purpose is ipecacuanha, which, after vomiting has been effected, may be continued in small doses. Vesicatories and other counter-irritants are a useless torture.

The *chronic* form early admits a direct local action upon the diseased mucous membrane, by means of catheterism, and without this, can rarely be removed. It requires, however, at the same time, that particular regard should be had to the constitutional peculiarities of the patient, as well as to the local complaints that may have contributed to the ear disease. Among these, throat affections are of the greatest importance. If there is no dyscrasy at the bottom, stimulating alteratives are indicated. Ipecacuanha, in small doses, either alone or with sulphur antimoniatum, kermes,

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senega, in angina with torpid character. *Radix pimpinellæ*, *zingiberis*, *liquor ammoniæ anisatus*, are most proper in this case; while in scrofulous subjects, preparations of iodine, calomel, with sulphur antimoniatum, are the most effective remedies. In incipient angina, emetics and *guaiacum* are highly recommended. Gargles ought, however, not to be omitted. For this purpose, strong solutions of nitre, ammonia, alum, even of oxalium, are to be used. Oxalium (half a drachm to a pound of water) promotes mucous secretion in the throat more than any other remedy, but requires caution, so that it may not be swallowed.

It is of the highest importance that the activity of the skin should be kept up. The patient should be advised to bathe his whole body, first in tepid, and gradually in colder, water, and afterwards to rub the skin with a rough towel. He ought to be urged to take exercise in the open air, whenever the weather is not too unfavorable. Protecting his ears and his throat against the cold air, he will be much more benefited by going out than by staying at home. Much more injurious than the open air are the draughts of air in the house. Delicate persons ought to wear underclothing of flannel.

Where there is habitual constipation, with congestion towards the head, particularly in anomalies of menstruation and hemorrhoids, purgatives of course

are necessary. Aloe is best in such cases. When the stomach and the bowels are obstructed with phlegm, an infusion of senna-leaves with ammonia is to be preferred, because it promotes at the same time the loosening of the mucus in the throat.

Of great importance is an appropriate *diet*. All kinds of food that are difficult to digest, or that favor the formation of phlegm, are carefully to be avoided.

But the above treatment, corresponding with the causal indications, will but in very few cases be sufficient, but must be considered in most cases as preparing the way for a direct local treatment. In no other case the value of catheterism proves itself so unmistakably as in this. All other means, compared with this, are of subordinate significance.

Of particularly good effect is the *air-douche*. It ought, at first, always to be allowed to act only with a moderate force, in order previously to observe the impression which it makes on the diseased ear. The surest mode of proceeding is to condense the air in the machine very forcibly, and applying one ear close to that of the patient, gradually to open the cock of the machine, so that the whole force of the condensed air shall not be allowed to act at once on the mouth of the Eustachian tube. If the air is thus not heard to enter the canal at all, the *douche* may be allowed

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to act with its full force. In the more favorable cases, a very distant noise is heard. When the passage be still more free, the stream of air passes in with a howling noise, which at length becomes converted into a rattling sound (resembling the falling of heavy rain on the leaves of trees), when it obtains a completely free passage up to the membrana tympani. In order to facilitate the entering of air, the catheter used ought to have a wide opening, and the operation ought, if possible, to be repeated daily, until the air rushes against the membrana tympani without producing any noise. If both ears are affected, they should each be alternately submitted to the douche. It is not advisable to use the air-douche more than once a day. After every douche that has passed through to the membrana tympani, a striking improvement of hearing distance is observed. When, in the course of the treatment, the gurgling noise with which the air enters vanishes, if the faculty of hearing has again acquired its normal extent and acuteness, it may be considered a proof that the morbid excitement of the mucous membrane of the middle ear is removed. But it will be well, nevertheless, not to break the treatment off suddenly, but to repeat the air-douche from time to time (that is, after an interval of several days), in order to make success sure and to prevent relapses.

At the same time, the patient ought to be advised to pay *continued* attention to his *diet*. He ought carefully to avoid everything that tends to produce colds, catarrhal affections, and mucous engorgements. He ought to take regular active exercise, to wash the neck and upper part of the body with cold water, drink freely of cold water, rise early, &c. Gargles of alum or sulphate of iron are also very useful.

## STRICTURES OF THE EUSTACHIAN TUBE.

It is only by examination with a string of catgut that the existence of this disease can be ascertained. When such a string (an E harp-string is the best) has been introduced into the mouth of the Eustachian tube, and is carefully pushed forward, it meets with an obstruction which either cannot be overcome, or only by the most forcible pressure. If the opposition be not at once overcome, the string should be allowed to rest still for a few moments, and, after such a delay, or a day or two later, it may be introduced farther. We then feel distinctly as though the catgut slipped through an annular contracted spot, on passing beyond which, it again advances freely. On drawing out the gut again, it is, as it were, felt to be held fast at the constricted spot, so that it sometimes seems to the patient as if the stricture closed again behind the catgut, or as if it tore out everything along with it,

or as if everything returned into the ear; from whence it may be concluded that there is a great narrowing and cartilaginous degeneration at the diseased spot, and that it is, beyond all doubt, immovable. If the length of the catheter has been previously marked on the gut, it is easy, by comparing with the catheter the spot where the string arrived at the strictured part of the Eustachian tube, to calculate with accuracy the distance of the stricture from the mouth of the canal.

In the *treatment* of this disease, great attention ought to be had to the constitution of the patient, and particularly to the chronic inflammation of the throat and pharynx. The patient ought to avoid spiced meats, heating drinks, such food and drink as favor the secretion of mucus, butter, cheese, milk, and food containing milk, leguminous vegetables, and fat and acid food of all kinds. Water, a light bitter beer, and red wine and water are the best drinks; the stronger kinds of lean animal food, aided by free bodily exercise, and as little sleep in the morning as possible, are the best means of counteracting the general disposition to laxity of constitution. The bowels must be kept open. But it is only from an appropriate *topical* treatment that a perfectly satisfactory result can be expected. And for this, a skilful handling of the catheter is the first and most indispensable requisite.



When the mucous membrane of the Eustachian tube is equally swollen throughout its whole extent, so that air blown into it strongly strikes feebly against the membrana tympani, then solutions of kali hydriodicum ( $\text{℥ss}—\text{℥}\beta$  in  $\text{℥}\beta$  distilled water), of sal ammoniacum (gr. j—x in  $\text{℥}\beta$  water), liquor hydrarg. muriat. corros. (3j in  $\text{℥}\beta$  distilled water), of zincum sulphuricum  $\text{℥}\beta—\text{j}$  in  $\text{℥}\beta$  water), are to be blown into the Eustachian tube and the tympanic cavity. This is done in the following manner. The funnel-shaped end of a narrow catheter (No. 12, for instance) is closed with a cork; by means of a little syringe, one or two drops of the above solutions are dropped into the opening of the beak; the catheter is introduced into the orifice of the Eustachian tube; the cork is taken out, and the drop is quickly blown from the catheter into the Eustachian tube.

If a solution of ammoniacum is used, the catheter and the syringe must be gilt; and if a solution of nitrate of silver is used, the catheter and the syringe must be of platina.

These solutions must be so weak that they do not irritate the diseased mucous membrane, because otherwise they would increase its swelling.

Instead of the above method of *Kramer*, *Rau* makes use of vapors of iodine, and, in cases where the orifice of the tube is so swollen that a fine harp-

string can only be introduced with an effort, he considers cauterization as the only means to produce a lasting enlargement of the tube. Harpstrings prepared with a solution of nitrate of silver are the surest, and at the same time the mildest, means to effect uniform cauterization, together with a gentle dilatation. The string is to be pushed as far as possible into the strictured part, but is, at first, to be left only a few minutes in the place; and the application is only to be repeated after every trace of irritation has disappeared, and is, by degrees, to be prolonged to a half-hour.

2. *Inflammation of the Periosteum of the Middle Ear.*

(Otitis interna.)

Although this form of inflammation usually proceeds from the membrana tympani, still its principal seat is the periosteum. It does not, however, confine itself to the middle ear, but almost constantly extends to the Eustachian tube and the mastoid cells, frequently attacks the labyrinth, and may even spread to the cerebral membranes and the brain.

The *acute* form is almost always confined to one side. It generally makes its appearance quite suddenly, at night, with an acute, tearing, pricking, or boring pain at the bottom of the auditory passage. The pains extend to the throat, the temples, the jaws,

the back of the head, and are increased by the slightest noise, by moving the jaw, by sneezing, coughing, or even swallowing. The eye of the affected side is very sensitive to light, filling with tears, and the retina is inflamed. The fever augments, the nights become sleepless, and are passed with pain of the head of the most intolerable character. Furious raving delirium occurs, with an extremely quick hand-pulse, great heat of skin, urgent thirst, constipation, high colored urine, anxiety, restlessness, vertigo, loss of appetite, and even vomiting. In the midst of these very violent symptoms, a purulent fluid suddenly bursts through the tympanic membrane and out of the ear, whereupon the pains instantly decrease. The fluid is, in the beginning, mixed with blood, and of a highly offensive odor. Instead of bursting through the tympanic membrane, it sometimes forces its way through the mastoid process, and, in very rare cases, through the Eustachian tube. When breaking through the mastoid process, the purulent fluid is mixed with bony fragments, sometimes even with the ossicula auditus.

The *chronic* form makes its first appearance, generally, with a moderate pain in the ear and about the mastoid process, which might easily be mistaken for a rheumatic affection. After repeated fluctuations, now getting better, now getting worse, the pain fixes itself at last in the bottom of the auditory passage, with all

that variety of gradations, just as in the acute form. The hearing is always very much deranged, and there is tinnitus (noises in the ear). It is sometimes attended with vertigo, loss of memory, drowsiness, &c., and always with a general deterioration of the constitution. At last, a purulent, highly-offensive discharge takes place from the ear, attended with a destruction of the membrana tympani. With the appearance of the discharge, the cerebral symptoms frequently disappear for a time, and the hearing improves in a remarkable degree. Nevertheless, the patient continues to remain in great danger: the discharge may stop, new inflammatory symptoms may supervene, and death by apoplexy may take place.

The *course* of the disease is sometimes very rapid, terminating in from five to seven days, and sometimes protracted for weeks and months, when fresh accessions of inflammatory excitement occur, at longer or shorter intervals, and are repeated either till the patient, in some rare cases, is restored to health, or till, as is more generally the case, death ensues.

The disease occurs mostly before the age of puberty, and is, at least in its chronic form, generally in connection with a scrofulous dyscrasy. The attack of the inflammation, particularly of the acute form, is almost always occasioned by the application of cold to the

ear, or by metastatic transference of the cutaneous inflammatory action in scarlatina, small-pox, &c.

The *prognosis* is extremely unfavorable. The disposition to caries is so great, that, in the most favorable cases, the function of the ear is materially and incurably injured. If the inflammation have spread to the membranes of the brain, and induced suppuration between these membranes and the parspetroza or the brain, death is inevitable.

The *acute* form requires the most energetic *antiphlogistic* treatment. Full bleeding must be had recourse to, leeches must be put on the temples and the neck and in the nostril of the affected side, to diminish congestion towards the head: if these do not produce the desired effect, cold fomentations are to be applied to the head (but by no means to the ear). At the same time, foot-baths with mustard may be used, and mustard-plasters be applied to the legs. Internally, calomel, in large doses, should be given alternately with full doses of purgatives, and the evacuations may be increased with injections of vinegar. Mercurial ointment is to be rubbed into the mastoid process. When chills, combined with throbbings, indicate that suppuration has commenced, the cold fomentations are to be exchanged with cataplasms on the ear and the mastoid process. At the same time, warm almond-oil is to be dropped into the ear. The antiphlogistic treatment is

to be continued, but the calomel is to be exchanged for purgative salts, in case salivation should take place. When the inflammatory character of the disease has disappeared, the cavity of the tympanum may be rinsed out by mild injections of lukewarm water, cautiously made into the auditory passage, and a loose plug of lint (which must be renewed several times a day) is to be put into the passage (but without touching the membrana tympani), for the absorption of the pus. Abscesses over the mastoid process are to be matured by cataplasms, and must be opened as soon as there is a sign of fluctuation.

The *chronic* form demands the same energetic antiphlogistic treatment as the acute. Here, too, bleeding is to be had recourse to, and tartar emetic ointment to be rubbed into the neck. Internally, calomel is to be given, which, in the beginning, in order to prevent rapid salivation, may be combined with rhubarb, and afterwards, particularly in scrofulous cases, with sulphuret of antimony. Digitalis is of less service, and hydriodate of potassa, which has an excellent effect, is to be employed only in a later period of the disease. The ear is to be covered with a cataplasm, and warm almond-oil is to be dropped in it, as long as there is no discharge. When the latter takes place, cleansing injections of tepid water are to be made into the external passage, and the cata-

plasms are to be continued. If the discharge flows freely, the cleansing injections must be followed by instillations of a weak solution of zincum or plumbum aceticum (acetate of zinc or lead), in order to remove the still existing sensitiveness, and gradually to moderate the discharge. The best way of using these solutions is to pour them, moderately warmed, into the ear, by means of a teaspoon, and to let them flow out again after five or ten minutes, whereupon the passage is to be closed with lint. In cases of caries, however, these means are insufficient. Here, droppings of a solution of sulphurcupri are the most reliable local remedy. They are to be used once or twice a day, in the beginning, in the proportion of 2-3 grains, and later of 10-11 grains, to an ounce of distilled water. If they produce too great an irritation, they are to be discontinued, but a moderate burning sensation, caused by them in the beginning, is of no consequence, and ceases after repeated use of the solution. Opium had better not be used at all for this purpose. As long as the integuments of the mastoid process are swollen and reddened, cataplasms are constantly to be applied. A fluctuating abscess must be opened early, in order to prevent further injury. Where fistulous openings are formed, they are, in case they should be too small to let the pus flow off freely, to be enlarged by a gutstring or by the knife, and a plug of

lint put into the artificial opening, which must be removed at least once a day. Perforations with a trocar, which have been often recommended, for the purpose of affording an opening to the pus, are not necessary, because, under the influence of cataplasms, an opening soon occurs of its own accord. As injections into the external auditory passage are not sufficient to empty the pus out of the mastoid process, they must be made, but without any violence, and in small quantities, through the fistulous openings. The latter ought to be prevented from closing too soon by a plug of lint placed into them, and the walls of the abscess cavity ought to be brought to concretion by a light pressure-bandage. Collodium, repeatedly applied, is of particular service for this purpose. If the pain in the mastoid process has entirely ceased, but the discharge still continues, if the probe touches upon bare rough osseous parts, the above-mentioned solution of sulphur-cupri is to be had recourse to, which is to be injected with a little glass syringe, immediately after the injection with tepid water. Without causing any dangerous degree of irritation, these injections promote the healing of the caries, while gradually moderating the purulent discharge. In necrosis of the exterior parts of the mastoid process, the sloughing of the deadened parts may be promoted by repeatedly touching them with nitrate of silver. *Internally*, hydriodate of po-



tassa and iodine, with cod-liver oil, ought to be used when suppuration and caries have taken place; they are far preferable to the commonly-recommended acidum phosphoricum and asafoetida.

### C. INFLAMMATIONS OF THE INNER EAR.

That inflammatory processes may occur in the ear, is proved by the fact that carious destructions, collections of pus and other effects of inflammation, are often quite unexpectedly discovered in dissection. But as we are unable to perceive these effects in the living subject, our knowledge of the inflammation itself amounts to little more than nothing. We have no single indubitable instance (the one case mentioned by Kramer in his second edition proves nothing) to prove that the labyrinth is ever *directly* attacked by inflammation; in all well-ascertained cases, the inflammation has spread to the labyrinth from contiguous parts, particularly from the tympanic cavity. For this reason, we have, in describing the otitis interna, embraced both the inflammation of the middle ear and that of the inner one. The so-called *Nervous Deafness*, which by most writers on ear diseases is treated of under the head of diseases of the inner ear, we shall speak of in the following chapter.

## II. NERVOUS DISEASES OF THE EAR.

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### 1. OTALGIA, NEURALGIA OTICA.

There is no class of diseases, respecting which the medical practitioner finds more difficulty in tracing the proximate cause to some determinate seat, and of all the disorders to which the nervous system is liable, there are few more afflicting than these painful affections. The sufferers are generally more or less incapacitated for any permanent exertion or employment, through the intense pain and the general debility which are thus induced, and also through the consequences which result from the action of the powerful narcotics so often used to deaden the severity of the pain, and which are in many cases urgently called for by the intensity of the suffering; thus both the disease and its treatment tend greatly to impair the powers of mind and body.

At the same time, it must be confessed that there are few diseases which are so little understood. Even if opportunities for post-mortem examinations were not so rare, the alterations in the structure of the

nerves themselves are not generally of a nature to be perceivable by our senses. The human eye is unable to distinguish the minute changes in the tubes composing the structure of a diseased nerve.

The characteristic feature of otalgia, which distinguishes it from all other ear diseases, particularly from otitis interna, is the paroxysmal character of its pains, together with the absence of all inflammatory symptoms. Most frequently without any forewarning, sometimes after previous toothache, it makes its first attack with an, at first, moderate, but soon intolerable, tearing and boring pain at the bottom of the auditory passage, which soon thrills through the whole affected part of the head, commencing from the nervus trigeminus, and sometimes radiating through all its ramifications. The pain is generally confined to *one* ear. The attacks of the pain are at first mostly of short duration; but they gradually grow longer and more violent, and generally recur at the same time of day, particularly the evening. The *diagnosis* is impossible without the most careful examination of the ear, as the disease is exclusively attended with subjective symptoms. It is only after the examination has shown us that there are no signs of inflammation, and that the pain is not produced by the presence of a foreign body in the ear, that we have a right to look upon the disease as purely nervous. If such a strict

objective examination is not made, the disease may be very easily confounded with the otitis interna.

Among the ascertainable *causes* of otalgia, sitting or standing in a cold draught, while the body is heated, takes the first place. It also appears in sympathetic connection with irritation of the tooth nerves, particularly when produced by caries.

Although the disease is one of the most obstinate, easily becomes protracted, and easily recurs again, it still permits a favorable *prognosis*, as it sometimes quickly yields to an appropriate treatment, and, even after a long duration, hardly leaves any bad consequences behind.

The *treatment*, like that of other neuralgias, must be adapted to the individuality of the patient and the causes of the disease. Sympathetic ear affections can only be removed by attacking the radical disease. So does, for instance, the extraction of a carious tooth often produce the most favorable effect. When the disease is founded in rheumatism, vesicatories of cantharides are the most efficient remedy. Internally, pills of equal parts of zinc, hyoscyamus, and valerian, in increasing doses, may be given. But the greatest service is derived from the instillation of a warmed solution of chloroform (ʒj in ʒj almond-oil) into the meatus.

As cold is the most frequent accidental cause of

this complaint, it is of the highest importance that the activity of the skin should be kept up. The patient ought to remain in a dry room of even temperature, to avoid draughts of air, to keep his feet warm, to protect the ear and the surrounding parts with a woollen covering. He ought not to leave the house, except when the weather is quite fair and warm, and when there is no wind. After the disease has been cured, great care is to be taken to guard against relapses. Cold, and particularly night air, must be entirely avoided, and the activity of the skin must be well kept up.

## 2. NERVOUS DULNESS OF HEARING AND DEAFNESS.

### *Dysacusis and Cophosis Nervosa.*

The term "nervous deafness" is too commonly applied, without sufficient discrimination, to cases of deafness, the cause of which is unknown, but which further investigation has shown to be dependent upon other parts of the organ of hearing than the acoustic nerve. Only that kind of dulness of hearing and deafness deserves to be called *nervous*, where there is no obstruction in the conveyance of the sonorous undulations, nor any perceptible *organic* change or destruction of the organs of hearing. Wherever those complaints exist, together with a perfectly sound condition of the other parts of the hearing organ we

are necessarily led to seek for their cause in an abnormal condition of the *acoustic nerve*. It must be confessed, however, that the insuperable difficulties in the way of a perfectly reliable diagnosis often compel us to have recourse to the supposition of a *nervous* origin of dulness of hearing, when it may have been produced by a very different cause. From these latter kinds of dulness of hearing, the nervous one is not to be distinguished by a single pathognomic symptom.

The *nervous* dulness or deafness is caused by the *functional* derangement of the auditory nerve; and this derangement may be either of an *erethic* or of a *torpid* character, that is, it may be attended by augmented or diminished irritability.

The inseparable companion of the *erethic* form is *tinnitus* or noises in the ear, which Kramer looks upon as so characteristic of this form, that he considers it the essential point of difference between it and the chronic form.

One of the most annoying symptoms is a pulsation in the ear, synchronous with the heart's action, more or less constant, and always much augmented by mental excitement or bodily fatigue. These unpleasant sensations shift from side to side, and though they almost always begin in one ear, frequently terminate by affecting both. At other times, the affection commences and proceeds more gradually, the hearing

being impaired, and the above sensations produced, only when listening to minute sounds, which circumstance may be forgotten until the disorder becomes more severe. These symptoms are increased by circumstances affecting uncomfortably the mind or body, and are lessened by quietude, cheerfulness, and improvement of health. This disease proceeds to such an extent as to incapacitate the sufferer from attending to his avocations, and it may exist for many years, or even during life. In severe and long continued cases, otalgia is sometimes excited, which extends to the surrounding muscles and skin.

A curious circumstance is connected with this affection: the patient can sometimes hear the human voice and hold a conversation, when the surrounding noise is very great, as in a carriage, or walking along a noisy street, whereas without this loud accompanying noise he would be deaf to the slightest sound. In most cases, though not in all, the secretion of cerumen gradually diminishes, and is accompanied by frequent and very annoying tickling, the meatus becomes dry, throws off large transparent scales of cuticle, and is either extremely sensitive or altogether insensible to the touch, so that it seems to the patient as though the probe touched a parchment. This loss of sensation extends to the whole auricle, and even to the cheek. If, even at this stage of development, the

disease is not arrested, the faculty of hearing becomes more and more impaired, till complete deafness ensues. With this state there is frequently associated a feebleness of smell and of sight. In the latter stages of the disease, however, the tinnitus ceases altogether.

The *torpid* form either develops itself from the *erethic* form or commences at once in its own character. In the former case, the auditory nerve gradually loses its irritability, and grows duller and duller, the tinnitus decreases, and the dysacusis progresses evenly. In the second case, when the disease at once commences in the *torpid* form, it generally develops itself so insensibly that it excites the attention of the patient only after it has made considerable progress. This is the more easily to be accounted for as he is not affected with tinnitus, or with excessive sensitiveness to other noises, as is the case in the *erethic* form. But once commenced, it progresses with such constancy, that no further self-deception is possible. There shows itself at first a certain inertness in the function of the auditory nerve. The patient answers questions addressed to him correctly still, but tardily, frequently only after they have been repeated, and as if waking from a dream. In the same proportion as the hearing decreases, the voice becomes hollow, and sounds as if it came from a distance. Exciting influences, a moderate use of spirituous drinks, of tea and



coffee, pleasant news, fine weather, sometimes bring a transient improvement. The same curious phenomenon noticed in the *erethic* form, occurs still more frequently in the torpid form, namely, that the patient hears better under the influence of a strong but uniform noise, such as the ringing of bells, the beating of drums, the rattling of cars, &c. Much more frequently than in the *erethic* form, both ears are equally affected. Hereditary predisposition is undoubtedly the most important predisposing cause of the disease. Next to this, noisy occupations form another predisposition, as by too great an irritation of the auditory nerve, they gradually render it obtuse. The *erethic* form occurs mostly in feeble, irritable, and nervous individuals, particularly females. The torpid form may make its appearance as a consequence of the *erethic* form in every period of life, but, unless when produced by violent causes, appears originally only in more advanced age.

The principal exciting cause of the disease is generally considered to be cold, but all debilitating influences act in an injurious manner; such as fevers, distress, care, grief, night-watching, excess in drinking, and other excesses. Sudden great noises, such as explosions of powder-magazines, discharges of big pieces of artillery, &c., often produce complete deafness. Nervous deafness, though not absolutely in-

curable, belongs to the most obstinate diseases. It can never be expected to disappear of its own accord, except when produced by typhous fevers. There is hope for its cure when it has not yet existed too long, or when the patient is still youthful; but in old persons, and where it has once struck a deep root, no cure, hardly an improvement, can be expected. This is certainly the case when dulness of hearing has attained to so high a degree, that a watch applied close to the diseased ear can no longer be heard, or where the patient has already undergone electricity, galvanism, and electro-magnetism. The erethic form allows a more favorable prognosis than the torpid one, but, on account of the greater variability of its symptoms, is much more difficult to treat than the latter; congenital deafness is, as a general rule, incurable.

The *treatment* will necessarily be both *direct* and *indirect*. That is, it will, 1st, try to remove all the causes which more or less have contributed to produce the disease (*indirect*), and 2d, it will seek to combat the disease itself (*direct*).

The *indirect* treatment will of course vary, according to the nature of the case. Where there is a derangement in the action of the skin, catarrh, and rheumatism, a diaphoretic method is indicated, but care must be taken to avoid all stimulating heating remedies, lest the erethisms be increased. In cases of suppressed

hemorrhoids, leeches are to be applied to the anus, and in cases of suppressed menstruation, to the inner part of the thigh. In cases of congestions towards the head in very plethoric individuals, venesection may become necessary, but it ought to be made on the foot rather than on the arm. Foot-baths with mustard are best calculated to diminish the congestion for the moment. Thoroughly the latter will only be removed with the irritation of the acoustic nerve itself. In gastric and visceral derangements, purgatives do excellent service. Cases of suppressed eruptions demand counter-irritants applied to the affected parts, together with a diaphoretic alterative treatment. That accumulations of earwax must be removed, that catarrhs of the middle ear must be cured, before a *direct* treatment of the nervous deafness is attempted, is a matter of course. As a general rule, no dulness of hearing or deafness is to be looked upon as *nervous*, so long as there exist other causes that may produce a derangement of hearing.

The *direct* treatment is either general or local. The general treatment tries to influence the acoustic nerve by an alteration of the whole nervous system, in the presupposition that both are in the same condition. But this presupposition is, in many cases, unfounded. The acoustic nerve may be in an excited condition in seemingly torpid individuals, and may

be quite dulled in decidedly erethic persons, yea, it may be in a different condition in the two ears. The general treatment has therefore, at best, only a subordinate significance not compared with the local one. The *erethic* nervous deafness requires, above all things, *quiet* and a mild diet. The patient ought to avoid everything that causes excitement, all loud noises and particularly cold draughts. He never ought to go out in bad weather, without protecting the ears well with a plug of cotton.

Among *medicines*, hyoscyamus, aqua laurocerasi, and digitalis are most calculated to quiet the general excitement of the nervous system, which accompanies this kind of nervous deafness. In cases of congestion, combined with increased tinnitus in excitable, non-plethoric individuals, sulphuric acid with aqua laurocerasi or tincture of digitalis, is particularly beneficial, and in hysterical individuals, sulphuric acid with tincture of valerian.

The only reliable kind of *local* treatment is the introduction of medicated vapors into the tympanic cavity by means of the catheter. Of particularly good effect are vapors of extract of hyoscyamus ( $\frac{1}{4}$ – $\frac{1}{2}$  gr. with water) introduced into the Eustachian tube. Vapors of chloroform (2–3 drops) introduced into the Eustachian tube have an almost instantaneously quieting effect upon the organ of hearing.

At the same time, they alleviate the tinnitus sooner than the extract of hyoscyamus, and increase the hearing distance. Used with *caution*, they certainly belong to the principal remedies against erethic-nervous deafness.

The *torpid nervous* deafness requires in the first place a nourishing and even somewhat stimulating *diet*, as it may be connected with a general depression of the nervous system. Internally, the same medicines are to be given as in the torpid nervous fevers. But they are only then of service, when the torpor of the acoustic nerve is connected with a corresponding general affection. Ethereal oils, valerian, arnica, serpentaria, camphor, the stronger preparations of ammonium, strychnine, the various kinds of ether, and sweetened acids, are the most frequently used excitantia, from which, in cases of great exhaustion, one may proceed to cinchona and its alcaloids. But care must be taken not to stimulate so much as to produce a congestion towards the affected part. The effect of these remedies is generally sought to be increased by excitants applied to the external meatus, such as ethereal oils, camphor, moshus, amber, balsams, infusions of ethereal-oleaginous substances, particularly arnica. But with the exception of promoting the secretion of earwax, where the latter is defective, these remedies are not of very great use.

Here too, as in erethic deafness, vapors of volatile excitant medicines led into the middle ear by means of the catheter, are the principal remedy. Among these, the *ether* takes the first place. But it must only be employed in very small doses. In the beginning, the spiritus ætheris acetici had better be used, as it is milder (*one* drop with steam of water or warm air).

The tinnitus, as far as it accompanies nervous deafness, is most easily removed by vapors of chloroform introduced into the tympanic cavity. But as it is symptomatic of many other morbid affections of the ear besides nervous deafness, it needs hardly an express statement, that, according to the different diseases of which it is a symptom, it requires a different treatment. So, for instance, in the various inflammations of the ear, it may be removed by the antiphlogistic method; in accumulations of mucus in the tympanic cavity, by the air-douche; in concretions of earwax, by syringing the external auditory passage.

### III. ORGANIC DISEASES OF THE EAR.

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#### 1. WANT OF THE EARSHELL (DEFECTUS AURICULÆ.)

WHEN it occurs either in a complete or in a partial form, either on one or on both sides, as a congenital defect, it is always connected with a more or less considerable diminution of hearing. Where the earshell has been lost by sabre or shot wounds, no sensible derangement of hearing is perceived. A partial loss of the earshell shows no influence upon the hearing function.

To make up for the loss, attempts have been made to form an ear from the adjoining skin. But these attempts have been so unsuccessful, that it is far better to supply the place of the lost natural ear with an *artificial* one. They are made either of papier maché, or pressed leather or wood, or metal, and painted with oil color or enamelled. Though mostly used for the sake of removing a deformity, they also assist in hearing, the more so as they are fastened by a little tube inserted into the meatus. In order to give them a better hold, they are, besides, supported by a spring running over the head.

## 2. AURICULA ADPRESSA.

This defect is most frequently produced by too close-fitting caps drawn over the ears of newly-born children. If the earshell is sore at the same time, it may grow together with the contiguous parts of the headskin.

Smaller degrees of this deformity in little children not unfrequently cease of their own accord, when the pressure of the head covering is removed. To promote the normal position of the ear, a cloth may be tied behind it. In higher degrees of the deformity, the most appropriate remedy is *Webster's Otaphone*, i. e., a silver clasp, adapted to the posterior side of the earshell, which increases the angle between ear and head to  $45^{\circ}$ . When the instrument is taken off, the earshell gradually recedes to  $40^{\circ}$ , which is considered the most favorable angle for a good hearing. Where the earshell adheres to the skin of the head, the adhesion is to be cut through with the knife, and a little pad of lint, covered with cerate of lead, placed in the wound to prevent concretion.

## 3. DILATATION OF THE AUDITORY PASSAGE

is incurable. But the dryness of the cutaneous lining, and the unpleasant itching which attend it, may be relieved by palliative treatment. The secretion of the ceruminous glands is best promoted by iodine (gr. j dissolved in  $\bar{3}$ j of cod-liver oil). If this has no effect,



nothing remains but to moisten the lining of the auditory passage with tepid injections of glycerin.

#### 4. THE NARROWING (CONTRACTION) OF THE AUDITORY PASSAGE.

This may be caused by various defects of organization, such as, 1. Thickening of the sides of the passage; 2. Osseous excrescences; 3. Compression of the meatus; 4. Introversion of the tragus and anti-tragus; 5. Tumors of the meatus.

##### *a. Thickening of the Walls of the Passage*

usually occurs only on the cartilaginous part. It sometimes consists in an annular, firm, whitish stricture, which hardly allows a fine probe to pass through; at other times, only in a swelling of the integument, which assumes various colors, mostly red, with or without discharge from the meatus. If the thickening occurs at the entrance of the passage, the latter is changed into a mere fissure. Sometimes excrescences are to be found in the posterior part of the osseous meatus, which spread over the tympanic membrane. They are not unfrequently mistaken for polypi; they bleed easily, and look like caruncles. They are always connected with inflammations of the integument, which, particularly in dyscratic subjects, not unfrequently continue in a blennorhoïc form. In firm

strictures, the meatus is mostly without morbid secretion. When the stricture is very narrow, the earwax is apt to accumulate behind it.

*b. The Exostoses of the Meatus*

have already, when speaking of the periosteal inflammation of the auditory passage, been mentioned as a rare cause of its contraction.

*c. The Compression of the Meatus*

is caused in various ways, generally by swellings of the contiguous parts, tuberculous deposits, &c. A very curious cause is the loss of the hind teeth (first noticed by Larrey), by which the condyloid processes of the lower jaw gradually receive an upward and backward direction, inserting themselves in the fossa auricularis of the temporal bone beyond the fissura glaseri, and before the auditory passage, so that the latter is either closed or receives an oblique direction, which prevents the sonorous undulations from reaching the membrana tympani.

*d. The Introversion of the Tragus and Anti-tragus,*

by which these parts are placed like a valve before the entrance, and change it into a narrow fissure, is usually produced only by a constant pressure, rarely by a spasmodic tension of the tragus muscle.

*e. The bladder-like (cystic) Tumors of the Meatus,* which occur but very rarely, are almost always near the entrance, close behind the tragus and anti-tragus, mechanically narrow the opening, and sometimes entertain an irritation combined with a purulent discharge, so that they may be mistaken for polypi

*Diagnosis.*—The fact of the stricture is easily enough ascertained; but its nature is only to be determined by a careful examination with the speculum and the probe, unless it occur in the entrance, where a simple ocular inspection may be sufficient. But even in this latter case, it will be well to make use of the probe, as there may possibly be a second stricture in the remoter part of the auditory passage. Where there are carunculous excrescences, there is always a possibility of a carious affection, in which case the diseased part of the bone is most frequently found out with the curved probe, through a not always visible opening in the midst of the excrescence. Exostoses still covered with the integument are likewise only to be discovered by the probe. The speculum sometimes cannot be applied, owing to a too great narrowing of the orifice; but where it can be properly applied, it acts as a conveyance of the sound, and temporarily improves the hearing. The derangement of hearing is, as a general rule, in proportion to the degree of the stricture; but nevertheless there are cases, where the

orifice is reduced to a narrow fissure, and where the hearing is fine and keen. An oblique direction of the meatus has the least influence upon the hearing; whereas the wartlike excrescences at the bottom of the auditory passage obstruct the sound the most.

*Treatment of Contraction of the Auditory Passage.*

The treatment must of course vary according to the cause of the disease. The *thickening of the sides* (parietes) must, on the whole, be treated like the chronic catarrhal inflammation of the auditory passage. In the beginning, drops of a solution of corrosive sublimate, sulphate of copper, or nitrate of silver ought to be infused into the passage, and when the irritation has passed away, repeated cauterization with nitrate of silver in substance ought to be made use of (particularly where there are carunculous excrescences). Immediately after cauterization, an injection of a very weak solution of kitchen salt is to be made, a piece of sponge to be put in, and the cauterization to be repeated when the scurf caused by cauterization has fallen off. Where the stricture is very narrow, gutstrings prepared with nitrate of silver, like those used in strictures of the Eustachian tube, had best be employed. They are to be kept twenty-four hours in the passage, and before inserting them again, a cleansing injection is to be made to

remove the scurf. When dilatation has been achieved, a little tube of lead is to be worn, in order to prevent the passage from narrowing again.

The *compression of the auditory passage* requires the removal of the glandular swellings, which are its cause. If the patient, after the loss of his molar teeth, hears better when the osseous and the cartilaginous portion of the meatus, by means of the speculum, are brought into a corresponding direction, the latter can be kept up permanently by putting in a little tube. This is best made of India rubber, as it is able to keep its position without any fastening, merely by its elasticity.

In cases of *introversion* of the *tragus* and *anti-tragus*, nothing remains but the radical remedy of cutting off the projecting flap with the knife or the scissors. A palliative relief is afforded by putting in little tubes of India rubber or metal; but they are attended by the inconvenience of being easily displaced.

*Cystic tumors* of the auditory passage had best be extirpated, and the remaining parts, if there should be any, are to be touched with nitrate of silver.

*Osseous excrescences* are, as a general rule, incurable. Toynbee recommends to cauterize them with nitrate of silver, and to rub them with tincture of iodine, in order to moderate their growth.

## 5. CLOSURE OF THE AUDITORY PASSAGE.

It is sometimes combined with a want of the ear-shell, still more frequently with a crippled condition of the latter. In most cases, it is only the orifice that is closed, and the rest of the auditory passage is in a normal state. In this case the closure is membranous, and not unfrequently indicated by a small concavity; but sometimes it is not visible to the eye; a smooth tight membrane being drawn over the orifice, the margins of which are not always clearly to be distinguished by the touch. If the posterior part of the auditory passage is open, the rushing of the air against the tympanic membrane, when the air-douche is applied, can be heard almost as well as when the passage is open. The hearing is deranged in a high degree, so that, in case both passages should be closed, no articulate sounds can be heard at all, and deaf-dumbness must ensue. But, as before said, congenital closure is, in most cases, confined to one ear. In rare cases, the auditory passage is closed by a smooth membrane stretched across it, either at the entrance or in the middle, or even farther inwards, resembling the tympanic membrane, but distinguishable from this latter by its position, and its insensibility when touched with the probe. Parenchymatous closures affect the hearing even more than membranous ones. They may be discovered either by the eye, or, when

more deeply seated, by the speculum or the probe, and very often, where the orifice is closed, only after an operation has been attempted. Where the osseous part of the passage is entirely wanting, owing to congenital malformation, or where it has been subsequently closed in consequence of periosteal inflammation, the hearing is entirely lost.

*Treatment.*

As an operation can only then be of use, when the internal organs of hearing are in a normal condition, the aurist ought first to ascertain, by means of the air-douche, whether the Eustachian tube is open, and, by placing a watch at the mastoid process, whether the acoustic nerve is still capable of perception. A membranous closure of the orifice is to be cut through by a cross cut; the flaps, each singly taken up with a tooth-pincer, are to be cut off with a bent pair of scissors; a bourdonnet covered with cerate of lead, or a round piece of sponge, or a gutstring, is then put in until cicatrization takes place, and in order to prevent reclosure, a little tube is to be worn in the meatus for some time afterwards. If the closure exists farther down the passage, the cross cut is to be made with a very small bistouri, and the flaps must be destroyed by cauterization with nitrate of silver. Less appropriate is perforation with a trocar. Anorganic mem-

branes can easily be drawn out with a pincer, after the incision has been made.

## 6. DEGENERATION OF THE TYMPANIC MEMBRANE.

This name embraces different alterations of the organization of the tympanic membrane, which, however, correspond with each other in their effect. They have this general characteristic—that the membrane of the tympanum, owing either to a thickening or a hardening, or some other alteration, loses its sensibility for the sonorous undulations, and exercises an injurious effect upon the hearing.

### *a. Vascular Exuberance of the Tympanic Membrane.*

(Varicositas et pannus membranæ tympani.)

This abnormality almost always remains behind after a chronic inflammation of the tympanic membrane. It makes its first appearance with excessively enlarged blood-red vessels running along the handle of the malleus, which spread themselves net-like, while, in the interstices, a lymphatic exsudation is deposited. The tympanic membrane thereby receives a dirty red aspect, sprinkled over with grayish or yellowish points, spots, or streaks, loses its shining surface, and gradually becomes so loosened that the natural unevennesses disappear.



*b. The Thickening of the Tympanic Membrane*

presents a variety of symptoms, according as it is caused either by simple hypertrophia, or by plastic exsudation, or by granulation. In simple *hypertrophia*, it is least changed in appearance, but still loses its transparency, and assumes a dull yellowish color. Fresh *exsudations*, which are generally accompanied by vascular injections, impart to the tympanic membrane a dull, damp, loosened aspect. When the exsudations, owing to the resorption or drying of the fluid parts, shrivel up, the surface becomes dry, paper-like, is here and there covered with scales, and the auditory passage gets equally dry.

*Granulations* of a red color frequently occur in connection with pannus, succeeding chronic inflammations of the tympanic membrane, accompanied by so-called otorrhœas.

Sometimes the thickening of the tympanic membrane is attended with an increased concavity of the latter. This occurs principally where an inflammation of the tympanic cavity has gone before, and it is almost always combined with opaqueness of the tympanic membrane.

*c. Induration of the Tympanic Membrane.*

The diagnosis is to be formed by a careful investigation with the probe. The tympanic membrane,

which, when in a normal condition, is so extremely sensitive to the slightest touch, in most cases of degeneration, loses its sensibility to such a degree that the probing causes no pain at all. When indurated, it shows a greater degree of tension, is entirely untransparent, and usually white as chalk. The highest degree of induration is

*d. Ossification of the Tympanic Membrane,*

which, however, occurs but rarely, and almost exclusively in more advanced age. In this case the membrane is not only thickened and untransparent, but sprinkled over with irregular whitish or yellowish little spots, which, when inspected by the eye in the light of the sun, appear as small unevennesses, and hence a rough feeling when touched with the probe. The membrane is quite unelastic and insensible. In most cases, the ossification is merely partial.

All the above-described forms of degeneration are usually only the consequences of chronic inflammation of the tympanic membrane, and occur most frequently in dyscratic individuals. Scrofula, scarlatina, and small-pox are most apt to produce them.

Degenerations of the tympanic membrane belong to the most obstinate of all organic diseases. They affect the hearing most injuriously, and when fully

developed, produce almost complete deafness. Beside that, they are frequently accompanied by other products of preceding inflammations, particularly in the tympanic cavity, which, even without degeneration of the tympanic membrane, would produce incurable dulness of hearing.

The *treatment* must first seek to allay the *congestive* condition of the ear, while, at the same time, trying to counteract the cause that may have produced it, such as anomalies of menstruation, hemorrhoids, abdominal plethora, &c. It must therefore be *anti-phlogistic* and *counter-irritant*. Local bleeding is only necessary, in case inflammation should recur. Tartar emetic ointment is to be applied to the neck, and mercurial ointment to be rubbed into the mastoid process. Solutions of zincum aceticum, cuprum sulphuricum, and aluminatum, dropped into the ear till they produce a moderate burning, check the progress of degeneration. The tendency to vascular exuberance is best counteracted by solutions of acetate of lead and nitrate of silver. Even stronger swellings of the vessels may be obliterated by a cautious touch with a silver wire dipped into nitric acid. But the perfect transparency of the tympanic membrane cannot be restored by any means. Where there are granulations of the membrane and deposits of plastic exsudations, nitrate of silver, either in substance or in a strong solution, is

the principal remedy. Induration or ossification of the membrane permits of no direct cure. Simple perforation, formerly so generally recommended in such cases for the purpose of restoring the hearing, may be performed if there are no inflammatory products in the inner parts of the ear. (We speak of that operation more fully in another place.) If the hearing on both ears is wanting, and the membrane presents no longer any signs of irritation, then trepanation may be had recourse to.

#### 7. EAR-POLYPI.

The parasitic excrescences called polypi, occur in the ear as they do in other parts. They are usually seated in the lining of the external meatus, which, although clothed with an epidermis, frequently, when in a morbid condition, assumes the character of a mucous membrane. The ear-polyps, though presenting considerable formal varieties, may be reduced to two principal forms. These are the *soft* and the *hard*, or, as they are also designated, the *mucous* and the *fibrous* polyps.

The *mucous* polyps are of a whitish, grayish, or reddish color, and frequently of a jelly-like character, in which case they can easily be compressed, and contain in their cellulous interior a serous glabrous fluid. In other cases, they exhibit a greater consistency, have

a fibrous stalk and thicker parietes, and in their interior, a cavity filled with a clear thready fluid. The *mucous* polyps have neither nerves nor vessels.

The *hard* polyps are endowed with blood-vessels, have a bluish, reddish, and sometimes dark-red appearance, are distinctly fibrous, sometimes smooth, sometimes furrowed. They are without nerves, like the mucous polyps. When they have existed for a longer time, they often attain a considerable hardness, and assume a cartilaginous and osseous character.

The *diagnosis* is only difficult when the polyps are still very small, cause little inconvenience, and may possibly be mistaken for other, particularly carunculous, excrescences. As they make their appearance in connection with a discharge, they can hardly be seen before the meatus is cleansed by injections. Their seat is to be found out by a curved probe, introduced through the speculum. Large polyps, even if they have not yet reached the orifice of the ear, are easily discovered by ocular inspection, unless they are entirely hidden by the purulent discharge. When more developed, they protrude from the orifice, fill the ear-shell, and sometimes even cover the entire auricle. In this case, the difference between the *mucous* and the *fibrous* polyps becomes very distinct. The mucous polyps are usually dry and insensible at that part which is exposed to the atmospheric air, while the

pressure of the probe on the peduncular attachment (that is, the stalk with which they are connected with the lining of the meatus), causes a painful sensation. They are strikingly hygrometric, which means they increase and decrease in size, according to the dampness of the air.

The *fibrous* or fleshy polyp rarely protrudes from the meatus, bleeds easily when touched, attains more consistency as it grows older, and passes into ulceration. Touching, and particularly pulling, the peduncular attachment causes pain.

The subjective symptoms of the existence of ear-polyps are so trifling in the beginning that it is difficult to ascertain when they commenced. A purulent discharge, usually attended with an itching sensation, a decrease of hearing, with or without tinnitus, usually first induces the patient to ask for surgical examination, in the course of which the polyp is discovered. When fully developed, so as to fill out the meatus, the polyp entirely takes away the hearing, causes a feeling of fulness and heaviness in the ear, a like feeling in the head, and, by reflex action on the stomach, sickness and vomiting. In the case of the mucous polyps, these symptoms are temporarily allayed by fair, dry weather; often, relief is obtained by the spontaneous bursting of the polyps. When the end

of the polyp once protrudes out of the ear, the sensation of pressure is of course diminished.

Polyps of the tympanic cavity and the Eustachian tube are mentioned in all works on aural surgery, but as yet we know of no well-authenticated instance of their occurrence.

*Ætiology.*—Polyps always presuppose a morbid alteration of the lining of the meatus, and are the consequence of catarrhal, particularly blennorrhœic, inflammation, be the latter produced by local irritation or by a specific cause. The remoter causes of polypic formation are the same as those of otitis catarrhalis externa. Polyps do by no means presuppose a dyscratic diathesis, as they are very often found in entirely healthy individuals. Once existing, they keep up the irritation in the meatus, so that the discharge which accompanies them may be considered effect as well as cause.

*Prognosis.*—Though not absolutely incurable, the ear-polyps still oppose so many difficulties to the treatment, that they can rarely be radically removed without leaving injurious consequences behind. Internal remedies seem to have no effect upon these parasites, even when they are originally connected with a dyscratic condition which renders a general treatment necessary.

The prognosis is most favorable in the case of mu-

cous polyps, that are not very large and whose peduncular attachment is in the anterior part of the meatus, as they can be more easily removed, and as their covering cuticle is not much degenerated.

Fibrous polyps allow a less favorable prognosis, particularly when they are seated farther back in the meatus or in the tympanic membrane. When they fill up the passage entirely, or when they are seated on a broad basis, they become so inaccessible that it is almost impossible to remove them. Still more unfavorable becomes the prognosis when an offensive, purulent discharge argues considerable degeneration in the depth of the meatus, and the probe touches upon bare rough osseous spots. Under these circumstances, even if the polyp is removed, the hearing, though much improved, is seldom completely restored. In removing the polyps great care should be taken that no root be left behind, as they have a tendency to grow again if this precaution is not taken. The tympanic membrane, after the operation, generally remains in a thickened condition, and covered with granulations, and, moreover, is very apt to be injured by the operation itself, if the operator is not very careful. When repeatedly irritated, ear-polyps may turn into cancer.

The *treatment* must of necessity be a *local* one. Its object is to cause the polyps to shrivel up by desic-



cative and astringent remedies, or to destroy them by caustics and hot iron, or to remove them mechanically.

*a. Desiccatives and Astringents*

have formerly been much used, but have been given up again as efficient. As very effective, *Buchanan* praises pencilling with tinctura ferri muriatici, which is to be repeated daily till the polyp is destroyed, and followed by the introduction of lint smeared over with unguentum hydrargyri nitratis. In cases of fresh, loose mucous polyps, *Rau* recommends a daily pencilling with tinctura opii, as not only gradually removing the polyp itself, but also the purulent discharge. In older cases of mucous polyps, the remedy is of no effect, and applied to fibrous polyps, it is decidedly injurious, because it increases the irritation.

*b. Cauterization.*

Caustics are only to be employed, where other more effective remedies cannot be applied, as, for instance, when the polyps, with a broad basis, are seated far back in the meatus or on the tympanic membrane. They may also be used for the destruction of roots that may still remain behind, after another mode of extirpation has been tried. The most popular remedy (though not the most effective) is nitrate of silver, thin little sticks of which are

applied through the speculum by means of a finely-wrought caustic-holder. Much more effective is the causticum Viennense fusum Filhos. It is introduced in the same way as the nitrate of silver, the polyp is slightly touched with it, and immediately afterwards, before the speculum is removed, an injection is made of strongly-diluted vinegar. The application of the causticum is only to be repeated after an interval of two or three days. How powerfully it acts, will be seen when the scurf has fallen off. On this account it requires much more caution than the nitrate of silver. The latter is to be preferred for the destruction of the remaining roots of polyps, which are extremely sensitive. Equally effective but more inconvenient than the caustic of Filhos is the one used by *Toynbee* (made of kalicausticum, quinine, and iron), because it melts too easily. To protect the meatus, *Toynbee* uses a glass tube which entirely fills the passage.

*c. The Application of Hot Iron,*

already employed by the Arabic physicians, and afterwards recommended by a number of high surgical authorities, belongs to the most hazardous remedies, as it is hardly possible, in the narrow passage, to concentrate its effect exclusively upon the parasite. The manner in which it is commonly made use of is

this: the canule through which the white-heated tro-car is applied to the polyp is wrapped in wet linen or blotting-paper, and the tympanic membrane is sought to be protected by means of a plug of lint tied to a thread. But as the metallic tube gets easily heated, the whole lining of the meatus is liable to be injuriously affected. When the polyps are seated far back in the passage, and particularly when they are rooted in the tympanic membrane, the hot iron cannot be applied at all; and, on the other hand, when the polyps are near the orifice, it can easily be dispensed with.

*d. Cutting off.*

This is the easiest and least painful mode of extirpation, and ought therefore always to be preferred to all other methods, whenever it is applicable. It is not possible, when the polyps with a broad basis are seated far back in the meatus, and it is extremely difficult, when the polyps are provided with a thick fibrous stalk. This is the mode of performing the operation: the polyp is seized with a pincette on a little hook, gently drawn, and then, with a little knife or a fine pair of scissors, cut off as near the root as possible. After its removal, the bleeding, which often is very considerable, is stopped by an injection of cold water, and then the meatus is again carefully examined, to see if any remains of the polyp are left

behind. If there are any, they are removed in the same manner. The operation can be performed without the slightest injury to the meatus, if the instrument is properly introduced. It is indeed true, that after the polyp itself is cut off, its roots still remain, but the latter may afterwards be destroyed by cauterization.

*e. Extraction.*

This operation, formerly recommended by Leschevin, Quelmalz, Boyer, Buchanan, and others, and lately again defended by Melion and Angelstein, is only practicable when the polypus has no very thick and firm stalk, and is not seated on the tympanic cavity. Many polyps that appear very compact are so brittle, that they very easily crumble to pieces, and absolutely cannot be extracted. After it has been fully ascertained that the polyps are not rooted in the tympanic membrane, when the stalk is clearly to be distinguished, a fine polyp pincette is introduced up to the root, and the polyp is twisted off, without any violent pulling.\* This is the best way of preventing bleedings, which often are very considerable. The remains of the root sometimes dwindle away by atrophica without any further treatment (as Toynbee very justly re-

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\* See the Lever Ring Forcep, for the removal of polyps, given amongst instruments, with directions.

marks), but the root is sometimes surrounded with globulous bodies, which require subsequent removal or destruction. Bouncefort recommends for extraction a fine two or three-armed pincette, enclosed in a canule, and provided with a handle affixed at an angle of  $75^{\circ}$ . When the polyp is seized by the arms of the pincette, the tube is pushed forward, and the pincette is shut. If the polyp, owing to a fibrous root, cannot be extracted, it can be cut off with a fine little knife introduced through the canule.

*f. Crushing.*

Of all modes of operation, this is the least recommendable. It is only used when the polyps are seated far down in the meatus, but even then rarely, and, of itself, is always insufficient.

*g. Undertying.*

This operation is performed with a variety of instruments, some of which are exceedingly complicated. A very simple method is the one described by *Itard*. The ligature is pushed to the basis of the polyp with the fork-like end of a stylet, both heads of it are passed through the eye of a long flat needle, which is pushed in as far as possible, and the two ends of the thread are then tightly drawn. *Meissner* introduces the noose by means of a thin, light tube, which he pushes

in as far as possible, and after having got it round the root, fastens the ends of the thread to the protruding part of the tube, drawing them tighter every day, until the polyp drops off.

Whichever method may be used, the introduction of the ligature is much facilitated when the polyp is seized and drawn tight with a pincette or a little hook, while an assistant draws the earshell backwards and upwards. We have in our own practice had great experience in the treatment of polyps, and have been very successful in practising both the cutting and extracting operations, and the after treatment as given here.

#### *After Treatment.*

All the above-mentioned methods of operation are hardly ever sufficient of themselves for a radical destruction of the roots. It is only after the application of a ligature that the end of the root is sometimes destroyed by the suppuration which always follows that kind of operation. This happens much more rarely after extraction. It is therefore advisable, in all cases, for the purpose of preventing a new growth, to act directly upon the seat of the polypus. This is best done by the above-mentioned desiccatives and astringents, which, besides, contribute most to put an end to the mucous-purulent secretion that always

remains behind for some time after. In the beginning, as long as there is an inflammatory irritation of the auditory passage or the tympanic membrane, a solution of acetate of lead dropped into the ear will be found of much service, as also pencilling with tincture of opium, where there is a greater degree of looseness of the lining, together with small carunculous excrescences. This latter remedy (tincture of opium) far surpasses in efficiency the frequently-recommended solutions of nitrate of silver, alum, or tannin. In cases where the polyps are connected with a dyscratic diathesis, the latter must be duly taken into consideration; otherwise, relapses are to be apprehended. Less good is to be expected from the counter-irritants which *Toynbee* recommends to apply on the mastoid process.

## PERFORATION OF THE MEMBRANA TYMPANI.

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THOUGH Eustachian catheterism has in part superseded the operation of perforation of the membrana tympani, yet a knowledge of the latter operation is absolutely necessary and serviceable in many cases, aside from its value as a means of restoring hearing, when obliteration of the Eustachian tube exists. The theory of the operation is thus explained: In order that the hearing may be perfect, and that the membrane may execute its functions freely and perfectly, it is necessary that it be constantly placed between two columns of air in equilibrium with the atmosphere, and each communicating freely with it. This, in the natural condition of the organ, is effected, on the one hand, by the Eustachian tube, and on the other by the external meatus. If, by any accident, the Eustachian tube happens to be obliterated, or only obstructed, the air contained in the cavity of the drum loses its elastic quality and its vital property, qualities without which this fluid cannot be in equilibrium with the atmospheric air, as it was before the accident. In



that case, it is necessary to restore the equilibrium between the two columns of air, by restoring the functions of the Eustachian tube, which, till recently, was regarded as very difficult, or even impossible. Hence, undoubtedly, arose the idea of opening a communication between the air contained in the cavity of the drum and the external air which fills the external auditory meatus, by perforating the membrana tympani.

Though it is ascribed to Cheselden to have been the first to propose the operation, yet the honor of having first performed, and relieved by it persons laboring from deafness, is due to Sir Astley Cooper. He had noticed that hearing was only impaired, not lost, when suppuration in the tympanum had injured, and even destroyed, the membrana tympani, and that the degree of deafness by no means equalled what resulted from an obstruction of the Eustachian tube. Hence, when the tube was permanently obliterated, he conceived that a small puncture of the membrana tympani might be the means of enabling the patient to hear. He reports four cases in which the experiment was made with success.

The operation consists in introducing an instrument resembling a hydrocele trocar, but curved, into the meatus auditorius externus, and pushing it through the anterior and inferior part of the membrana tym-

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pani, a place rendered eligible on account of the situation of the corda tympani and manubrium of the malleus, parts which should be left uninjured. The instrument must not be introduced far, lest it wound the vascular lining of the tympanum, and cause a temporary continuance of the deafness by an effusion of blood. When the puncture is made in proper cases and in a judicious manner, hearing is immediately restored. A small hole in the membrana tympani now conveys the air into the cavity of the tympanum, answering the same purpose as the Eustachian tube. The operation is easily performed, by having a strong light directed upon the membrane, the head held firmly by an assistant.

Several instruments have been invented for that operation, but we can, from experience, bespeak attention to the one so highly mentioned by Dr. Joseph Williams, and have therefore copied it into this work in the words of the author.\*

“The best instrument for puncturing this membrane is that recently invented by M. Fabrizi, an Italian. Its object is to make a circular opening, the divided portion of the membrana tympani, fixed by the spiral wire, remaining within the canula. It is simple in its construction, and consists of a canula

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\* Williams on the Ear, London, Eng.

into which slides a spiral wire, somewhat resembling that of a corkscrew.\* It is to be used in the following manner: Pass the canula with the spiral wire down upon the inferior part of the membrana tympani; retain it there with the left hand, being careful not to press too firmly upon the membrane; then, with the right hand, take hold of the small handle which revolves the spiral wire, and turn it from right to left, being what is usually called turning the wrong way. The instant the membrane is perforated, it is sensibly felt by the operator. The wire is now no longer to be turned, but by its handle the instrument is to be retained in its situation; then gently revolve the canula, which has a cutting edge, from left to right, when a circular portion of the membrana tympani will be cut out, and at the same time drawn into the canula, and held fast by the spiral wire."

When this operation was first introduced, surgeons, eager to try anything to cure deafness, punctured the membrana tympani in every case submitted to them, and finding it to fail, began to place no confidence in it. But if the cases be properly selected, there is every chance and hope of a favorable result.

The following is a case of my own experience. The wife of a well-known physician of St. Louis con-

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\* See Aurist's Instrument Case.

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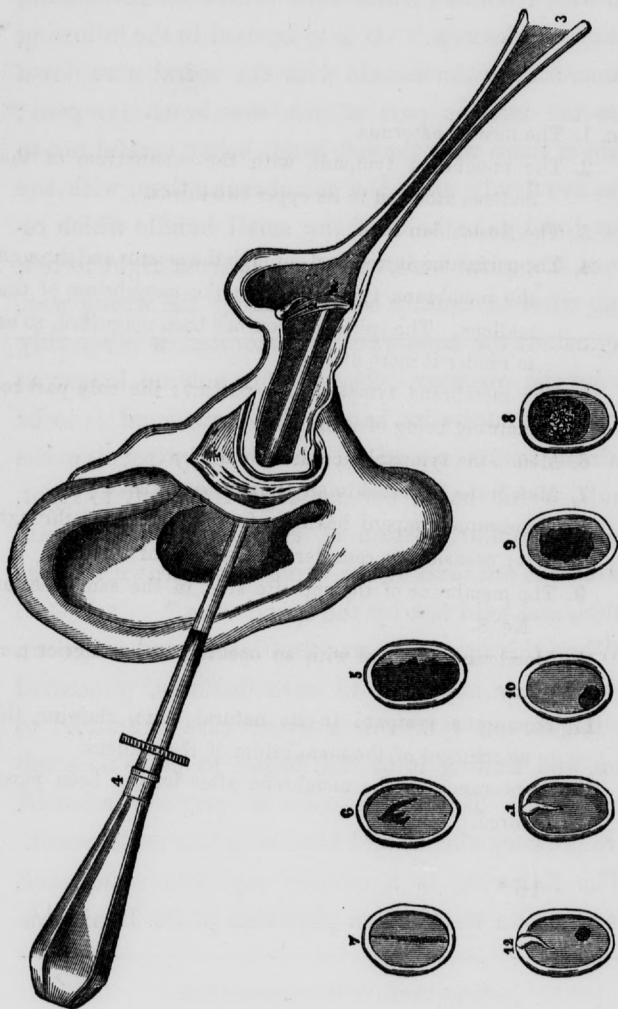


FIG. 1. The meatus externus.

2. The membrana tympani, with the manubrium of the malleus attached to its *upper* two-thirds.
3. The Eustachian tube.
4. The perforator, introduced through the meatus and through the membrana tympani, *below* the manubrium of the malleus. The spiral portion has been magnified, so as to render it more distinct.
5. The membrana tympani of a patient; the only part remaining being of a lighter color.
6. Membrana tympani lacerated by a blow.
7. Membrane lacerated in an attempt to extract a pin.
8. Membrana tympani having a fungus projecting through it; occasioning considerable deafness of this ear.
9. The membrane of the opposite side, in the same case as No. 8.
10. Membrana tympani with an opening in its inferior portion.
11. Membrana tympani in its natural state, showing the attachment of the manubrium of the malleus.
12. Appearance of the membrane after having been punctured.

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sulted me on a case of deafness. Dr. B. stated that she had been under the care of a surgeon who professed to have paid particular attention to diseases of the ear. He had tried to pass the catheter into the Eustachian tube, but caused her so much pain at each attempt, that she would positively not consent to a repetition of the operation. All my endeavors of persuasion and assurances that the operation was entirely without danger, and that if she could not bear it I would immediately desist, could not induce her to permit me to make any attempt with the catheter. After an examination, using the aural otoscope, and finding that she was unable to inflate the tympanum, and in consultation with her husband, we agreed that I should perform the operation of perforating the membrana tympani of the left ear. The operation was performed with Fabrizi's instrument, and to our great satisfaction it was a complete success. The hearing almost instantly returned, and when I last heard from them, some six months after operating, her husband wrote: "She continues to hear perfectly with the left ear."

The membrana tympani should never be punctured while in a state of inflammation, as the operation will be very painful, and ulcerations may be the consequence.

If patients can distend the membrana tympani when

## PERFORATION OF THE MEMBRANA TYMPANI. 187

closing the mouth and nostrils, then it is improper to puncture this membrane, as it is a proof that air can pass into the tympanum. After the operation, a piece of cotton should be inserted in the ear, to guard it, for some days, against cold.

## EXAMINATION OF THE ORGANS OF HEARING.

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WE now proceed to a part of our work which is of particular importance to the practitioner, and for which we therefore claim the especial attention of our professional reader.

The first grand point which a physician, called to the treatment of any disease, is bound to attain, is an *accurate diagnosis*. Without gaining this, he will be a mere empiric, and his treatment will lack a sure scientific basis. And what holds good of all diseases, is doubly true of diseases of the ear. It is therefore indispensably necessary, that the aural surgeon should be thoroughly acquainted with the means of obtaining an accurate diagnosis, by possessing himself of the best mode of conducting an *examination*.

It is true, indeed, that the examination of the ear is attended with greater difficulties than that of any other organ, and that, in some cases, they may even prove insuperable. Still, in most cases, the diagnosis may be formed with absolute certainty, provided



always that he who makes the examination knows where to look for what he wishes to find. On that account, it is of paramount importance that he should have an accurate acquaintance with the *normal* state of the ear, in order that he may be able more readily to perceive and understand any deviation from it, that may have taken place. On this account, we have in this volume placed before the division which contains an account of the morbid conditions of the ear (Pathology), a short description of the structure and functions of the organs of hearing in their normal state (Anatomy and Physiology).

The scientific examination of the ear is termed *otoscopy*, from the fact that it is made mostly by ocular inspection; yet, in many cases, it requires the assistance of the organs of touch and hearing. It may be divided into *objective* and *subjective* examination, according as it is founded on what is perceptible of itself, or on what is perceived only by the patient. The objective symptoms are, of course, always the more important ones for the physician, as they alone furnish him with a safe criterion, by which he may judge of the value of the subjective symptoms, which are always more or less delusive and unreliable. The physical examination of the ear must, therefore, in no case be omitted; not even where the morbid affection seems to be merely functional or dynamic. In fact,

we have only then a right to believe that the disease is of the last-named character, after the objective examination has furnished us merely negative results.

In proceeding now to give an account of our method of examination, we follow the natural anatomical order of the parts of the ear.

The patient being placed near the window, opposite a strong direct sunlight, with the head inclined at such an angle that the sun's rays may fall directly upon the membrana tympani, we first carefully observe the condition of the concha, external meatus, mastoid process, infrazygomatic region, and the space immediately below the lobe of the ear.

The *auricle*, in its various folds, its color, its temperature, its thickness as learned by feeling its hem or helix between the fingers, and the angle which it forms posteriorly with the cranium, is first to be examined.

Where we have reason to believe that inflammatory action exists, the *mastoid process* demands our attention. Its color, size, shape, and temperature may be learned by even a cursory examination. But, besides this, it should be most carefully pressed upon with a couple of fingers, with a much greater degree of force and firmness than is usual in making examinations of the like nature elsewhere, and this examination should not only be applied to the mastoid region, but

to the whole posterior and lateral portion of the head, if we have reason to suspect any inflammation. The insertion of the sterno-mastoid, as well as the upper third of that muscle, should also be carefully examined in the same way, as there is a small gland, in shape and size like a horse-bean, situated immediately behind the auricle, over the middle of the mastoid process, which frequently becomes enlarged during the progress of aural inflammations, and is also, in some instances, the seat of violent neuralgic pain. If the integuments and soft parts are swollen or oedematous, as is frequently the case in certain inflammatory actions of the ear, as also where they have become thickened from long-continued disease, it will require a considerable degree of force to make a perfectly satisfactory examination. The amount of pitting made by the finger during this examination, and its degree of permanency, are also circumstances of value in the formation of a diagnosis.

We next proceed to inquire into the condition of the *external meatus*. In order to make this examination successfully, it is necessary that the surgeon should pay attention to three points:

1. To render the auditory canal as straight as possible;
2. To dilate somewhat the outer membranous and cartilaginous portion;

3. To throw as much light as possible on the walls of the canal.

To straighten the meatus it is necessary to press the tragus forward, and the cartilage forming the posterior wall of the auditory canal backwards. When the canal is very large, this may be accomplished by simply pulling the outer ear backwards with the finger and thumb, at the same time that the tragus is pressed forwards by another finger.

For the proper inspection of the auditory canal, a strong light is required. *Sunlight is incomparably the best.* Whenever it is possible, the hours of the forenoon and afternoon should be selected for making the examination, on account of the more horizontal direction of the sun's rays. But, in many cases, the practitioner will not be able to avail himself of the sunlight, as his assistance may be called for at any hour of day or night or in any kind of weather, and he will therefore very often be compelled to have recourse to *artificial* light. For this purpose various kinds of apparatuses have been invented. *Cleland* used a convex glass, which was held before a wax-candle, in order to concentrate the rays of light into the meatus. To this apparatus *Bozzini* added a concave mirror. *Deleau* further modified it by placing a lighted taper between two concave mirrors. *Buchanan* invented a so-called "inspector auris," consisting in a

lantern-like apparatus, by means of which the light is reflected from a concave mirror, and falls into the meatus through a tube provided with two lenses. This apparatus was subsequently improved upon, and its effects increased by *Kramer*, who substituted an Argand lamp for the comparatively feeble wax-light of the original inventor. *Kramer's apparatus*, in form, construction, and effect, very nearly resembles a concave magic-lantern. It consists of a tin box, the interior surface of which is blackened, in order to exclude disturbing reflections of light. It is provided with a strong lamp and powerful reflector, opposite which there is a tin tube, fourteen inches long, the interior surface of which is likewise blackened, and which contains two convex lenses, each two inches and a half in diameter. In using this apparatus, a disk of strong light, about the size of a half-penny, is thrown upon the opening of the meatus, and by means of any of the ordinary specula, a portion of this light is transmitted to the membrana tympani.

Two portable ear-lamps have been produced in England, one by *Jordan*, of Manchester, the other by *Avery*. *Jordan's* consists of a small box, containing a lighted taper and two metallic reflectors, one of which is set at an angle in the bend of a projecting arm, which throws a stream of light up the membrana tympani, through a fixed tubular speculum, inserted

into the meatus, while the operator looks through a narrow tube containing two small lenses. Toynbee recommends two other lamps as throwing a good light into the meatus, one by Segalas, the other by Miller.

*Segalas' lamp* consists of two vertical iron rods, the anterior of which is about four inches high, and surmounted by a gas-burner which communicates with the vulcanized India rubber gas-tube. This vertical rod is connected by a horizontal rod, four inches long, with a second vertical rod almost three inches high, to the summit of which is fixed a circular reflector about four inches and a half in diameter; and in the centre of which is an orifice for the surgeon to look through, about half an inch in diameter. Attached to the horizontal rod is a ball-and-socket joint, and a handle and movable piece, by which the lamp may be held in the mouth, and thus both hands are left at liberty. What diminishes somewhat the value of this lamp is that it can only be used with gas.

*Miller's lamp* consists of a wax-candle, enclosed in a Palmer's spring tube, about six inches in length, standing upon a foot about two and a half inches in diameter and three-quarters of an inch deep, so as to hold the reflector, when not in use. For the top there is a cap which acts as extinguisher, and also as a defence to the candle when carried about.

But while we are far from depreciating the value

of the above-described apparatuses, and while we are willing to give full credit to the ingenuity and industry of the inventors, we must still come back to what we said above, that *there is no light like that of the sun*. Even Kramer himself, the inventor of one of the best apparatuses, is forced to acknowledge that no artificial illumination can equal "the light of the sun's rays or render this light unnecessary, on which account it must always be had recourse to in important cases." Every other light, with the exception of the hydro-oxygen gas, has a peculiar lurid glare which throws a false coloring upon the object to be examined, and prevents the examiner from observing with accuracy the condition of the affected parts, where color and the character of the vascular arrangements form the chief means of true diagnosis.

Far more important than the above-mentioned apparatuses, and without which the latter cannot even be used with any degree of success, are the so-called *specula auris* or ear-mirror. They belong to the most indispensable auxiliaries for the diagnosis, as no thorough examination of the meatus and the membrana tympani is possible without them. Their use consists not only in their acting as light-conductors, but they serve also to straighten the meatus, and to dilate its cartilaginous part.

*Kramer* has invented a speculum which for many

years has been in general use, and which is still highly recommended by Rau and Harvey. It consists in a metallic funnel, one inch five lines long, divided longitudinally into two arms. The farther extremity is of an almost cylindrical form, one line in diameter and seven lines in length, so that it can be introduced with ease, even into an unusually narrow meatus. Both halves of the funnel are united by their superior border, at right angles with two forceps-handles, fastened by a joint. Pressing on these handles opens the funnel widely. The inner surface of the latter is painted, in order to prevent a reflection of the luminous rays, which would materially interfere with the examination.\*

Kramer gives the following directions for the use of his speculum. The patient is placed on a stool near the window, with the affected ear directed towards the latter, through which the sun should be shining brightly. The auricle is drawn strongly up with the left hand, and the patient allowed to hold open his mouth, in order to free the auditory canal from the pressure of the articulation of the lower jaw. The speculum is introduced, with its cylindrical extremity closed, as far into the meatus as its width or sensibility will admit of, or as far as is required for the

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\* See wood-cut in the Instrumental Case.



purpose of examination. The hand being pressed on the handle of the instrument, it opens directly with the utmost care, as far as is necessary or as far as the meatus allows of being dilated. The practitioner can thus, by a proper inclination of the head of the patient, direct the rays of the sun to the bottom of the meatus, and obtain sufficient room to discover any diseased condition of the meatus and membrana tympani which may exist, provided he does not obstruct the light of the sun by his own head.

There are, however, various objections to this speculum of Kramer, although recommended by such high authorities. In the first place, it is too heavy to remain in the meatus without being held. Secondly, on account of its weight and size, it cannot be used with delicacy, and a sensitive meatus is liable to be pained by it. Thirdly, it requires the exclusive use of one hand, so that it cannot be well employed during the performance of an operation. And lastly, another great objection is, that when the two portions of the funnel are separated in the meatus, two spaces are left between them, through which hairs or portions of epidermis and cerumen often project and obstruct the passage of light.

To remedy some of the above defects, the *tubular speculum* was invented by Dr. Gruber, of Vienna. Already in 1827, Dr. Newburg, in his "Memoire et

Observations sur la Perforation de la Membrane du Tympan," published at Brussels, had recommended a slender horn-tube, nearly four inches long, with a bell muzzle. It is this instrument, which, however, was much too long, which suggested to Dr. Gruber the idea of his tubular speculum. Wilde, who had seen it used by Gruber himself, published an account of it (in 1844) in the Dublin Journal of Medical Science. It is a small conical tube of silver, measuring about an inch and a half in length, five-eighths of an inch in width at the greater aperture, and varying from two to four lines in the clear of the smaller extremity. It must be made as light as possible, highly polished both inside and out, with a stout rim round the larger margin, and the smaller aperture well rounded off, so as not to irritate the ear in entering.

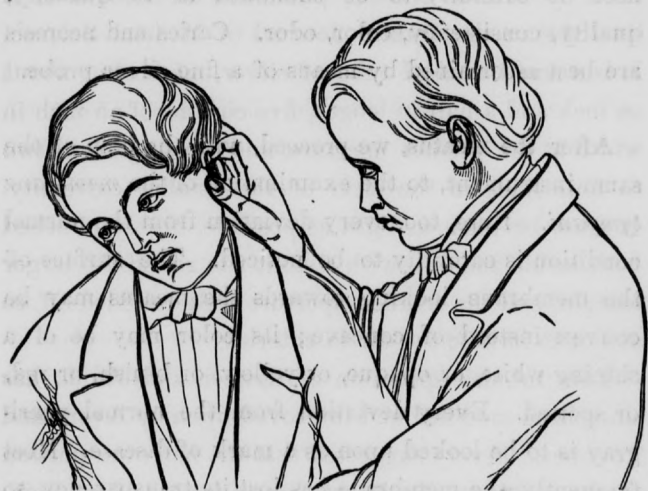
This tubular speculum of Gruber and Wilde has since been modified and improved upon by Avery and Toynbee. Avery suggested that the narrower portion of the speculum, for about three-quarters of an inch, should be of the same diameter throughout; and Toynbee recommended that the part of the speculum inserted into the meatus should be of an oval shape. This modification of the tubular speculum has been very generally adopted.\*

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\* We give this in the Instrumental Case.

A set of three or four specula should be in the possession of the surgeon.

The subjoined wood-cut, reproduced from Toynbee's work, gives a representation of the mode of inserting the speculum. The patient's head should be a little more inclined towards the shoulder.



With the help of the speculum, then, the practitioner proceeds to the examination of the meatus. He will carefully notice any deviations from the normal condition that he may find there. Of course, in order to be able to do this, he must be thoroughly acquainted with the latter. As in all diseases, so particularly in those of the ear, no one can understand pathology

without previously having studied anatomy. The practitioner will then examine the lining of the meatus, and see if there is any redness, or dryness, or looseness, or excoriation, &c. In cases where a strong discharge exists, the meatus is to be previously cleansed by injections of tepid water. The discharge itself is carefully to be examined as to quantity, quality, consistency, color, odor. Caries and necrosis are best ascertained by means of a fine silver probe.

After the meatus, we proceed, with the help of the same instrument, to the examination of the *membrana tympani*. Here, too, every deviation from the normal condition is carefully to be noticed. The surface of the membrane looking towards the meatus may be convex instead of concave; its color may be of a shining white, or opaque, or yellow, or bluish, or red, or spotted. Every deviation from the normal pearl-gray is to be looked upon as a mark of disease. Most frequently, the membrane has lost its transparency, so that the handle of the hammer can no longer be perceived. The membrane itself may be thickened, or hardened, or perforated, or partially or entirely destroyed. The last-named abnormalities very often can only be ascertained by a careful probing. Perforations occur mostly on the lower half of the membrane. Looked at through the speculum, they exhibit a black-

ish color. Persons whose membrane is perforated or destroyed are able to blow tobacco smoke through their ears.

As the *tympanic cavity* is not accessible to any direct examination, owing to the interposed membrane which hides it from our view, it is very difficult to attain an accurate knowledge of the morbid changes that may take place in it. An ocular inspection is only then possible when the membrane is either partially or entirely destroyed. But even in this case, the examination is rendered difficult by the obstruction of morbid secretion, which must be first removed. For this purpose, weak injections of tepid water are to be used, which, however, in the case of sensitive patients, must be made with great caution. Where the tympanic membrane is entire, the principal object of the surgeon is to see whether the communication between the tympanic cavity and the pharynx is free or obstructed. For this purpose, various instruments and methods have been proposed, all of which have for their object an *auscultation* of the ear.

When a person whose *membrana tympani* is entire, and whose Eustachian tube is free, while closing his mouth and nostrils, attempts to swallow, a small quantity of air passes through the tympanic cavity and rushes against the membrane, producing a sensation of fulness in the ears, and a slight noise, which may

be heard by placing one's ear against that of the person under examination. To render this noise still more distinct, *Toynbee* invented a certain instrument called *otoscope*. This consists of an elastic tube about eighteen inches long, each end of which is tipped with ivory or ebony. One end of it is to be inserted into the ear of the patient, and the other into that of the physician. Care must be taken that no portion of the tube touches any neighboring body. As soon as the patient, with closed mouth and nose, attempts to swallow, he will, in case his Eustachian tube is pervious, experience a sensation of fulness in the ear, and, at the same time, the surgeon will hear distinctly a faint crackling sound, produced apparently by a slight movement of the *membrana tympani*.

The wood-cut opposite gives a representation of the *otoscope*, and the mode of using it.

The most reliable information, however, concerning the condition of the Eustachian tube, whether it is pervious or not, is to be obtained from the auscultation of the ear during the application of the air-press, by means of a *catheter* introduced into the tube. These important instruments, and the mode of using them, we have already sufficiently described, when treating of them as *remedial* agents, in the chapter of "General Pathology and Therapeutics." Here we have to speak of them merely with regard to their *diagnostic* use.



It is to *Deleau* (in his "Introduction à des Recherches Pratiques sur les Maladies de l'Oreille," Paris, 1836) that we are indebted for the first suggestions concerning the important service of these instruments for the formation of an accurate diagnosis.

In a sound ear, air blown in through the Eustachian tube produces a very strong noise, which bears some resemblance to the roaring of a distant waterfall or the pattering of a strong rain on the trees of a forest. *Deleau* has therefore called it "*Bruit de pluie*." The sudden entering of air into the tympanum produces a violent effect upon the person undergoing the operation, which is distinctly expressed in his face; delicate

persons are sometimes even momentarily stupefied by it. When the physician places his ear against that of the person, the noise strongly reverberates against his tympanic membrane.

When the Eustachian tube is impervious, the air which has been blown in regurgitates with a seemingly distant rushing into the throat, and there is no reverberation from the membrana tympani. In this case, the noise is heard more distinctly when the ear of the surgeon or the otoscope is placed near the opened mouth or the nose of the patient. When the tube is considerably contracted, there is heard, alternately with the distant rushing sound, an extremely fine whistling, which seems much nearer, and which indicates that the air-stream has momentarily overcome the obstruction. The patient experiences at the same time the illusory sensation as if the air escaped from the meatus through a small opening. When the tube is not closed up, but filled with mucus, the entering of the air produces a peculiar gurgling sound, which Deleau has called "*Bruit muqueux*." If, together with the mucus, there is also a narrowing of the tube, a whistling sound is heard alternately. The mucous noise is much more distinct when the accumulation of secretion exists in the tympanic cavity, than when it does in the pharyngeal portion of the tube. When the application of the air-douche is attended with



stupefaction, we have a right to infer an inflammatory condition of the tympanic cavity or membrane. When the air-douche is followed by an increased dulness of hearing, without pain, it is a pretty sure indication of an erethic nervous disease. When the membrana tympani is perforated, and the Eustachian tube pervious, the air rushes out of the meatus with a loud hissing sound, and drives fluids which may have accumulated in the tympanic cavity into the meatus.

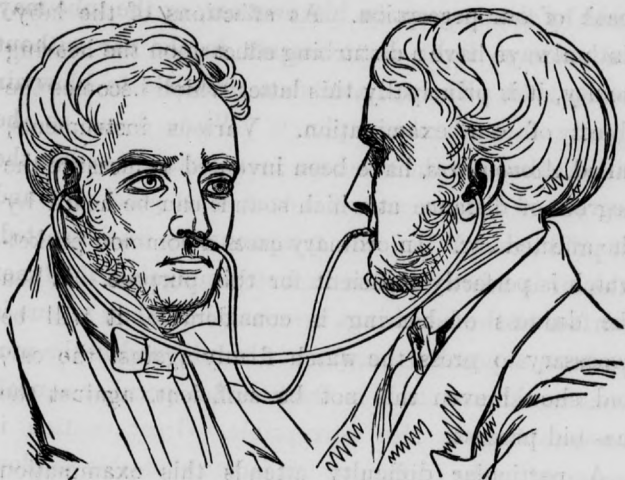
Other noises that may be heard only indicate that the catheter has not been applied with sufficient skill.

Instead of the air-press, *Toynbee* uses an instrument of his own, which he calls the *explorer*. It consists of an elastic tube, about eighteen inches long, one end of which has a flat mouthpiece of ivory, with one or two deep incisions upon it, so that it may be more easily held by the teeth of the operator, while the other end has a small portion of steel tubing attached to it, which fits accurately into the farther end of the catheter. When the catheter has been properly fixed in the tube, and held there by the left hand of the surgeon, one end of the explorer is to be placed in his mouth and the other in the catheter, and held there also by the left hand. With his right hand, which is thus left free, the operator then takes the otoscope and introduces one end of it into the ear of the patient, who may hold it there, and the other end is

held by the surgeon in his own ear, or the tube may be made so light as to remain in the ear without being held. The operator then proceeds to blow air gently through the explorer. While doing so, he listens through the otoscope to ascertain whether the air enters the ear, and, if it does, what peculiar sound it produces. When the tympanum is unobstructed, the air is heard to pass in a stream against the inner surface of the membrana tympani, but when mucus is present, a peculiar gurgling is heard; and if the mucous membrane itself is thickened, a peculiar squeak or bubbling is also perceptible. Great caution is required in the operation. It is not advisable to blow with force into the ear, but rather to make a few gentle successive puffs, while attentively listening during each, to detect the kind of sound that may be heard in the tympanum. Sometimes the mucous membrane is so thickened that it allows no air to pass. In this case, it would be extremely unwise and dangerous to attempt to force air into the tympanum. Very serious and even fatal consequences might result from such a proceeding.

The wood-cut on p. 207 gives a representation of the mode of applying the catheter together with Toynbee's explorer.

We conclude this chapter with a few words on the examination of the *labyrinth*.



Although pathological anatomy has already discovered a number of organic changes in the labyrinth, whose connection with a deranged condition of hearing function is beyond doubt, they are unfortunately of little value for the aurist, as, on account of their hidden position, they can never be ascertained during life.

The aural physician is therefore, in this case, confined mostly to subjective symptoms; and the diagnosis of the morbid changes in the labyrinth is to be formed with the more caution, as it is never the disease itself, but only its reflex action upon the functions of the affected parts, which comes within

reach of our perception. As affections of the labyrinth always have a disturbing effect upon the hearing faculty, it is principally this latter which becomes the object of our examination. Various instruments, called *Acouometres*, have been invented to measure the degrees of distance at which sounds can be heard by the affected ear. In ordinary cases a common pocket-watch is perfectly sufficient for this purpose. When the dulness of hearing is considerable, it will be necessary to press the watch firmly against the ear, and should even this not be sufficient, against the mastoid process.

A particular difficulty attends this examination of the hearing faculties in cases of *simulated* deafness, as it occurs not unfrequently with conscripts or criminals. In these cases, when the objective examination furnishes no satisfactory results, it is often only by a long-continued observation or by surprise, particularly by a sudden rousing from sleep, that it is possible to unmask the imposition. Even anæsthetics, sulphuric ether, or chloroform, may be used for this purpose.

Our attention has been called to a number of the Boston Medical and Surgical Journal of November, 1859, wherein is an article "Improved Method of Examination of the Ear. By Dr. A. Young, Jr.,

Farmington, Maine." In quoting it at the end of this chapter, we would remark that what Dr. Young calls "speculum-scope," has been used for a long time by every surgeon in the habit of making examinations of the ear, that is, magnifying glasses of certain focal distances have been employed for that purpose; we consider them more advantageous, and far better, detached from the speculum. Of the "solar-scope," we are inclined to think most favorably. Always having given the preference to sunlight over artificial illumination, in our own examinations, we hail with much pleasure any means of obtaining a strongly-reflected sunlight within the meatus. We shall certainly give the solar-scope a trial, and will report as to its satisfactoriness at some future day, and recommend others also to try it.

#### "IMPROVED METHOD OF EXAMINATION OF THE EAR.

"None of the authors whom I have consulted, and among them the best and most recent publications—Wilde, Pilcher, and Kramer, make mention of the use of reflected *sun* light; and as simple as the means thus afforded, no practical aurist, after a single trial, will adopt any other in the use of direct sunlight.

"The common method, as detailed by authors, borrowing an extract from Wilde, is to have 'the patient seated beneath the examiner, with the head

slightly bent, opposite a window through which the sun is shining at the moment, and, if possible, between the hours of eleven and three.'

"Now my method is available when the sun shines, between sunrise and sunset, by means of the following simple apparatus: to a foot, or base board, about eight inches square, is attached a rod two feet in length, bearing a sliding ring with a thumb-screw, and an armature twelve inches long, having at the end a ball-and-socket joint with a thumb-screw, and another short armature to hold a mirror six inches square.

"To use the instrument (would not *solar-scope* be an appropriate name?) raise the lower sash of the window, and place it upon the sill, and rest the beam of the sash upon the top of the rod. Swing the armature out of the window, and by means of the thumb-screws adjust the mirror to direct the rays of the sun into any part of the room you please.

"With such an instrument, the patient can have a stream of beautiful, clear light playing upon the auricle and within the meatus, with the head erect; and the examiner may be seated by his side, and with the aid of his speculum make as complete examination as desirable, and all of this without the inconvenience of a heated head and dazzling sun rays.

“Now that cold weather has come, I content myself by setting the *solar-scope* upon a table, close to the window, and direct the rays of the sun, as in the former case, to any part of the room; or having first seated my patient, direct the rays immediately upon the auricle. The distance at which the patient may be seated from the instrument, may be a few feet or twenty, although ten feet is about right.

“Those who know the difficulties attending some operations within the meatus and on the *membrana tympani*, such as removing polypi or any extraneous bodies, as well as a thorough explanation of the parts, cannot but appreciate this invention. The same may be used also for more complete explorations within the vagina, rectum and throat, and nasal fossa—and, as such, will be found a valuable acquisition in the procurement of a bright light.

“With one other improvement upon the *speculum auris*, I close this article. The thing was suggested by a more determined effort to ascertain the true cause of a slight inflammation as well as a peculiar itching sensation on the *membrana tympani* of a patient, without any tinnitus or loss of hearing. The naked eye, in the best light, could discover nothing but the slightest vascularity of the membrane at the point of the malleus. On the application of a two-and-a-half inch focal magnifier, a small hair was

found and removed, which the naked eye alone could not see, and by the removal of which, the symptoms immediately ceased.

"Hence, springs up what I shall call the *speculum-scope* (name suggested, however), and by means of which I can conceive that a good thing has been found at last, which, indeed, may be, by longer and larger glasses, adapted to other speculums. Mine is a *forceps speculum*, with an attachment on its left handle of a two-and-a-half inch focal magnifying glass, which is about the true distance from the external opening of the speculum to the membrana tympani—after it is adjusted to the meatus. Some eyes, however, may require a larger or shorter focal glass. The lens may be thrown over the external opening of the speculum, when required.

"I use the *speculum-scope* in the following manner:—Having seated my patient in a chair, with the ear facing the *solar-scope*, a stream of light is reflected upon the auricle. Seated in a chair beside the patient, the speculum-scope is introduced into the meatus, and as soon as a good view is had, with the right index finger move the magnifier over the opening of the speculum. The meatus is several times enlarged, and the beautiful mechanism of the membrana tympani is viewed with all its lesions and deformities."



## VI. DIETETICS.

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THIS highly-important subject has not yet received the attention which it so undoubtedly deserves. Even in many works professedly written for medical readers, it is either entirely omitted, or receives but a passing notice.

When we consider the extremely delicate structure of the organ of hearing, its exposed condition, and the constant demand made upon it, the frequent diseases with which it is attacked cease to be a matter of surprise.

The greatest enemy of this organ is *cold*. It is therefore a good precaution, when going out in stormy weather, to protect the ears against the cold air by a cap with earlaps, or at least by a plug of cotton. Women, whose ears are generally covered by their head-dress or their hair, are on that account less frequently attacked by ear complaints than men. Most injurious of all is a direct draught of air striking on the ear. Sitting near badly-closed doors or broken windows ought therefore carefully to be avoided. Cold water entering the ear is also very injurious.

For which reason, one ought, in bathing, to take the precaution of stopping the ears with an oiled plug of cotton before diving or plunging into cold water. When using cold douches, the head ought to be protected by an oilskin cap. A cold atmosphere in general exercises an unfavorable effect upon the organs of hearing, and living in damp rooms, basements, cellars, &c., is particularly injurious.

It is therefore not to be wondered at, that ear diseases occur more frequently in northern than in southern latitudes, and more frequently in winter than in summer.

*Wet feet* are a productive source of affections of the ear. Care ought therefore to be taken that the feet are always well protected. In cold or wet weather, woollen stockings ought to be worn, and boots or shoes with thick soles. When the snow or mud in the streets is deep, India rubber overshoes are required as an additional precaution. When the feet have become wet, they should, at the first opportunity, be dipped into cold water, with an infusion of salt, and then rubbed till they are quite dry and warm, and a fresh pair of stockings put on.

Cleanliness is greatly conducive to the health of the organ, and the earshell ought therefore to be daily washed with cold water; but care must be taken to wipe it thoroughly dry, and not to expose it immedi-

ately afterwards to a stream of cold air. The best means for cleansing the auditory canal from any superfluous quantity of earwax, is by the application of a little piece of cloth dipped into tepid water. We may mention here, by way of parenthesis, that a *moderate* quantity of earwax is one of the normal conditions of good hearing, and that it only becomes injurious when accumulated in too great quantity.

When the earwax has become excessive, an ear-spoon will be required to remove it. Great care must be taken not to push it so far as to touch the tympanic membrane. No pointed instruments ought ever to be used for this purpose. When the earwax is so abundant as to entirely fill up the auditory canal, a gentle injection of tepid water must be made to remove it.

It is evident that mechanical violence applied to the ear must have an injurious effect upon the hearing. Hence it must be considered a very bad practice to punish children by boxing or pulling their ears. This injudicious treatment on the part of teachers and parents is strongly to be condemned, as it very frequently lays the foundation of inflammations of the external ear, and particularly to a gradually progressing paralysis of the auditory nerve.

Piercing the earlap, if not performed in too rude a manner, is not attended with any danger to the organs of hearing. But, on the other hand, it is a very

dangerous practice to pull out the hairs that may grow in the entrance of the auditory canal.

As an organ of sense, the ear is subject to a variety of injurious influences. Excessive sounds, such, for instance, as explosions of powder-magazines, discharges of big guns, &c., may produce paralysis of the auditory nerve. When it is impossible to avoid them, the ears ought, at least, to be protected by a plug of cotton wool. During the discharge of big guns, the mouth ought to be kept open to facilitate the communication of external air with the tympanic cavity.

*Little children* ought never to be brought into close proximity to shrill and powerful music, as their organs of hearing are extremely sensitive. Whenever they do not acquire the power of speech at the usual time, their ears, as well as the inner parts of the mouth and throat, ought to be minutely examined by a physician, in order that the necessary remedies may be employed. Children's ears should be daily cleansed with a soft sponge, or the end of a towel dipped in tepid water. Nurses should be cautioned not to dress children near a broken or open window or half-opened door, from which a draught is likely to play upon them, nor in riding in a car with them to sit under an open or broken window, or to let them sleep in a draught. The want of such simple precautions may cause inflammation of the ears and permanent deafness.

Persons inclined to *catarrhal* affections ought to be particularly on their guard against taking cold. An excellent means to render the skin less sensitive to atmospheric changes, and thereby to diminish the liability to take cold, consists in daily sponging the neck, chest, and parts adjacent to the ear with cold water, strongly tinctured with rock salt, and then rubbing them with a coarse towel, until the skin is perfectly dry and warm.

In cases of *congestions* of the blood towards the head, combined with a gradual diminution of hearing, foot-baths and moderate exercise ought to be employed, and, at the same time, the bowels must be kept regularly open. Cold douches are less appropriate.

*Itching* in the external auditory canal, which is generally combined with a greater degree of dryness, is most easily relieved by drops of tepid almond oil.

When the hearing decreases from unknown causes, an aurist or experienced physician in aural diseases ought to be consulted; and under no condition ought a patient to try to help himself by the use of the suggested remedies of well-meaning but ill-judging friends, advertised nostrums of ignorant pretenders to medical knowledge, ear-tubes and similar apparatuses, which may prove no less injurious to the ear than unfitting glasses to the eye.



**Drs. Coynbee and Hearsley**

ON THE

**ARTIFICIAL MEMBRANA TYMPANI,**

EDITED BY

**The Author of this Work.**

**TO WHICH ARE ADDED SEVERAL NEW ILLUSTRATIONS, NOTES, EXPLANATIONS,  
AND DIRECTIONS, WHICH ARE NOT IN THE ORIGINAL.**





## ARTIFICIAL MEMBRANA TYMPANI.

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It has indeed been a matter of astonishment to us how apparently few practitioners, in this country, know anything of the practicability of the construction and application of an artificial membrana tympani, while its efficacy in supplying the place of the natural organ, when lost, or perforated, is no longer a subject for doubt.

The artificial membrana tympani has now been successfully used by us, in every variety of case, where partial or complete loss of the natural membrane has occurred. Every practitioner should be acquainted with the principle, and the cases to which it is applicable, as it may be the means of restoring many patients to hearing, whom he may, for the want of the knowledge of this new mode of treating such cases, pronounce incurable. The testimony of numerous European aurists of high standing shows that in cases of deafness, dependent upon such partial or complete loss of the natural organ, the artificial membrane will be found effectual in restoring hearing.

Drs. Yearsley and Toynbee, two English aurists, both claim to have been the first in pointing out the efficacy of the artificial membrana tympani, and to have constructed such. The former ascribes his discovery to accident, as will be shown, the latter, to the results of scientific investigation.

We decidedly, while fully appreciating all that is said by Dr. Toynbee on the subject, give the preference as regards the practicability of the material, for the construction of the membrana, to Dr. Yearsley, and feel sure our professional and unprofessional readers will thank us, for making them familiar with what both those learned gentlemen have written on the subject. We have no knowledge, and cannot learn, that the pamphlet of Yearsley, entitled "A new mode of treating Deafness, when attended by Partial or Entire Loss of the Membrana Tympani, associated, or not, with Discharge from the Ear," has ever been brought before the American public; we therefore do not hesitate to extract from it, and have subjoined to it a drawing of the cotton and instrument, with directions for use, and other remarks which do not appear in the original.

Toynbee is better known to the profession in this country, by the republication of his work on Diseases of the Ear. The following is from his pamphlet entitled "On the Use of an Artificial Membrana Tym-

pani, in cases of Deafness dependent upon Perforation or Destruction of the Natural Organ":—

\*"It is well known that the partial or complete destruction of the membrana tympani affects, more or less, the power of hearing. In those cases where the orifice in the membrana tympani is small, and the mucous membrane of the tympanum continues healthy, but little inconvenience is experienced: when, however, the orifice is large, and the mucous membrane of the tympanum has become thickened, the capability of hearing is so much impaired that the patient is entirely excluded from the advantages of general conversation.

"In the present paper I purpose to describe the results of my attempts to provide a remedy in cases of perforated membrana tympani, by the introduction of an artificial substitute for that important membrane. I shall divide the subject into the following sections:—

"I. On the structure of the healthy membrana tympani.

"II. On the functions of the membrana tympani, tympanum, and Eustachian tube.

"III. On the formation and use of an artificial membrana tympani.

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\* On the Use of an Artificial Membrana Tympani, by Joseph Toynbee, F. R. S. From the Sixth Edition, London, England.

"I. ON THE STRUCTURE OF THE HEALTHY MEMBRANA  
TYMPANI.

"In a paper published two years since\* I demonstrated that the healthy membrana tympani consists of five laminæ, which, commencing externally, are as follows:—

'A. The epidermis.

"B. The dermoid layer.

"C. The radiate fibrous layer.

"D. The circular fibrous layer.

"E. The mucous layer, with its epithelium.

"A. The *epidermis*, as is well known, forms a *cul-de-sac* at the inner extremity of the external meatus, from whose surface it is easily removed by maceration.

(Figure 1.) In the course of dissecting, I have more than once observed this delicate epidermis to be the only layer remaining over portions of the



membrana tympani, varying from a line to a line and a half in circumference, and yet appearing sufficient to close the tympanic cavity, so as to render the power of hearing nearly perfect. The knowledge of the fact that this delicate layer is occasionally all that is left

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\* On the Structure of the Membrana Tympani in the Human Ear. (Phil. Trans., Part i., 1851.)

of the membrana tympani, ought to induce caution in the use of the syringe, as its application may cause a rupture of the epidermis.

“B. The *dermoid layer*, as its name implies, is continuous with the dermis lining the meatus, and it is situated between the epidermis and the radiate fibrous layer. It is extremely thin, and is the seat of the exquisite sensibility possessed by the membrana tympani; it also secretes the epidermis. (Figure 2.) The latter, previous to the publica-

tion of the paper just alluded to, was supposed to be secreted by the outer surface of the radiated fibrous layer; but there is now no doubt of the existence of the dermoid layer, which is more easily visible in cases of hypertrophy.\*



“C. The *radiate fibrous layer*—hitherto usually described, in conjunction with the circular layer, as ‘the fibrous lamina of the membrana tympani’—was wrongly considered by Sir Everard Home to be muscular. The fibres of this lamina are attached, externally, to a circular cartilaginous ring, which is received into a groove of the osseous meatus and centrally to the

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\* In the specimen from which figure 2 was taken, the dermoid layer was slightly hypertrophied. It is seen passing from the surface of the meatus, and in some degree concealing the malleus.

malleus. (Figure 3.) The most attenuated portion of this layer lies between the posterior part of the long process of the malleus, and the circumference of the organ. This lamina is continuous with the periosteum of the meatus.



“D. The *circular fibrous layer* is attached to the radiate lamina by fine cellular tissue, and the two structures may be readily separated. It consists, as its name implies, of circular fibres, which are firm and strong at the circumference of the organ, but towards its centre become so attenuated as to require care in order to detect them. (Figure 4.) The strong fibres at the circumference form a complete circle, and are attached to each side of the body of the malleus, as well as to the sides of the upper third of the processus longus. The circular fibrous layer is continuous with the periosteum of the tympanic cavity.



“E. The *mucous layer* lines the inner surface of the circular fibrous layer. Like the rest of the mucous membrane of the tympanum, it is very thin and delicate, and the epithelium covering it is composed of cells with ciliæ. It will be observed that of all the laminae composing the membrana tympani, none are

proper to it, but they are continuations of other structures. (Figure 5.\*)

“In order to give a complete idea of the membrana tympani, it is desirable to add, in this place, a few words relative to the *tensor tympani ligament*. This structure is about three-fourths of a line in length, and is attached, internally, to the cochleariform process, and externally to the inner surface of the malleus at the juncture of the long process with the neck. The interior, which is tubular, forms a receptacle for the tendon of the tensor tympani muscle. (Figure 6.†) This ligament performs the important function of drawing the membrana tympani inwards, and thus, by antagonism with the circular and radiate fibres of the organ, which tend to draw the membrana tympani outwards, the organ is kept in a state of moderate tension, and adapted to be acted upon by the tensor tympani and




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\* *a* The layer of the mucous membrane.

*b* The circular fibrous layer.

*c* The radiate fibrous layer.

† *a* The tubular tensor tympani ligament.

*b* The tensor tympani muscle, the tendon of which has been drawn upwards from within the tubular ligament.

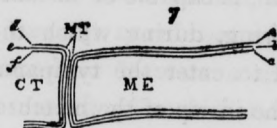
stapedius muscles. In cases of apparently total destruction of the tympanic membrane, the ligament in question still performs the function of keeping the chain of ossicles in a due state of tension, drawing the malleus inwards at the same time that that bone is pulled outwards by the few fibres of the membrana tympana that happen to remain attached to the body of the malleus.\*

“II. ON THE FUNCTIONS OF THE MEMBRANA TYMPANI,  
TYMPANUM, AND EUSTACHIAN TUBE.

“During the present year, I have been engaged in some investigations into the functions of the membrana tympani and tympanic cavity, the results of which have

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\* The accompanying diagram gives an idea of the relations of the several laminae of the membrana tympani.



*M. E.* Meatus externus.

*M. T.* Membrana tympani.

*C. T.* Cavitas tympani. *a* The epidermis of the external meatus.

*b* The dermis of the external meatus.

*c* The Periosteum of the external meatus.

*d* The periosteum of the tympanic cavity.

*e* Mucous membrane.

*f* Epithelium.



been laid before the Royal Society in a paper.\* In that communication I have shown that, contrary to the usually received opinion, the Eustachian tube does not remain always open, and that so far from allowing an uninterrupted communication between the cavity of the tympanum and that of the fauces, the guttural orifice is always closed except during the momentary action of swallowing.† In this latter case, the muscles of the Eustachian tube, the tensor and levator palati muscles, open the guttural orifice of the tube, afford free egress to the mucus secreted by the lining membrane of the tympanum, and allow air to enter or leave the tympanic cavity. The closure of the tube, excepting during the act of deglutition, can be experimentally proved. To those accustomed to descend in a diving-bell, it is well known that the unpleasant sensation in the ears, amounting sometimes to positive pain, is capable of instant removal by the act of swallowing, during which the condensed air being allowed to enter the tympanum and come in contact with the inside of the membrana tympani, the pressure on its outer surface is relieved by being counterbalanced. Again, if an attempt is made to

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\* On the muscles which open the Eustachian tube.

† Hyrtl and Wharton Jones had previously stated that the walls of the guttural portion of the tubes are in contact.

swallow while the nostrils are closed by the finger and thumb, a sensation of fulness and pressure is experienced in the tympanic cavity, in consequence of air having been forced, during the act of deglutition, through the open tube into the tympanum; and this sensation continues until, by another act of swallowing, the tube is reopened and the confined air escapes into the fauces. In the above paper an account was given of the muscles of the Eustachian tube in mammalia, birds, and reptiles; and in every animal examined it was quite apparent that the guttural orifice of the tube was closed, excepting during muscular action. In some mammalia the tube is opened by the muscles of the palate; in others, by the superior constrictor of the pharynx. In birds there is a common membranous Eustachian tube, into which the osseous tubes open at the base of the skull, and this common tube descends between the two internal pterygoid muscles, to the internal surface of each of which the circumference of the tube is firmly attached by dense cellular tissue; and it is only during certain actions of these muscles that the tube is opened.

“Having shown that the guttural orifice of the Eustachian tube in man and animals was closed, except during certain muscular actions, I next showed, by a modification of Mr. Wheatstone's experiment, suggested to me by Mr. C. Brooke, that the sonorous

vibrations communicated to the bones of the head appear much louder when the meatus is closed, than when its orifice is open. If, for instance, a tuning-fork be made to vibrate, and it be then placed in contact with the head, the sound proceeding from it will, in a few seconds, cease to be heard ; but if, directly on this cessation of sound, the experimenter close the entrance of the meatus in one ear, so as to convert it into a shut cavity, he will immediately hear a renewal of the sound of the tuning-fork ; from which it appears most probable that the sonorous vibrations communicated to the external meatus impressed the *membrana tympani* much more powerfully when confined to the cavity of the meatus, than when allowed free communication with the external air. Considering the result of this experiment in connection with the preceding fact of the ordinarily closed state of the tympanic cavity, it appeared to me highly probable that the sonorous vibrations imparted to the cavity of the tympanum, could only make their due impression on the membranes of the labyrinth, when strictly confined to the tympanic cavity and were not allowed to expend themselves in the cavity of the fauces. This conclusion was strengthened by the recollection that all the walls of the tympanic cavity appear constructed for producing resonance, having an investing mucous membrane of such tenuity as scarcely to be detected, save by

the touch, or by the use of a magnifying glass, and also by observing that this peculiar condition of the mucous membrane was restricted to the tympanic cavity itself, and to that portion of the Eustachian tube which forms a portion of the resonant walls of the tympanic cavity.\*

“If the view here advocated be correct, and if, for the perfect performance of the function of hearing, it be necessary that the sonorous vibrations should be confined to the tympanic cavity, it is clear that the analogy usually cited as existing between the musical instrument the kettle-drum and the tympanum of the

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\* “In a paper published in the British and Foreign Medical and Chirurgical Review, No. 21, January, 1853, I have endeavored to show that a leading function of the membrana tympani, and the muscles and ossicles of the tympanum, is to act as the analogue of the iris in the eye. The tensor tympani muscle not only, as its name implies, renders tense the membrana tympani, but also compresses the fluids of the labyrinth, while the stapedius muscle has a directly opposite action in relaxing the membrana tympani, and in placing the contents of the labyrinth in a state to be affected by the most delicate sonorous undulations. The base of the stapes moves to and fro in the fenestra ovalis, as a piston in a cylinder. There is no doubt in my mind that the fenestra rotunda is the chief medium for the passage of these undulations to the labyrinth, for the chain of bones may be incomplete without the hearing power being affected to scarcely an appreciable extent. Another very important function of the membrana tympani is to form part of the resonant walls of the tympanic cavity.”

human ear, to the effect that in both, the air within should be allowed to communicate with that without, is incorrect; and it is also evident that an opening in the membrana tympani must, in a degree, diminish the power of hearing.\* Upon the examination of patients affected with a simple perforation of the membrana tympani, this diminution in the ability to hear can, in fact, always be detected; although, as has been stated, if the orifice be small and the organ otherwise healthy, the difference is inconsiderable. In the greater number of cases, however, where perforation of the membrana tympani has existed, other lesions of a serious character have accompanied it—as thickening of the mucous membrane of the tympanum; pressure on the membrane of the fenestra rotunda; derangement of the articulation of the stapes with the fenestra ovalis; or injury to the nervous expansion in the labyrinth. Under any of these circumstances, it occurred to me that as an orifice in the membrana tympani, by preventing the sonorous undulations from being concentrated upon the mem-

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\* “Müller has shown that for the production of sonorous undulations it is not requisite a small drum should have an orifice for the communication of the air within and that without; and Mr. C. Brooke states that such orifice is only required where the air is considerably displaced, which is the case only in the more simple vibrations of the membranes.”

branous labyrinth, owing to their diffusion in the meatus, might be the direct cause of the diminished power of hearing, so it was probable that increased power would be the result of an artificial stoppage of the orifice.

“III. ON THE FORMATION AND USE OF AN ARTIFICIAL  
MEMBRANA TYMPANI.

“As a consequence of the preceding train of reflection, I was led to attempt the construction of an artificial membrana tympani, which it was hoped might serve as a substitute for the natural membrane, so far, at least, as its function of closing the tympanum and of rendering its walls resonant was concerned.\*

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\* “My hopes of success were strengthened by the result of some observations I had made upon cases of perforate membrana tympani. When these cases are not complicated with any other serious lesion of the organ, it must have been remarked, by others as well as by myself, that the patient, from some inexplicable cause, at times suddenly hears perfectly well, or nearly so. This improved hearing sometimes remains a few minutes only, at others for one or more hours. Having found this improvement to follow the use of a syringe and tepid water, or even of the pocket-handkerchief, I examined the ear in certain patients, after these operations had been effected, and I found in the former case that a bubble of water, and in the latter of discharge, filled up the orifice in the membrana tympani. Upon destroying the bubble, the improvement in the hearing at once disappeared. In one patient

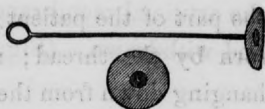
"After some experiments, I tried vulcanized India rubber and gutta percha, making use of the thinnest layers of them that were procurable. With both these substances I succeeded in making a rude kind of artificial membrana tympani, by cutting a portion about the size of the natural membrane, and passing through it a piece of thread, by means of which and a fine tube it could be passed down to its proper situation. The tube was then withdrawn, and the thread alone left in the external meatus, by which the artificial membrane could be withdrawn at the pleasure of the patient or the operator. The disadvantages attaching to this apparatus were, difficulty of applying it on the part of the patient; liability of the material to be torn by the thread; and unsightliness of the latter hanging down from the meatus. The experiment, however, was sufficiently satisfactory to induce me to request Messrs. Weiss to construct one, the centre of which should consist of two very fine plates of silver,

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I was able to keep up the improved hearing by the use, from time to time, of a solution of gum acacia in water. Upon reconsidering these facts, since I completed the observations upon the closed state of the tympanic cavity, I have arrived at the conclusion that the bubble of water, discharge, or mucilage acted beneficially by again confining the sonorous undulations to the tympanum, and this conclusion has been strengthened by subsequent observations."

having a diameter of about three-quarters of a line, between which the layer of vulcanized India rubber or gutta percha might be placed, and to the outer surface of one of these plates a silver wire was to be attached. The artificial membrana tympani made by Messrs. Weiss, from these directions, has hitherto been perfectly successful. As supplied by them, the portion of vulcanized India rubber or gutta percha is about three quarters of an inch in diameter, which leaves sufficient margin for the surgeon to cut out a membrane of any shape that may seem to him desirable, and to leave the silver plate either in the centre or towards the circumference, at his discretion.\* (Figure 8.)

The silver wire is of sufficient length to admit of the membrane being introduced or withdrawn by the patient, but is not perceived externally except upon especial observation. A second kind of artificial membrane is made by fixing the layer of gutta percha or vulcanized India rubber between two very delicate silver rings from the eighth to the sixth of an inch in diameter; these rings are riveted together, leaving a portion of the membrane drawn moderately tense in their cen-

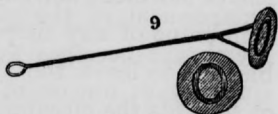



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\* "I now invariably use vulcanized India rubber, not much thicker than ordinary brown paper."



tre; a margin of the membrane is also left beyond the circumference of the rings, so as to prevent the latter being in contact with and irritating the tube of the ear. To the surface of one of these rings the silver wire is fixed by two branches, and they should be joined so that the outer surface of the rings should look obliquely outwards and forwards instead of directly outwards, thus imitating the direction of the natural membrana tympani. This kind of membrane is often preferable to that previously described, if the meatus is sufficiently large to admit of its passage. (Figure 9.\*) A pair of forceps is made whereby the artificial membrane can be more easily introduced and withdrawn. (Figure 10.)



“Before proceeding to speak of the mode in which the artificial membrana tympani should be applied, it is necessary to premise a few words on the diseases

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\* “In some cases, however, it produces a loud noise as if it were too tense; it would, perhaps, be desirable to have it made with only one branch, so that the surgeon may be able to alter the angle of the membrane with the stem, according to the case.”

which usually cause perforation or destruction of the natural membrane, and upon the condition of the structures which remain. The most frequent of these diseases is catarrhal inflammation of the mucous membrane lining the tympanic cavity. It is one of those usually styled otorrhœa, of which a more particular account will be found in the paper cited in the margin.\* This disease generally follows an attack of scarlet fever, scarlatina, measles, or any ordinary cold, and it usually occurs in children having a tendency to enlargement of the glands. The tympanic mucous membrane becomes thickened, and secretes so large a quantity of mucus of so viscid a character, that it cannot escape through the Eustachian tube; consequently, it gradually distends the tympanic cavity, and presses upon the inner surface of the membrana tympani, a portion of which, generally posterior to the malleus, begins to ulcerate, and an aperture is at length produced, through which the mucus exudes into the external meatus. This orifice is in some cases not larger than a small pin's head; in others it is a line in diameter; while in many cases the entire membrane is destroyed, with the exception of a margin at the

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\* On the Nature and Treatment of those Diseases of the Ear which have hitherto been designated Otorrhœa and Otitis. Transactions of the Provincial Medical and Surgical Association, vol. xviii. 1851.

circumference about half a line in diameter, which, being composed of the combined fibres of the thickest portion of the circular and radiate laminae, generally remains. This margin is deepest at the upper part. In some rare cases, the long process of the malleus continues entire after the complete destruction of the membrane to which it was attached; but, as a general rule, the whole of this process is gradually absorbed, leaving merely the head of the bone which articulates with the incus, the neck, and the body which receives the attachment of the tensor tympani ligament internally; anteriorly and posteriorly the fibres of the remnant of the membrane are attached, and externally the processus brevis remains. It will therefore be understood that, in cases of so-called destruction of the membrana tympani, a margin is generally left, to which the body of the malleus remains fixed, and to the inner part of which the tensor tympani ligament and muscle are attached, affording the means by which the small bones and muscles of the tympanum are still enabled to perform their functions. In cases of general *ulceration* of the mucous membrane of the tympanum, which fortunately seldom occurs, the incus is generally discharged, and sometimes the malleus also; but even in these cases, if the attachments of the stapes to the circumference of the fenestra ovalis remain uninjured, the power of hearing may be much

improved: should the stapes however be removed, total and irremediable deafness ensues.

“The other disease through which an orifice in the membrana tympani is usually effected, is *ulceration of the fibrous laminæ*. The disease itself is commonly the result of inflammation of the dermoid layer, which spreads first to the radiate fibrous and thence to the circular lamina. The laminæ, being weakened by the ulcerative process, fall inwards as far as the promontory, to which they often ultimately adhere, and, when an orifice has been thus produced, its margins are not unfrequently drawn into the shape of a funnel, whose inner part adheres to the tympanic walls. In ulceration of the membrana tympani, proceeding from the dermoid layer, the entire organ is very rarely destroyed, but an orifice merely is produced.

“The cases in which the artificial membrana tympani is of the greatest benefit are those where there is a well-defined aperture in the natural membrane, or, if it be entirely absent, where there is simple hypertrophy of the mucous membrane of the tympanum, with or without discharge from its surface. In these cases, it will be found that the organ has by no means entirely lost its power of discerning sounds; as a general rule, the human voice is heard when the mouth of the speaker is situated within about a foot of the patient's ear, and when the words are spoken

slowly and distinctly. The diminished power of hearing just noticed, while it entirely excludes the sufferer from the advantages of general conversation, is, however, greatly aggravated when, to the affection of the membrana tympani and mucous membrane of the tympanum, the stapes has become ankylosed to the fenestra ovalis, or the nervous expansions have been injured. In such cases where the patients require to be shouted to close to the ear, the artificial membrane will not prove of any service.

*“The Mode of applying the Artificial Membrana Tympani.”*

“As in cases of perforation or destruction of the membrana tympani there is so frequently catarrhal inflammation of the mucous membrane of the tympanum, it is obviously important that no foreign substance should be placed in contact with that membrane; and, as there is always a margin of the membrana tympani remaining, the object of the surgeon should be to keep the artificial membrane external to the latter. After carefully noting the size of the inner extremity of the meatus to which the natural membrana tympani was attached, the operator should then cut the artificial membrane as nearly of the size and shape of the natural one as possible, taking care at the same time to keep the margin quite smooth

and regular.\* The patient must then be placed with the head inclined to the opposite shoulder, while a strong light is thrown into the meatus, which if liable to discharge should have been previously syringed. The operator will now take the artificial membrane, and, having moistened it with water, pass it, by means of the silver wire, gently inwards, until it has reached what he considers the natural position. This he will ascertain by the occurrence of a faint bubbling sound, caused by the escape of the slightly compressed air beyond it; he will also feel a slight obstruction offered to its further passage by the remnant of the natural membrane. Should he attempt to pass the artificial membrane beyond this point, the patient will complain of pain, which until then had not been felt. The most certain test, however, of the artificial membrane having been properly placed is the sensation of the patient, who discovers, by the sound of his own voice, or that of the surgeon, or by the movement of his tongue and lips, that his hearing has been suddenly much improved.

“It will be imagined that great care must be taken

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\* “In cases where only a small border of the natural membrane remains, it is often desirable to cut the artificial membrane of a size larger than the inner extremity of the tube, so that its edge may turn outwards.”

to cut the membrane so that it shall fit the inner extremity of the meatus with exactness, since if too large it would cause discomfort, and if too small it would not fulfil its purpose of rendering the tympanum an air-tight cavity. It is not easy, in all cases, to fit the artificial membrane exactly to the inner extremity of the meatus, so as not to allow of any communication between the air in the tympanum and that in the external meatus; this is, however, the object which should always be sought to be attained. At first, the patient should be instructed not to use the artificial membrane for more than two hours daily; and, if he complains of an uncomfortable feeling, one hour, or even half an hour, will be sufficient.

“It would, perhaps, be expected that the contact of a foreign body, like the artificial membrana tympani, with the wall of the external meatus would soon become intolerable; such, however, is not the case, and several patients have left my room without being able to say, from the sensation in the ear, whether any foreign body were there; many have now worn this apparatus daily, during several months, without having suffered the slightest pain. The explanation of this circumstance may be found in the fact that the most sensitive part of the meatus externus is about its



centre, the membrane in the immediate vicinity of the membrana tympani not being so abundantly supplied with nerves: another explanation is that the circumference of the artificial membrane presses with extreme gentleness against the wall of the meatus.

“The results of the application of the artificial organ have been much more satisfactory than I had reason to anticipate. I have already used it beneficially in nearly fifty cases. The substitution of a thin layer of vulcanized India rubber or gutta percha,



for so exquisitely delicate a structure as the healthy membrana tympani, would be expected to afford but trifling aid ; such, however, is not the case, for among the patients relieved by it most have heard the human voice perfectly across an ordinary sized room, and in one case the voices of boys in the open air were heard at a distance of between one and two fields. Surgeons, who have paid careful attention to diseases of the ear, will not be surprised at the efficient substitute the artificial membrane offers, as they will bring to mind many cases in which the natural organ has been greatly hypertrophied, especially in chronic inflammation of its dermoid layer, with but a very slight diminution of the power of hearing.

“The surgeon having ascertained that the artificial membrane is beneficial to the patient, if no pain is experienced, it may be allowed to remain in the ear for a few hours, and gradually increased to the whole day : it is often desirable that the use of the membrana tympani should be preceded, or accompanied, by vesication over the mastoid process, whereby the thick mucous membrane of the tympanum may be rendered more healthy. In all cases, the artificial membrane should be removed at night, and, when there is any discharge, the ear ought to be syringed each night and morning with tepid water.

## "CASES.

*"Deafness for sixteen years, discharge from each ear for six years, aperture in each membrana tympani; power of hearing restored.*

"Peter Turnbull, æt. forty-three, formerly in the army, from which he was discharged on account of his deafness, was admitted, under my care, at St. Mary's Hospital, on the 12th of January, 1852. He stated that sixteen years ago, without any other assignable cause than a cold, he became slowly dull of hearing, and five or six years since he perceived a discharge from both ears, which has continued up to the present time. The power of hearing has been gradually diminishing, so that, at present, he requires speaking to loud, close to his head. Upon examination, an aperture between one and two lines in diameter was observed in each membrana tympani, and the mucous membrane of the tympanum, which was the source of the discharge, was more thick and red than natural.

"The treatment consisted in keeping up counter-irritation over each mastoid process, and in the use of an injection composed of three grains of acetate of zinc, to an ounce of water. Under this treatment, he somewhat improved, but the hearing still remained so defective that he was precluded from following any

avocation. In the commencement of June, I experimented on this patient with the first artificial membrana tympani, composed of vulcanized India rubber, and the good effect was at once decided. When it was placed over the surface of the original membrane, so as wholly to close the orifice, the patient made a movement of his lips, and said, 'I hear as differently as possible from what I have done for many years; everything sounds clear!' This patient went away with the artificial membrane in his ear, hearing conversation perfectly. The following morning, he came to my house, saying that he had accidentally moved what I had left in his ear, and that he was 'as dull as ever.' I replaced the artificial membrane—he again heard well; and being supplied with one which he could introduce or remove at pleasure, he has worn it during the day, ever since—a space of between three and four months—and he has never complained of pain or discomfort from it. Latterly, he has found the hearing so much improved that he has been able to dispense with the use of the artificial membrane for a few hours daily; but he hears much better with than without it. As a proof of the great amelioration that has taken place, this patient told me that while in the country lately, and using the membrane, he heard voices at a distance, and upon going towards the place from which they appeared to proceed, he

found some boys under a hedge, more than a field distant from the spot where he heard them. He is going back into the army.

“This patient was shown at a meeting of the Pathological Society of London, in February, 1853; the following is the published report:—‘The artificial membranes having been removed, the members of the Society had the opportunity of observing the perforate condition of each membrana tympani. After the removal of the membranes, he could not hear, unless loudly spoken to; but, when he had replaced them, which he did with apparent readiness, his hearing was excellent.’—*Medical Times and Gazette, February 12, 1853.*”

“S. H., Esq., æt. twenty-one, was sent to me by Mr. Fergusson, on December 4th, 1853. Between six and seven years of age, he had an attack of scarlet fever, since which he has had, at intervals, discharge from each ear, attended by so considerable a degree of hardness of hearing, that he is obliged to lean forward whenever he is spoken to, so as to be within a yard of the speaker. Upon examination, the membrana tympani was found to have disappeared from each ear; the watch was not heard by the right ear, and at a distance of five inches from the left. By the aid of the artificial membranes, he was able at once to hear

me talk across my room, and he soon heard general conversation perfectly. He went into the country, and in the end of January, I had the following confirmation of the persistence of the benefit: 'My hearing is quite optional to me; that is, I can hear or not, just as I choose. The artificial drums I use quite well—can put them in or take them out without assistance. My debt of gratitude to you I can never repay.' ”

## SCARLET FEVER.

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WE cannot resist the opportunity which the case last mentioned affords us to introduce a few words with special relation to this distressing disease, "Scarlet Fever." No one who has not paid attention to diseases of the ear knows how many of the human family have to bear through life the marks of this terrible battle with the angel of death. It is too frequently the case that physicians are apt to consider a diseased condition of the ear at the time of the fever as simply symptomatic, and about to pass away with the disease. Dr. Morris remarks, in his most skilful and beautifully emphatic Essay on Scarlet Fever\* :—

"The affections of the ear which complicate Scarlet Fever in its progress, or are developed as sequelæ, should always receive prompt attention, as they not unfrequently result in the entire destruction of the diseased organ. There may be *otitis*, or acute inflam-

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\* An Essay on the Pathology and Therapeutices of Scarlet Fever, by Caspar Morris, M. D.; published by Lindsay & Blakiston, Philadelphia. This essay should be studied by every practitioner. We have perused it not only with pleasure, but profit.

mation of the inner ear, or mere *otorrhœa*. The least important cases are those in which the inflammation commences in the meatus auditorius externus. This may occur at any time during the progress of the disease, but most commonly commences about the fourth or fifth day. If the patient be a young child, it will be found more drowsy than usual, and when awake, more fretful; and if old enough to express the seat of distress, it will indicate one or both ears. In some cases, however, there is little or no pain, and the first intimation of any local lesion will be derived from the stain of the cap or pillow-case, by a glairy, purulent discharge, which excoriates the concha as it flows over it, and occasions a vesicular eruption wherever it touches the skin. Whether the accumulation of this matter in the ear produce an extension of the disease to the tympanum, or the membrana tympani itself take on the inflammatory action, it not unfrequently happens that even those cases which are attended by little or no suffering in the beginning, become very serious in their progress, and result, finally, in the destruction of the membrana tympani and discharge of the ossicula.

“During the first few days, the external meatus should be kept perfectly cleansed by the injection of simple warm water with a little pure Castile soap dissolved in it; after which, if the discharge still con-

tinue and become fetid, the weak solution of chloride of soda or sulphate of copper may be employed.

‘The injection of the ear should never be intrusted to the mother or nurse. Ignorant of the structure of the parts, they are either restrained from the effectual use of the remedy by apprehension of doing mischief, or employ an undue force, and injure the inflamed membrane. Where the ulcerative process has destroyed the membrana tympani especially, great care is requisite not to throw the fluid so far into the cavity that it shall lodge there and become a source of additional irritation.

“Even the cases which originate externally, sometimes result in the entire destruction of the ear; but when the inflammation is extended from the fauces through the Eustachian tube to the internal ear, the pain at the time of invasion is much more severe, and the consequences are much more serious. In the case of infants or young children, this internal affection is first manifested by sudden shrieks, like those of meningitis, accompanied by grinding of the teeth and violent febrile excitement; these symptoms may continue many days before any discharge from the external ear affords positive evidence of the site of the inflammation.

“This extension of the inflammation from the fauces to the inner ear may occur at any period; either dur-



ing the progress of the scarlet fever or after the primary symptoms have declined. In either case, it demands prompt and energetic treatment; and unless the prostration of the vital forces is so extreme as to render the recovery of the patient hopeless, *leeches* should be applied to the mastoid process, followed by a blister. No apprehension of sloughing or ulceration should be allowed to interfere in these cases. The introduction of warm olive-oil and laudanum into the external meatus may be resorted to for the temporary relief of the suffering, simultaneously with these applications; and morphia may be applied afterward to the blistered surface, in doses appropriate to the age of the patient.

“These are the cases which result, of necessity, in the destruction of the organ, and lay the foundation for necrosis of the petrous portion of the temporal bone, and occasionally produce inflammation of the dura mater and death. It is not at all uncommon for the matter to find its way into the mastoid cells, and to give rise to abscesses behind the ear, which discharge externally, and leave openings, through which pus, contaminated by the dead bone, is discharged during a series of years, making the patient an object of disgust and pity by the excessive fetor. I have known both ears thus destroyed, reducing the child to the condition of a mute. Where the disease assumes

this chronic form, cod-liver oil is a most valuable resort, and should be administered perseveringly."

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We will now quote Mr. Wilde's extensive experience on the subject\* :—

"The most unmanageable causes of otorrhœa which I have met with in practice, in which the most destruction has taken place, and where the ossicula have been most frequently lost, have been the result of scarlatina. In my own practice, one case had existed for thirty-five years ; in another, twelve years ; and a third case, which came under my care, had been more or less under medical and surgical treatment, for seven years. In several other cases, the duration was respectively, one, two, and three years. The most recent cases have been the result of the late epidemic in our city. The profession have not, at any time, been sufficiently alive to the great importance of the treatment of acute inflammation of the tympanum, so as to prevent, if possible, the destruction of the internal portion of the ear, and the subsequent otorrhœa.

"If the same amount of care and trouble were exercised by physicians in the treatment of the ear, as

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\* Wilde on Diseases of the Ear, p. 323.

of the throat, a much smaller number of children would be permanently deaf, and a much smaller number would suffer from destruction of the tympanum, or with chronic otorrhœa for months or years after. Having been successful in most of my cases, during the late epidemic, in preventing deafness, I will give an outline of my treatment, hoping it may save a few children that important organ, the ear, so adapted to increase knowledge and delight mankind.

*"Treatment.*—In the early stage, when the scarlet fever is at its height, we must endeavor to arrest the acute inflammation of the ear, by depletion; but care must be exercised, as this exanthem will frequently assume a low type, which was the case during the recent epidemic. In such cases, local depletion (by leeches or small cups, to the mastoid process and anti-ratus) should be employed as soon as acute pain is complained of, and sometimes it will be found necessary to make pressure, as the child may be too young to indicate the point of pain, except by sudden screaming and crying; but pressure at the lowest portion of the ear will reveal the cause instantly.

"Local depletion should be repeated at intervals, and in such quantities as the strength of the child will permit, assisted by active purgation by a drastic agent, as jalap, scammony, or senna in infusion; while, at

the same time, we support the child's strength with nourishing diet, &c.

“If the case will not bear depletion, or we are called too late, then we must still apply counter-irritation, and purge the patient; but should suppuration have commenced, indicated by a chill, with increased pain, of a darting and throbbing nature, with a sense of bursting in the ear, the meatus, on examination, being of a livid red color, with the membrane of the tympanum red and swollen, our proper plan is to introduce a delicate cataract needle, and puncture the membrane. This will liberate the fluid; the purulent matter being pent up in the tympanum, from which it cannot escape through the Eustachian tube, it may ulcerate its passage externally, or may, by its contact, cause destruction of the internal ear, with destruction of the tympanum by rupture, or even extend towards the meninges of the brain, being not only fatal to the organs of hearing, but even to life itself. Cases are on record, in which this ulcerative process has extended, so as to open the carotid artery into the Eustachian tube, causing death from hemorrhage from the ear. Or the extension to the brain may be in the form of effusion or disease of the periosteum and death from convulsions. But instead of this extension, your remedies may have prevented death, and the disease

may now take on the subacute form, attended with a discharge of a muco-purulent or sero-purulent matter.

“The treatment in such cases must be both general and local. The general treatment, which is of the utmost importance, is to improve the blood by tonics of iron, quinine, and cod-liver oil, with the frequent use of the bath or wet towel, with frictions, and outdoor exercise in clear weather. The local treatment should be directed to the throat, by the application of solid nitrate of silver to the region of the Eustachian tube, every third day, with stimulating gargles, and the internal use of weak astringent washes to the ear, while most active counter-irritation should be kept up by blisters, setons, or croton-oil, applied over the mastoid region and tonsils. In some of the most unpromising cases the otorrhœa will gradually cease, and the disease may thus be cured; and if the case become chronic, then the treatment must be continued for months, and even years.”

We must, from our own experience, earnestly reprobate the stupendous folly and error of the notion, to which, even now, physicians who should be wiser cling, of discouraging all interference of art for the cure of discharges from the ear from any cause. By this causeless fancy, numbers are doomed to a life-long evil, which no doubt could be, by judicious treat-

ment, not only arrested, but the accompanying deafness obviated, and probably entirely in time removed.

But, as Dr. Holmes not more brilliantly than justly remarks, "It is so hard to get anything out of the dead hand of medical tradition! The mortmain of theorists extinct in science, clings as close as that of ecclesiastics defunct in law."\*

We have slightly departed from our theme, but need scarcely apologize for so doing, and shall proceed to show what Yearsley says on the use of the artificial *membrana tympani*.

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\* "Currents and Counter-Currents in Medical Science." By  
OLIVER WENDELL HOLMES, M.D.

## ON A NEW MODE OF TREATING DEAFNESS.

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\*“UP to the present time, no successful mode of treating perforations of the membrane of the drum of the ear, either as respects the restoration of the membrane, or the relief of the accompanying deafness, has been discovered. The only means resorted to for the latter purpose have been the removal of pus or mucus from the tympanal cavity by syringing, or rendering it free by passing air through the perforation, by way of the Eustachian tube. Either of these proceedings will produce a temporary improvement of the hearing in cases where the tympanum suffers from obstruction, but in many others, when such a state does not obtain, they are of little, if of any service.

“I have now, however, the extreme gratification of promulgating a mode of relief for deafness attended by loss of the membrana tympani, which will cause

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\* From pamphlet entitled “On the Artificial Tympanum—a New Mode of treating Deafness,” by James Yearsley, M. R. C. S. E., Eng.

great surprise, not less from its extreme simplicity, than from the extraordinary success which generally attends its employment.

“In 1841, a gentleman came from New York, to consult me under the following circumstances:—He had been deaf from an early age, and on examination, I found great disorganization of the drum of each ear. On my remarking this to him, he replied, ‘How is it, then, that, by the most simple means, I can produce in the left ear a degree of hearing quite sufficient for all ordinary purposes; in fact, so satisfied am I with the improved hearing which I can myself produce, that I only desire your assistance on behalf of the other ear.’ Struck by his remark, I again made a careful examination of each ear, and observing their respective conditions, I begged him to show me what he did to that ear, which I should unhesitatingly have pronounced beyond the reach of remedial art. I was at once initiated into the mystery, which consisted of the insertion of a spill of paper, previously moistened at its extremity with saliva, which he introduced to the bottom of the passage, the effect of which, he said, was ‘to open the ear to a great increase of hearing.’ This improvement would sometimes continue an hour, a day, or even a week, without requiring a repetition of the manipulation. Such an interesting fact could not fail to excite my attention, and it naturally



occurred to me to try so simple a method in other cases. I did so in several which appeared to me to be identical with that of my patient, but I invariably failed. I was on the point of abandoning the idea that the remedy could ever be made available in practice, and of considering either that my American patient's case was unlike all others, or that it depended on some idiosyncrasy (singularity of constitution), when it happened that a young lady came under my care, by the recommendation of Mr. Squibb, surgeon, of Orchard Street. She was the daughter of wealthy parents, whose anxiety for her relief was so great as to induce them to bring her to me long after I had discouraged their visits, and openly expressed my inability to relieve her. She had become deaf at a very early age, after scarlatina, which had produced disorganization of the drum of each ear, and the deafness was extreme. Unwilling, however, to abandon hope, her friends continued to bring her to me, in order, as they said, that 'nothing might be left untried.' With little expectation of success, after so many previous failures, I was induced to apply the new remedy, with some modifications upon my previous experiments. Instead of adopting my American patient's plan, it occurred to me to try the effect of a small pellet of moistened cotton wool, gently inserted and applied at the bottom of the passage, so as to

come in contact with the small portion of membrane which still remained. The result was astoundingly successful. On the evening of a day in which she had risen from her bed with the sad reflection that she must be for ever debarred from social converse and enjoyment, she joined the family dinner-party, and heard the conversation which was going on around her with a facility that appeared to all present quite miraculous. Day after day, the remedy was applied with the same marked success, and eventually she learned the art of applying it herself, and thus became independent of me. It was observed that, until the wool could be brought in contact with a particular spot at the bottom of the passage, the hearing was not at all benefited, on the contrary, was prejudiced; but the moment it was properly adjusted on that particular spot, the hearing was restored. Subsequent experience, in a vast number of cases, confirms this remarkable fact. It is not merely necessary to insert moistened cotton wool to the bottom of the passage. Such manipulation would in most cases add to the deafness. It is essential to find the spot on which to place the wool, and so adjust it as to produce the best degree of hearing of which the case may happen to be susceptible. This of course differs according to the variety and extent of the disorganization.

“I quote the above case, not only because it was the

first which it was my happiness to relieve by this novel plan, but because I am in a position to show the permanency of the remedy; for recently I have made it my business to write to the mother of the young lady, who states that her daughter 'continues to derive the same benefit as ever from the remedy, and that in her case it has been most successful, restoring her to the charms of society, from which she had been almost entirely excluded. It is now scarcely necessary for the members of her family to raise their voices when addressing her.' She adds: 'When the aid is removed, she scarcely hears at all.'

"For nearly five years this young lady has used the remedy with undiminished success, and during the same period I have been availing myself of it in the ordinary routine of my practice, stepping neither to the right nor to the left to seek for cases in which it would be applicable, nor even speaking of its extraordinary success out of the circle of my immediate medical acquaintance. And most probably I should have continued so to do, if it had not happened that a gentleman, an army surgeon, recently consulted me, who having experienced the most happy result from the same mode of treatment, thought proper to publish some account of it in a local newspaper, considering, as he stated, that so important a mode of treatment ought to be more extensively known.

“Mr. Griffiths, of Pantgwyn, Newcastle Emlyn, Carmarthenshire, the gentleman in question (I am at liberty to use his name), did me the honor to call on me in September of last year, accompanied by Sir David Davies, to consult me about a young friend laboring under an affection of the throat. During the consultation it was necessary for me to raise my voice very considerably to make myself heard by Mr. Griffiths, and I observed that when he blew his nose, he distinctly passed air through the tympanum. After the consultation, I alluded to his deafness, and the probability that, by a new remedy, I could afford him some relief, more especially as he had unconsciously revealed to me, in blowing his nose, a state of ear favorable for success. He readily assented to a trial; and I must be permitted to quote his own statement of the result. On the remedy being applied, he says: ‘To my utter astonishment, I heard every sound so loud, that I felt I had never known what it was to hear until that moment. Sir David Davies could hardly have believed it had he not been present. On entering the streets, the noise was so intense, that I was compelled to stop up my ears to deaden the sound; but after a time I became accustomed to it, and can now enjoy the pleasures of social converse without straining my auricular organs, or being obliged to be addressed in a considerable elevation of voice. Personally I

continue to apply the remedy with the same beneficial effect, and am convinced of its permanent nature, when persevered in and properly attended to. This extraordinary discovery comes too late to be of that essential service it would have been to me in earlier life, yet it may render the rest of my days more comfortable in my intercourse with the world.'

"The following brief history of Mr. Griffiths's case, as detailed by himself, is interesting in many points of view:—'The crisis of a severe attack of scarlatina in my infancy was attended by abscesses in both ears, which produced deafness, and a continual discharge of purulent matter, more or less, until I attained my twenty-second year, when the latter ceased. Occasionally, concretions of wax formed in the passage, increasing the deafness. These were removed by syringing, after which a thin pellucid fluid would issue from the ears, during which my hearing was much improved, again becoming worse as the discharge ceased. While the discharge lasted, I experienced a slight tenderness in my ears, which also ceased with the discharge. I find that your remedy sometimes does the same thing, and that is my reason for not constantly using it; but if it is *not* applied, my hearing is not in the least degree remedied! The discharge is always more profuse when in bed, even without the remedy, and I am somewhat puzzled to

account for it. My children know as well as I do when the remedy is applied; and when it is, they remark, "Your ears are too sharp; we cannot now speak to mamma, even in a whisper;" but they cannot, more than other people, discover why I should hear so well one day, and the next, perhaps, not better than usual; and the question now is, "Have you got your new ears on to-day, papa?" The invention is invaluable.'

"From this communication, written three or four weeks after his visit to town, it appears that the remedy first set up an irritation in the ear, which occasionally rendered it advisable that it should be discontinued; but now I am enabled to state that such obstacle to its use no longer exists, and that he applies it regularly, uninterruptedly, and with undiminished success.

"This case, like the first quoted, proved to be one in which there was a loss of a great portion of the membrana tympani; and I may here observe that all my experience tends to show that this is an essential condition of the ear for success. At the present time I can refer to not very far short of two hundred cases in which the new treatment has been successful, and in all of which more or less perforation or destruction of the membrane exists.

"A very small quantity of wool is sufficient. It

must be moistened in some fluid without any compression, and gently pushed down the passage with the point of a probe. I have had constructed for the purpose a set of instruments, which are calculated to meet and overcome every difficulty; for I need scarcely say that it is very easy to talk of passing a foreign body down the meatus, but it is not so easily done. Besides, it is not sufficient to merely pass it down to the site of the membrane; but when there, the spot must be found which it is indispensable the wool should occupy and cover; for then only, and not till then, will success attend the application, and the patient regain the hearing.

“With a few rules, which, of course, vary with the case, the patient may be taught to manipulate upon himself, and all that is required is, to renew the cotton, night and morning, or morning only. This is quite sufficient to maintain the improved hearing in the intervals.

“It will be expected that I should say something of the *modus operandi* of this new application; but I can offer nothing that is conclusive. It has appeared to me in some way or other to supply the place of the lost membrane. The moisture is absolutely necessary to its perfect action; for when the cotton becomes perfectly dry it impedes rather than improves the power of hearing.

“Experience of several years has taught me that it is impossible to convey to others, in words, such explicit directions as shall enable them to manipulate with any degree of certainty. In fact, it was on this account that I have so long held back from publishing any account of the remarkable fact I had observed in my practice. Apart from other considerations, I felt that publicly to ascribe such extraordinary effects to so simple a remedy, would scarcely be credited; and not without reason; for it would naturally be tried in and out of the profession, although I will venture to say, that in not one instance in twenty, however appropriate and well adapted the case might be, would it succeed, solely from ignorance of the rules, the observance of which is essential to success. These rules more especially apply to the discrimination of the case—the preparation of the ear—the size of the pellet of wool—the degree of moisture—the degree of pressure—the precise spot on which to place the wool—under what circumstances to omit it, and when to resume it, &c., &c. In the absence of such knowledge, circumstances might arise by which not only the patient, but the practitioner, would be puzzled, balked, and might possibly do some serious injury. An instance of the kind has lately occurred. A surgeon brought a case to me in which the treatment was successful; and having seen me produce a great im-



provement in the hearing, he thought he should be able to succeed also, without further assistance. He inserted the wool, but could not reach the necessary spot; and in endeavoring to adjust it, some injury was done, which completely ruined the ear for future treatment. I have never since been able to get the remedy to act in this case. Many instances of the lamentable results of unskilful attempts on the part of patients, as well as practitioners, have since come to my knowledge."

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We have selected the following case from several on our own record. Mr. Harvey, an Episcopal clergyman, consulted me on a case of deafness, which he stated obliged him to relinquish his occupation as a preacher, as he could not hear his own voice. His age was forty-eight, and he related that he had lost his hearing from sea-bathing, fifteen years before, the deafness having gradually increased, although he had visited every one he had heard of, who professed to cure deafness, tried everything that was recommended him, only to the increase of his malady. "Within the last two years I found it," he said, "necessary to retire from the ministry."

On examination the membrana tympani of the right ear was found to have disappeared; in the left I observed a considerable orifice. I at once applied

the artificial membrana tympani to both ears (the cotton), and he seemed hardly to credit his own senses, when upon my speaking to him at a distance of five feet, he heard me distinctly. I removed them, and he could not hear me, although at his side. After a few visits he learned to insert them himself, and I here give his own words when, a few months after, he wrote to me:—"I regard the restoration of my hearing, by the use of the cotton, as a miracle of science."

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#### MODE OF PREPARING THE COTTON.\*

The illustrations of the mode of preparing the cotton, and the instrument with which to introduce it, with all the minute directions given by us, will convey as accurate an idea as can be given, even to an unprofessional person. We would, nevertheless, caution such, not to indiscriminately fly to its use, without having previously ascertained, from one able to make an examination, the causes of their deafness, and if its application would be advisable. If so, the first insertion should be made by the examiner.

Having thus in general terms pointed out the safest course, we say to the medical fraternity, in the lan-

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\* The following directions and drawings are not to be found in Yearsley's Pamphlet. The latter having been made and used by us from his verbal description of like instruments.

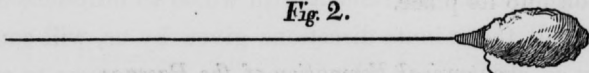
guage of Yearsley, "Although it is impossible in words to convey all the necessary information, it will at all times afford us great pleasure practically to illustrate the subject, before any practitioner who will favor us with a visit."

Fig. 1.



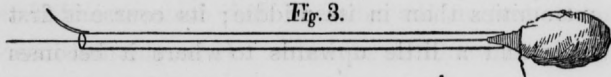
A silver tube of small calibre, from two inches to two-and-a-half in length, with a hook at one extremity, to entangle the cotton, if by any chance it should get disengaged from the thread.

Fig. 2.



A small piece of cotton, to which is attached a soft pliant thread, of three inches in length.

Fig. 3.



Shows the cotton in the tube.

#### GENERAL DIRECTIONS FOR USE.

The thread is to be drawn through the tube, so as to bring the cotton steadily against its extremity, then

having wetted the cotton in tepid water, introduce it into the passage of the ear, holding the tube and the thread at the same time with the finger and thumb, then move the cotton about at the bottom of the passage of the ear until it reaches a spot which, when touched, produces the improved hearing; this being attained, let go the thread, and gently withdraw the tube over it, leaving the cotton in the ear—finally, cut off the projecting thread, or turn it into the outer cavity of the ear. Should the cotton fall from its proper position in the ear, and the improvement of hearing be lost, it may easily be readjusted by using the tube as a common probe, and with it, lifting the cotton into its place.

### *Anatomical Formation of the Passage.*

The passage of the ear, to the bottom of which the cotton is to be introduced, is from an inch to an inch-and-a-half in length. It is slightly curved, wider at its extremities than in its middle; its course is first forwards, and a little upwards to where it becomes contracted, then it turns downwards and backwards to the membrana tympani, which forms the partition between the outer and inner ear, the loss or imperfection in which membrane it is the intention of the moistened cotton to rectify. It is necessary the patient should bear in mind this natural incurvated

form of the passage, otherwise he might suppose that in introducing the remedy he had arrived at the extremity, when in point of fact he had only struck against the side of the passage at its middle or contracted portion.

*The Mode of Wetting the Cotton.*

Take a tumbler of water, warmed to the temperature of the body—in which insert the tube threaded with the cotton ready for use—move the cotton briskly backwards and forwards in the water, so as to moisten every fibre. The next best fluid for wetting the cotton is the saliva of the patient.

*General Observations and Directions.*

For cleanliness' sake the cotton should be changed daily. Cotton wool will have the preference over every other substance, in this peculiar mode of treating deafness. Its chief advantages may be thus enumerated:

1. It is more easily applied.
2. It is simple, safe, and cleanly.
3. It retains its proper position longer.
4. It causes no irritation.
5. It produces no noises in the ear whilst eating or talking.

6. It is more agreeable to the feelings of the patient than any other known material.

7. It produces the highest degree of hearing of which a patient with perforated tympanum is susceptible.

In rare cases, owing to rough usage in the application of the cotton, the ear may become irritated, and rebel, as it were, against its use, but beyond the tenderness which is felt by the patient, no other inconvenience arises, and never any injury to the ear,—whilst this stage of irritation lasts (generally two or three days), it is better to discontinue the cotton, and soothe the ear by fomentations and poultices. Strange to say, this irritation seldom or never recurs, and the ear ever afterwards quietly submits to the presence of the remedy.

The cottons should be made larger than is required, and then trimmed round the sides and from the extremity, taking care not to interfere with their attachment to the thread. Three or four experiments will enlighten the patient or physician as to the proper size of the cotton for each individual case. Success is frequently made manifest to the patient by a *click* or *pop*, which is believed to arise from the bursting of a small bladder of air formed by the discharge which in some cases is present. Sometimes it is necessary to lift up the cotton after it is introduced, and this can

be done with the hook, for *it is a sine qua non that the cotton should not entirely cover the opening into the cavity of the tympanum.*

It is evident that, unless some noise is going on of uniform loudness at the moment of the experiment, the patient would experience a difficulty in estimating the success of the remedy. For our consulting-room we have an Acoemeter, which, having gradations of sound, is set going before commencing and during the application of the cotton, and the patient is directed to make some sign the moment success is attained; but for ordinary purposes, scraping the floor with the foot, rubbing the hand over the clothes, or snapping the finger and thumb whilst manipulating, will be sufficient to indicate to the patient the attainment of his wishes.

NOTE.—We have made arrangements with an instrument-maker to manufacture the prepared cotton and instrument to introduce the same, which, with further printed directions, we shall send, on application, to any practitioner or persons requiring such. This we do, not with a view to gain, but in order to insure, first, the transmission of such further printed directions, with each apparatus, as are needed for guidance; secondly, to prevent imposition, of the opportunity of which (being made public for the first time in this country), no doubt, numerous quacks will avail themselves to advertise and sell indiscriminately this apparatus, under some attractive name (as *a certain New York empiric* did with Kramer's Air-Press, advertising one of unheard-of calibre, in order to attract the notice of the public).

## WESTRAPP'S ARTIFICIAL MEMBRANE.

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MR. T. WESTRAPP, surgeon at Bristol, England, published in the Medical Times and Gazette of October, 1855, a new form of artificial membrana tympani.

We will here give the synopsis of the article, and without passing analytic judgment on the same, briefly remark we think it open to many objections, and will by no means answer as well as Toynbee's or Yearsley's. We do, however, fully appreciate the author's short yet just remark as regards the analogy of the eye and ear:—

“Having accurately inspected the meatus into which we desire to insert an artificial membrane, we must make a model of it in some hard timber. This should be as perfect almost as a cast, though not too tight; its end should be flat, cut obliquely, and the circular edge rounded off. This cast or model, previously oiled, should be repeatedly dipped into a solution of gutta percha in chloroform, till a film of sufficient thickness is formed, to peel off in one unbroken piece. A slit with a knife may be made longitudinally, without detriment, to aid its coming freely off, but the cut



should not go within a quarter of an inch of the flat end; it sometimes is necessary to touch with some of the gutta percha solution any inequalities of the membrane. This tube, if the timber model has been properly made, will be found to fit the meatus comfortably, and when oiled and coated with cerumen, to exclude the external air from the *cavitas tympani*; the tube should not be allowed to protrude, but should be cut obliquely, so as to lie entirely within the meatus; it easily adapts itself to the parts, the flat circular membranous end lies at the proper angle in the site of the lost membrane or its remains; when it becomes advisable to clean its surface, it can easily be taken out by the patient with a small pair of tweezers, washed in cold water, oiled, and reinserted. If found to fit, two or three should be made and given to the patient, who should be taught their use. If there be a discharge from any part, from the ear, polypi, obstructed Eustachian tubes, a nervous impairment, or any other aural affection, it should be appropriately treated. For functional nervous derangements of the ear, I am in the habit of using locally strychnia, dissolved either in water or glycerine, with the help of a little acid and spirit; I am inclined to think it often does good. Why should it not stimulate the aural nerves as well as it does those of the eye when dropped on the conjunctiva in functional amaurosis? The more we bring

to bear on aural disease our more advanced knowledge of eye complaints, and follow out the analogy, the more we shall advance and increase our success. In conclusion, I beg to remark, that though my contrivance is simple, yet I do not expect every person who tries to make or adjust it will at first succeed; it requires much practice and patience; failures will be as often met with as success in the attempt to construct a perfect membrane, as it is a difficult matter to hit on the proper thickness of the tube; the solution of gutta percha should be rather thin, so as not to coat the timber model too thickly, and to allow of its spreading evenly over its surface; it should be kept in a very small bottle, to avoid excessive waste of chloroform; each coat or film should be allowed to dry perfectly; six or eight coats will be required to complete the necessary thickness, and this takes two or three days to accomplish. The tube should not be peeled off the model when too thin, else it will tear; or should not be made too thick, else it will be hard and tough, and irritate the ear; it should be about as thick as very fine gutta percha, or oil silk; it is then pliable, soft to the ear, and will easily vibrate when adjusted. As might be expected, a great deal depends on the nicety of the model; the timber requires much carving, scraping, filing, and polishing; also the anatomy of each meatus must be strictly attended to. Without all these precautions I do not promise any material benefit."

## CONCLUDING REMARKS.

“Lend me your Ears.”

OUR task is done, and as we hand this volume over to the public, that tribunal to which every writer must bow, we can but give vent in a few words to the feelings our work has inspired. None but those who have passed the ordeal can understand the sensations of an author who approaches his subject, not only with a full sense of its importance, but with the achievements of his predecessors in the path he is about to tread, before him, and a perfect knowledge of the criticism, judicious and injudicious, that he will of a certainty encounter.

Our effort has been to produce a work upon the subject on which we treat, not only to equal, but, in a certain degree, to exceed any that has preceded it. The just claim we have endeavored to win to this distinction, has been pointed out in the preface; and in reviewing these completed pages, we cannot feel our assumption to be arrogant or unfounded. Others there may be more elaborately scientific, but such

are, of course, to the youthful student and general public, almost as sealed books. That the works of these great minds have materially assisted us is a matter of course, as we have duly acknowledged. They have written for those supposed to have already partial knowledge upon the subject. We have paved a way in which the most uninformed can walk with profit, while, as a specialist, we have endeavored to give the profession a work valuable for educational purposes, in this particular branch of medical science, to the undoubted neglect of which, in this country, in the faculty in general, is attributable the host of empirics who disgrace the honorable name of Aurist.

Well aware of the unaccountable prejudice of the American medical faculty against specialities and specialists, we have here given them a work which we assure them, but for our devotion of years past to our speciality, we should have found it impossible to produce. While, of course, it is unnecessary to state what every one must be aware is the opinion of an educated man, that we fully recognise the necessity of a specialist being first a physician of general information, must not the medical faculty acknowledge that to the renowned specialists, such as Graefe, Liebreich, Ruete, Kramer, Rau, Erhard, Linke, von Tröltsch, Roosbroeck, Lawrence, Jones, Dixon, Gritchett, Pilcher, Tod, Harvey, Buchanan, Yearsley, Toynbee, Williams,

Mackenzie, Wilde, Jacob, Itard, Duleau, Guiniere, Leschevin, Du Verney, Sichel, Demours, Velpeau, and others, it is indebted for that special knowledge which renders it useful in the various branches of the profession, to specialities of which each of these illustrious men has not thought it too much to devote a life?

We are glad to see the truth that we have here tried to demonstrate, fully appreciated and ably advocated by our brilliant and learned confrère and countryman, Julius Homberger, M. D. (Editor of the American Journal of Ophthalmology.\*)

To those less liberal minded, who, on account of a difference of opinion as to the system we advocate, may question our pretensions to speak "as one having authority," on a subject upon which we feel ourselves capable of so doing, we but quote the words of the immortal Shakspeare:—

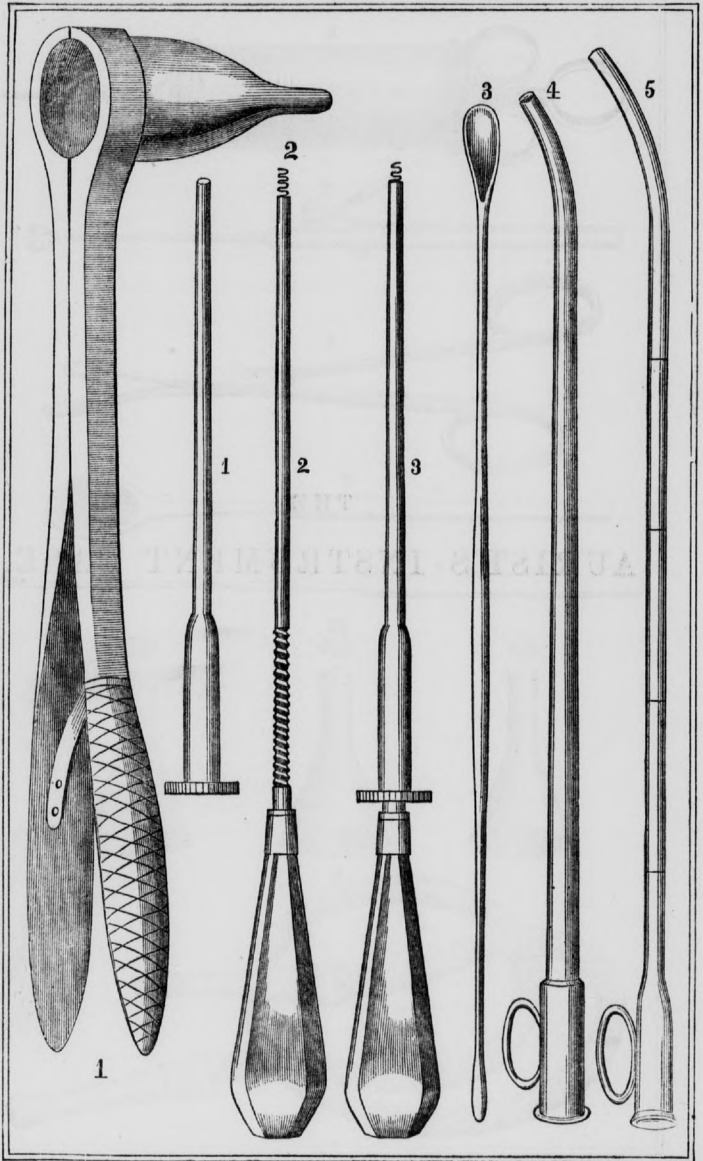
"If I am traduced by tongues which neither know  
My faculties, nor person, yet will be  
The chronicles of my doing, let me say  
'Tis but the fate of place, and the rough brake  
That virtue must go through. We must not stint  
Our necessary actions, in the fear  
To cope malicious censurers; which ever  
As ravenous fishes, do a vessel follow

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\* See the American Journal of Ophthalmology, Nos. 1, 5, 6.

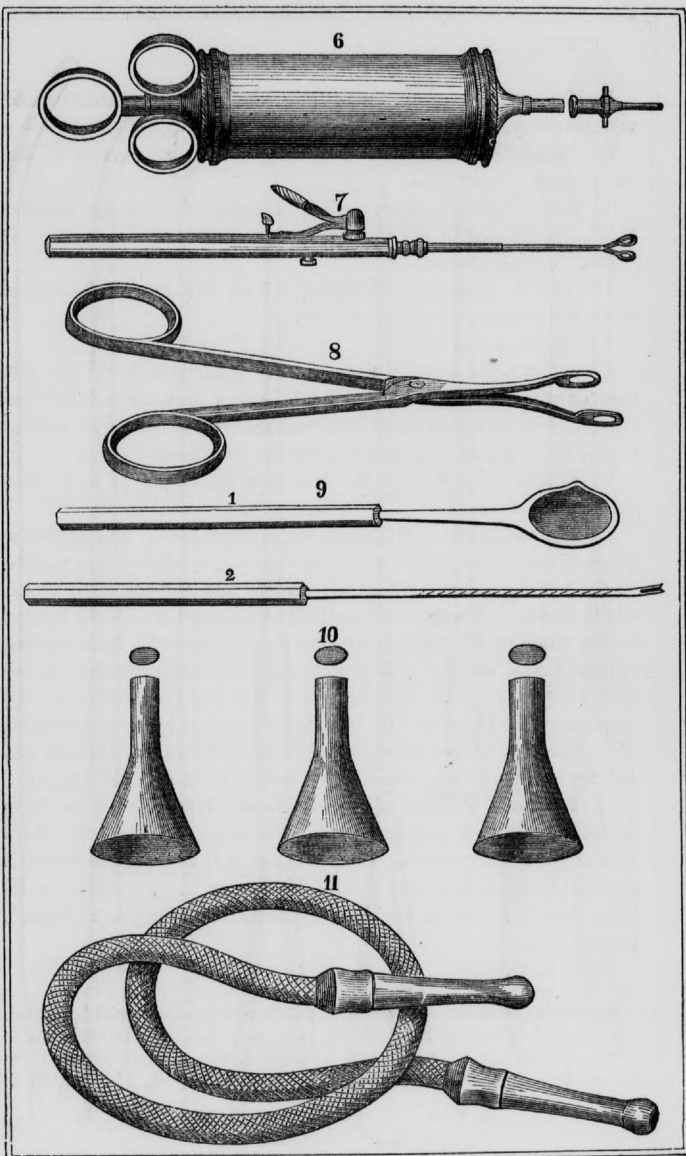
That is new trimm'd ; but benefit no further  
Than vainly longing. What we oft do best,  
By sick interpreters, once weak ones, is  
Not ours, or not allow'd : what worst, as oft  
Hitting a grosser quality, is cried up  
For our best act. If we shall stand still,  
In fear our motion will be mock'd or carp'd at,  
We should take root here where we sit, or sit  
State statues only."

THE  
AURIST'S INSTRUMENT CASE.





# INSTRUMENT CASE.



## EXPLANATIONS.

I. *Kramer's Speculum*, for examining the meatus externus and membrana tympani.

II. *Fabrizi's Trochar*, for removing a circular portion of the membrana tympani :—

1. The sheath; 2. The perforator removed from its sheath; 3. The perforator in the sheath.

III. *Spatula Aural*.

IV. and V. *Kramer's Catheters*, which are made of various sizes, for subjects of different ages.

VI. *Syringe and Nozzle*.

VII. *The Lever Ring Forceps*, open. (It is introduced into the meatus with the rings apart, which having been made to enclose the polypus, or a portion of it, between them, the lever is pressed down, the polypus seized and instantly drawn out.)

VIII. *The Ring Forceps*, for the removal of polypi and other fungous growths.

IX. *Porte-Cauteric*. (1. Silver or platina ladle, into which a piece of caustic is placed and held over a spirit-lamp, and melted to the boiling point. When the caustic has become quite clear, the instrument No. 2, which is the *Porte-caustic*, should be heated in the flame of the lamp, and then dipped into the fluid caustic several times, until a sufficient quantity is taken up, and we are then able to apply the nitrate of silver to any surface within the meatus. The *Porte-caustic* is about six inches long, and consists of a silver tube, cut spirally for three-fifths of its length, and having an aperture in the side, or hollow at end.) (Wilde.)

X. *Toynbee's Tubular Ear Speculum*. They should be fully an inch and a half in length, and six-eighths of an inch in width at the greater aperture. (We recommend, as we have found it preferable, that the tube should be larger in proportion to its body than is found in the drawing made according to Toynbee's suggestion.)

XI. *The Otoscope*.

To complete this case there should be other instruments, which we have not thought necessary to illustrate, such as a pair of fine forceps and scissors. The instrument makers from whom this case, as arranged by us, can be had, are J. W. Kolbe, Gemrig in Philadelphia, Tiemann, N. Y.

## REPERTORIUM.

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THE following formulæ having been used by us with much benefit, when any of the maladies below mentioned have either caused or accompanied cases of deafness which came under our care, we append them, recommending them to the attention of the practitioner.\*

### AMENORRHŒA.

R. Croci  $\mathfrak{D}$ ij.  
Sodæ Borat.  $\mathfrak{Z}$ j $\beta$ .  
Sacchar. Lact.  $\mathfrak{Z}$  $\beta$ .

M. f. pulv. D. ad scatul. S. To take a teaspoonful three or four times a day.

R. Aloës scotrina pulv.  $\mathfrak{Z}$ j.  
Ferr. pulv.  $\mathfrak{Z}$ ij.  
Extr. Taraxac. q. s. ut f. Pilul. gr. iij.  
Consp. Pulv. Cass. Cinnamom.

S. To take from one to two pills twice a day.

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\* The medicaments used in the following formulæ, and those recommended in the work, are all to be found either in Wood & Bache's United States Dispensatory, or in Christison & Griffith's Dispensatory.

R. Myrrhæ pulv. ℥j.

Gummi Arabic. pulv. ℥ij.

Fiat c. Syrup. spl. ℥j, infus. flor Chamomill. vulgar. ℥vj.

Emulsio; cui adde Ferri sulphuric crystall (antea in Aqua Cinna-  
mom. solut. ℥j gr. xv.

S. To take every three hours two spoonsful. Shake the bottle  
before pouring out.

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#### DYSMENORRHŒA.

R. Flor. Arnic. ℥β.

Ammon. muriat. dep. ℥ij.

Camphor. trit. gr. vj.

Sacchar. alb. ℥vj.

M. f. pulv. D. ad vitr. S. Three or four times a day a teaspoonful.

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#### CATARRH.

R. Fol. Senn., Sulphur depr.

Rad. Liquirit. Sem. Anisi.

Contus āā ℥β.

Sacchar. alb. ℥ijβ.

M. f. pulv. D. ad scatul. S. Teaspoonful four times a day.

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#### CATARRHAL AFFECTIONS OF THE LUNGS, WITH COUGH.

R. Gummi Ammoniac. dep. ℥iβ.

Rad. Seneg pulv. ℥ij.

Antimonii Sulphuret. aurant ℥β.

Rad. Squill pulv. gr. xv.

Extr. Tarac. liq. q. s. ut f. Pilul. 150.

Consp. pulv. rad. Irid. florent.

S. Five pills three times a day.

- R. Ammon. muriat. dep. ʒij.  
 (Gummi Arabic. pulv. ʒij.)  
 Antimon. tartarisat. gr. j, solve in Dec. rad. althaeæ (eʒij) ʒvj.  
 Syrup. Liquirit. ʒβ.  
 S. To take a spoonful every two hours. Shake it before taking.
- 

HEMORRHOIDS.

- R. Potassæ tartrat.  
 Extr. Marrub. āā ʒij, solve in Aqua Meliss. ʒiij.  
 S. To take half in the morning and half in the evening. (An excellent mixture if the patient suffers from constipation.)
- 

LIVER AFFECTION.

- R. Rad. Belladonn. ʒβ.  
 Rad. Rhei ʒij.  
 M. f. pulv. Divide in ten equal parts. S. To take one powder two or three times a day.  
 We have seen excellent effect from these powders, from obstructions and induration of the liver.

- R. Sapon. medicat. pulv. ʒvj.  
 Extr. Taraxac. ʒβ.  
 Ammoniac. dep. ʒβ.  
 Syrup. spl. q. s.  
 Ut f. Pilul. gr. ij.  
 Consp. Pulv. Cass. Cinnamom D. ad vitr.  
 S. To take ten pills three times a day.

- R. Extr. Taraxaci.  
Extr. Chelidonii ana ʒj.  
Potassæ tartrat dep. ʒβ.  
Aquæ Melissæ ʒiv.

S. A spoonful every two hours, to continue for some time.

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### THROAT AFFECTIONS.

- R. Liquor Ammonii acetici.  
Succi Sambuci inspissati ana ʒβ.  
Vini antimon. ʒj.  
Aquæ flor. Sambuci ʒiv.

S. A spoonful every two hours. (Excellent for angina catarrhalis.)

- R. Essent. Pimpinells ʒjβ.  
Syrup. Althacæ ʒiij.

S. Every half hour a spoonful. (Recommended for catarrhal angina, tonsillaris, and uvularis.)

- R. Alum dep. ʒj—ʒij.  
Aquæ destill. ʒviiij.  
Spiritus Vini gallici ʒj—iij.

An excellent gargle.

- R. Infus. flor. Sambuci ʒviiij.  
Liq. Ammon. acet.  
Mell. rosat. āā ʒj.

S. To be used as a gargle in follicular inflammation of the throat and air-passages.

INJECTIONS IN PURULENT DISCHARGES FROM THE EAR.

R. Pyroligneous acid fl. ℥ij.  
Aquæ Destillata ℥viiij.

S. To syringe the ear out every morning.

R. Cadmii Sulphatis ℥j.  
Aquæ Rosæ ℥viiij.  
Tinct. opii croc. ℥j.

S. To syringe the ear out twice a day.

R. Balsam Peruv. ℥ij.  
Cupri acet. crystall. gr. x.  
Unguent cerei ℥iv.

M. f. linimentum.

After cleaning the ear out with warm water, in offensive discharges, place a little of this ointment on a piece of cotton, and introduce it into the ear.

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EARACHE.

R. Chloroform } equal parts.  
Laudanum }

A little being introduced in the ear on a piece of cotton.

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IN DISORDERS OF THE DIGESTIVE CANAL.

R. Extr. ligni Quass ℥ij.  
Vini Hispan. ℥ij.  
Syrup Cinnamom. ℥jβ.

S. To take a table-spoonful three times a day.

R. Extr. Cascarill.

Extr. cort. Aurant āā ʒj, solve in Aquæ Cinnamom. vinos ʒβ.

S. Take a teaspoonful before meals.

R. Extr. Gentian. ʒβ.

Cass. Cinnamom. pulv. Rad.

Gentian pulv. āā ʒij.

M. f. pilul. gr. ij. Consp. pulv. Cass. Cinnamom. S. To take from eight to ten twice a day.



# EXPLANATION OF MEDICAL SYMBOLS, ABBREVIATIONS, AND TERMS USED IN PRESCRIPTIONS.

*āā*—ana—of each.

*Ad.*—add to.

*Contundo*—to bruise.

*D.*—Dosis—a dose.

*Dep.*—Depuratum—pure.

*Extr.*—Extracta—extract.

*F. M.*—Fiat Mistura—let a mixture be made.

*Fl.*—Fiat—make.

*Gr.*—Granum—a grain, the 60th part of a drachm.

*Gtt.*—Gutta—a drop.

*M.*—Misce—mix.

*M. F. Mist.*—Misce fiat mistura—mix to form a liquid mixture.

*M. F. P.*—Misce fiant pulvis—mix to form a powder

*M. F. Pil.*—Misce fiant pilulæ—mix to form pills.

*Pulv.*—Pulvis—a powder.

*Q. L.*—Quantum libet—as much as you like.

*Q. S.*—Quantum sufficit—as much as will suffice.

*R.*—Recipe—take. This sign is really a modification of the symbol  $\mathcal{J}$ , which was the old heathen invocation to Jupiter, imploring his blessing on the prescription.

*Rad.*—Radix—root.

*Red. in pulv.*—Reductus in pulverem—reduced to powder.

*S.*—Signa—sign, write.

*Scat.*—Scatula—a box.

*Ss.*—Semi—a half.

*Vitr.*—Vitrum—a glass.

$\mathfrak{m}$ —Minimum or minim—the 60th part of a fluidrachm.

$f\mathfrak{z}$ —Fluidrachma or fluidrachm—the 8th part of a fluidounce.

$\mathfrak{D}$ —Scrupulus—a scruple.

$\mathfrak{z}$ —Uncea—an ounce.

$\mathfrak{z}$ —Drachma or drachm—3 scruples.



G L O S S A R Y.



## GLOSSARY.

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WE assert not too much when we say, that this Glossary will be found as it were a Key to the work. By the medical student it should be studied attentively, and committed to memory. The unprofessional reader will find every technical term of all the branches of which this work treats, so copiously and clearly defined and explained, that a want of comprehension is impossible.

### A.

*Abnormal.* Unnatural ; irregular.

*Acoustics.* Belonging to the ear. A term for the doctrine of the theory and principles of sound. (*Acoustic Medicine*, is one used in diseased audition.)

*Acrid.* Pungent ; irritating.

*Adjuvant.* Auxiliary. (A medicine introduced into a prescription to aid the operation of the principal ingredient or basis. Also, whatever assists in the removal or prevention of disease.)

*Ætiology.* Doctrine of the causes of disease.

*Alæ.* Wings. (Anatomy applies it to certain parts, from their

supposed resemblance to wings, as *alæ nasi*, the wings or lateral cartilages of the nose, &c.)

*Alteratives.* Medicines intended to change the morbid action, by restoring the healthy functions of secretion, &c., by a gradual process.

*Amenorrhœa.* Term for absence or stoppage of the *menstrual* discharges (monthly flow of women).

*Ampulla.* A bottle. *Ampullar.* To swell out. Anatomically—The dilated or trumpet-mouthed portion of the membranous, semi-circular canals of the ear are called *ampullæ*.

*Anæsthesia.* Suspended sensibility.

*Analogue.* A counterpart.

*Anaplastic.* Surgical art of transplanting flaps of skin or integument; also, an agent which increases the amount of fibrin in the blood.

*Angina.* Pathological—A term for a sense of suffocation, and so applied to diseases in which this is a prominent symptom; also, to those attended by sore throat.

*Ankylosis.* A stiff joint.

*Annular.* Like a ring; applied to ligaments, &c., and to the fourth finger, counting from the thumb inclusive.

*Anomalous.* Unnatural; irregular. (Applied to diseases or to symptoms of disease which do not appear in the usual form or in regular course.)

*Anterior.* Before; applied to muscles, &c. (Professor Dunglison, in his *Lexicon*, says: Great confusion has prevailed with anatomists in the use of the terms *before*, *behind*, &c. Generally, the word *anterior* is applied to parts situate before the median line, the body being in the erect posture, with the face and palms of the hands turned forward; and the feet applied longitudinally together.)

*Antihelix.* A prominence of the external ear, opposite to the one called helix.

*Antiphlogistic.* Applied to that medical treatment which is intended to subdue fever, inflammation, or the excited state of the system in inflammatory complaints.

*Antitragus.* A term for an eminence on the external ear, opposite to the one called tragus.

*Anus.* A circle; the fundament, or lower extremity of the bowels; also, a foramen in the brain.

*Aqua.* Water.

*Articulation.* Term for distinct utterance of syllables or words.

Anatomically—applied to the connection or fastening together of the various bones of the skeleton one to another in their natural situation; also, a joint.

*Atrophy.* Literally: want of nourishment. Then, used as a term to designate a morbid diminution in the bulk of the whole body or of a part.

*Attenuant.* Applied to that which, it is supposed, can impart to the blood a thinner or more fluid consistence, as water, whey, &c. A fluidizer.

*Auditory.* Applied to vessels, nerves, canals, &c., connected with the organs of hearing.

*Auscultation.* Term for the act of listening to the sound given by particular parts of the body, in order to form a judgment of their condition.

## B.

*Bistoury.* A small knife, used by surgeons.

*Blennorrhœa.* A term for the flowing or excessive secretion from mucous glands in any situation.

*Brevis.* Little; short.

## C.

*Carotid.* The name of the great artery on each side of the neck, passing up to the head, external and internal.

*Cartilage.* Term for a pearly white, glistening, elastic, uniform substance adhering to articular surfaces of bones, either movable or immovable, or of a mixed character.

*Cataplasm.* A plaster; poultice.

*Cotunnus, Liquor of.*—*Liquor Cotunnii, Aqua audito'ria Per'ilymph.* A transparent slightly viscid fluid, which fills all the cavities of the internal ear; named after its discoverer, the Italian anatomist Cotugno.

*Cellular.* Having or consisting of cells or cavities.

*Cerumen (Cera, wax).* The wax-like secretion of the ear which is given out by the follicle (a little bag, sac or fold), ranged along the inner surface of the passage of the ear; earwax.

*Cervical (Cervix, the neck).* Of or belonging to the neck.

*Communis.* Common.

*Cochlea.* A cavity of the internal ear resembling the shell of a snail. (Barkalin, in his Anatomy, uses for the *cochlea* of the ear, *An'trum Buccinosum*, the trumpet or horn-like cavity.)

*Concha.* A shell; applied to the hollow portion of the external ear.

*Concha Auris.* Large cavity of the external ear.

*Conchæ Naris.* Spongy bones of the nose.

*Condyle.* An articular eminence, round in one direction, flat in the other.

*Condylloid.* Having the shape of a condyle.

*Consensus.* Sympathy, as between certain organs.

*Consistence.* Applied to the humors and other matters, useful as well as useless; it denotes their constitution: that is, their thinness or thickness, their solidity, &c.



*Cophosis.* Loss of hearing.

*Corde tympani.* Nerve of the ear.

*Cranium.* The skull or upper part of the head containing the brain and its connections.

*Creta.* An impure native carbonate of lime.

*Cretinism.* Organic idiocy, often conjoined with goitre.

*Cutaneous* (from *cutis*, the skin). Belonging to the skin; skin-like.

*Cyst.* A bladder or sack.

## D.

*Dentition.* Process of cutting teeth.

*Derma.* The skin.

*Dermoid.* Belonging to or resembling the skin.

*Desiccation.* Term for the state or process of drying.

*Diagnosis.* Term for the science of signs or symptoms by which one disease is distinguished from another; the art of discriminating diseases.

*Diaphoretics.* Medicines favoring perspiration.

*Dura Mater.* Term for the external membrane which envelops the brain. There is scarcely any part of the body which shows more beauty and simplicity of contrivance than the dura mater when viewed as the chief means of guarding the brain from the effects of concussion and compression.

*Dynamic.* Belonging to the vital power or strength.

## E.

*Embrocation.* Term for a fluid application for rubbing on any part that may be bruised, inflamed, or otherwise diseased.

*Emollients.* Medicines having the power of softening or relaxing the living animal fibre without any mechanical action.

- Emphysema.* A swelling produced by air or gas.
- Epidermis.* Name for the external covering of the body ; the cuticle or scarf-skin.
- Epithelium.* Originally applied to the cuticle covering the nipple, which alone it properly signifies ; but it is now generally used for the cuticle covering any mucous membrane.
- Erethism.* Increased irritability.
- Eroded.* Jagged.
- Erythematous.*—Inflammation rapidly tending to gangrene (mortification ; partial death.)
- Essence.* Principal ingredient ; essential oils diluted with alcohol.
- Eustachian Tube.* Canal leading from the throat to the internal ear.\* It begins, one in each ear, from the anterior extremity of the tympanum and runs forwards and inwards in a bony canal, which terminates with the petrous portion of the temporal bone. It then goes on, partly cartilaginous and partly membranous, gradually becoming larger, and at length ends behind the soft palate. Through this tube the air passes to the tympanum.
- Exacerbation.* An increase in the symptoms of a disorder. Often used synonymously with paroxysm.
- Exanthem.* Any cutaneous eruption or rash.
- Excitant.* Exciting.
- Excoriation.* Abrasion or removal, partial or complete, of the skin.
- Exostosis.* A tumor formed by an exuberant growth of bony matter on the surface of a bone, or by the enlargement of a part or the whole of a bone ; also termed *Hyperostosis*.

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\* Dr. Oliver Wendell Holmes, in his brilliant article on the Great Organ at Boston, happily compares the ventilator of that musical instrument to the Eustachian tube.

## F.

*Fauces.* The cavity at the back of the mouth, from which the pharynx and larynx proceed.

*Fetor.* By this term is generally understood the peculiar odor which is given out by putrefactive decomposition; but it is also sometimes applied to any foul smell.

*Filament.* A minute fibre.

*Fissure.* A fine crack in a bone; a groove.

*Foramen.* A little opening.

*Foramen Ovale.* Opening in the septum.

*Fossa.* A groove; shallow cavity or depression.

## G.

*Ganglion.* An enlargement in the course of a nerve resembling a knot. Term for a collection of vesicular matter which serves as a centre of nervous power to certain fibres connected with it.

*Gargarism.* A gargle; a wash for the mouth and throat.

*Gastric.* Belonging to the stomach.

*Geniculate.* Bent like the knee.

*Glandular.* Resembling a gland.

*Glosso* (from the Greek, the tongue). Names compounded with this word belong to muscles, nerves, or vessels from being attached or going to the tongue.

*Glosso-Pharyngeal Nerves.* The ninth pair of nerves. They arise from the processes of the *cerebellum* (anterior and superior portion of the brain), which run to the *medulla spinalis* (spinal marrow), and terminate by numerous branches in the muscles of the tongue and pharynx.

*Gracilis.* Small; thin; slender. Anatomically—applied to a long, straight, slender muscle of the thigh, and to a process

of the *malleus* (a small bone of the internal ear resembling a hammer).

*Granulation.* The filling up of a wound or ulcer by organized matter.

*Guttural.* Belonging to the throat.

## H.

*Helicotrema.* The hole by which the two scalæ of the cochlea communicate at the apex.

*Helix.* Border of the external ear.

*Hemispheres.* The two symmetrical halves of the *cerebrum* (anterior and superior portion of the brain), as divided by the *falx* (a scythe; process of the *dura mater*, the outermost membrane of the brain).

*Hermetic seal.* Closing the end of a tube by fusing it.

*Homogeneous.* Mixture of substances possessing similarity of nature and properties.

*Hypertrophy.* Morbid growth or enlargement of an organ without change of structure.

## I.

*Impetigo.* A disease of the skin in which several red, hard, dry, purulent spots arise on the face and neck, and sometimes all over the body, and disappear by furfuraceous or tender scales.

*Incus.* One of the small bones of the internal ear.

*Induration.* Hardening of the *viscera* (internal organs of the body) by disease.

*Infra.* A prefix—under.

*Infundibulum.* A funnel or duct; a name given in anatomy to parts which resemble a funnel.

*Integument.* That which covers anything.

## L.

*Lamina.* A layer or plate.

*Lateral.* Belonging to the side.

*Lauraceæ.* The cinnamon tribe of plants.

*Legumine.* Vegetable casseine.

*Levator.* To lift up; name of numerous muscles, the offices of which are to lift up the part to which the muscle may be attached.

*Ligament.* An elastic and strong membrane connecting the extremities of the movable bones.

*Lobe of the Ear.* Inferior extremity of the external ear.

*Longus.* Long; name of a muscle.

## M.

*Maceration.* Softening in water.

*Mammalia.* Animals which suckle their young.

*Mastoid.* A Greek word, meaning, like a nipple. It is applied to a *process* of the temporal bone, which has a nipple-like appearance.

*Mastoid Aperture.* The opening of the communication between the cavity of the tympanum and the mastoid cells.

*Mastoid cells.* These are situate in the mastoid process, communicate with each other, and open into the cavity of the tympanum. Their use seems to be to increase the intensity of sound.

*Meatus.* A passage.

*Meatus auditorius externus.* The auditory canal extending from the concha to the tympanum.

*Meatus auditorius internus.* Internal auditory passage.

*Membrana Tympani.* Dividing the external from the internal ear; drum of the ear.

*Membranous.* Having the texture of membrane.

*Meningitis.* Inflammation of the membranes of the brain.

*Metastasis.* Change in the seat of a disease.

*Modiolus.* A hollow cone in the *cochlea* of the ear, forming nucleus axis, or central pillar, round which the *gyri* (spiral cavities of the internal ear) of the cochlea pass. The modiolus forms the inner and larger portion of the central pillar, and is the cavity seen at the bottom of the meatus auditorius internus. It lodges a branch of the auditory nerve. The central portion of the modiolus contains a number of minute canals, and is called in consequence, *Tractus spira'lis foraminulo'sus*. Into these the nerves of the cochlea enter, and pass out at right angles between the bony plates forming the zona ossea of the lamina spiralis, to be expanded on the membranous portion of the lamina.\*

*Molar Teeth.* The grinding teeth.

*Motory Nerves.* Nerves upon which voluntary motion depends.

*Mucous.* Containing mucilage; also, one of the tissues of the body.

*Myringitis.* Inflammation of the membrana tympani; and also of the tympanum.

## N.

*Narcotic.* Stupefying; deadening.

*Necrosis.* Death of a bone.

*Neurosis.—Neurotica.* Diseases involving any portion of the nervous system.

*Nosology.* Classification of diseases.

## O.

*Ocular.* Appertaining to the eye.

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\* Dunglison.

*Edema.* Tumefaction, arising from serous effusion into the cellular membrane.

*Orbiculare Os.* Smallest bone of the body, found in the internal ear.

*Orifice.* An aperture.

*Oscillation.* Vibration.

*Osseous.* Bony.

*Ossicula.* Little bones.

*Ossicula auditus.* Small bones of the tympanum.

*Otic.* Pertaining to the ear.

*Otitis.* Acute inflammation of the internal ear.

*Otorrhœa.* Discharge from the ear.

*Otology.* A treatise on the ear.

## P.

*Palliative.* A medicine given only with an intent to relieve pains; not curative.

*Papilla.* The nipple of the breast; applied also to the termination of nerves in the skin, and to the red points upon the tongue in scarlatina and other fevers, &c.

*Paracusis.* Diminution or loss of hearing.

*Paratrophy.* Misnutrition.

*Parenchyma.* The spongy and cellular substance or tissue that connects parts together. It is applied to the connecting medium of the substance of the viscera.

*Paries.* A wall.

*Parietes.* A name given to parts which form the enclosures—the limits of different cavities of the body, as the chest and abdomen, &c.

*Paroxysm.* A fit of disease periodically recurring.

*Pathognomonic.* Indicative of disease.

*Pathology.* The doctrine of disease.

*Pectoral.* Of, or belonging to, or that which relieves disorders of the chest.

*Periosteum.* Membrane which invests the external surface of all the bones, except the crowns of the teeth. It is of a fibrous texture and well supplied with arteries, veins, nerves, and absorbents.

*Petrous.* Stony, hard.

*Pharyngeal.* Belonging to the pharynx.

*Pharynx.* Top of the *œsophagus* (the gullet, leading from the pharynx to the stomach).

*Phlegmonous.* Erysipelas, diffused cellular inflammation, with tendency to suppuration.

*Physiology.* That department of knowledge which relates to the laws of life and the functions of living beings. It is divided into vegetable physiology, which is employed in the consideration of vegetables; into animal or comparative physiology, which treats of animals; and into human physiology, of which the special object is man.

*Pinna.* Like a wing. A portion of the external ear termed pinna auriculæ, or the auricle.

*Plethora.* Excessive fulness of the blood-vessels, or a redundancy of blood.

*Plexus.* A net-work of nerves or vessels.

*Posterior.* Behind.

*Process.* Any projection of a bone. Procedure; method of performing any operation.

*Prognosis.* Art of foretelling the event of diseases from particular symptoms.

*Promontory.* A small projection at the inner walls of the cavity of the tympanum, which corresponds to the external scala of the cochlea and especially to the outer side of the vestibule.



*Pudenda.* The parts of generation.

*Purulent.* Of the nature of pus.

*Pus.* Matter produced by suppuration.

## Q.

*Quiescens.* At rest.

## R.

*Radix.* A root.

*Ramus.* A branch.

*Rarefied.* Expanded, or rendered less dense.

*Retrahens Auris.* Two small bundles of muscular fibres which arise from the external and posterior part of the *mastoid process* of the temporal bone immediately above the insertion of the *sterno-cleido mastoideus* muscle. They are inserted into that part of the back of the ear which is opposite to the septum, which divides the *concha* and *scapha*. Their use is to draw the ear backward, and stretch the *concha*.

*Reticular.* That which resembles a net. An epithet applied to many structures in the body.

## S.

*Sacculus.* A little sac.

*Saline.* Of the nature of salt.

*Scala.* A ladder or staircase.

*Scapha.* Literally, a boat, a skiff. Then used as a term for the excavation or cavity of the *auricula* or external ear, between the *helix* and *antihelix*.

*Scrofula.* King's evil, a constitutional and specific malady, involving the glandular system.

*Semi.* One-half, a prefix.

*Sensorium.* A term applied to a supposed centre of perception, residing in the brain, from which all impressions are referred or conveyed before they excite perceptions.

*Sensorium commune.* Brain.

*Septum.* A partition or division.

*Serous.* Thin, watery; relating to serum.

*Speculum Auris.* An instrument used to dilate the meatus auditorius externus.

*Sphenoid.* Wedge-like, as applicable to a bone of the skull, which wedges in and locks together most of the other bones.

*Stapedius.* A muscle attached to the stapes.

*Stapes.* Stirrup; a small bone of the internal ear.

*Sterno.* Names compounded of this word belong to muscles which are attached to the *Sternum* (breast-bone).

*Sterno-cleido Mastoideus.* A muscle on the anterior and lateral part of the neck, which turns the head to one side, and bends it forward. It arises by two distinct origins; the anterior, tendinous and fleshy, from the top of the sternum near its junction with the *clavicle* (collar bone); the posterior, fleshy, from the upper and anterior part of the clavicle. Both unite a little above the anterior articulation of the clavicle, to form one muscle, which runs obliquely upward and outward to be inserted by a thick strong tendon, into the mastoid process of the temporal bone, which it surrounds, and gradually becoming thinner, is inserted as far back as the lambdoidal suture. (*Lambdoidal.* The name of a suture of the skull, from its fancied resemblance in form to the letter *Λ*.)

*Stibalis.* Antimonial (powder).

*Stimulant.* An exciting agent.

*Stimulus.* That which arouses the energy of a part.

*Styloid.* Process of the temporal bone giving origin to muscles designated by the prefix "stylo."

*Subacute.* Applied to inflammation, &c., which is of but moderate activity.

*Suture.* A junction or union.

*Symptomatology.* A description of symptoms.

*Synchronous.* Occurring in equal time. Thus the pulsations of an artery may be synchronous with those of the heart.

## T.

*Tempora.* The temples.

*Temporal.* Bones, muscles, vessels, nerves, &c., of the temples.

*Tensor.* A muscle the office of which is to extend the part to which it is fixed.

*Tensor Tympani.* A muscle of the ear, which pulls the *malleus* (a hammer or mallet, a small bone of the internal ear, resembling a hammer), and the membrane of the tympanum towards the petrous portion of the temporal bone, by which the membrana tympani is made more concave and tense.

*Therapeutics.* Knowledge relating to the curative action of medicine.

*Tinnitus aurium.* Ringing noise in the ears.

*Tissue.* A term introduced by the French anatomists to express the textures which compose the different organs of animals.

*Topical.* Local ; applied to the parts.

*Tragus.* Eminence of the external ear, placed immediately before the auditory canal, which it partly conceals.

*Trigemini.* The fifth pair of nerves.

*Tympanum.* Drum of the ear.

## U.

*Umbo.* The top of a buckler. The knob or more prominent part in the centre of the hat or pilus of the fungus tribe.

*Undulation.* Fluctuation ; wave-like motion.

*Uvula.* The small conical fleshy substance hanging in the middle of the *velum pendulum palati* over the root of the tongue.

## V.

*Vascular.* Belonging to the vessels.

*Velum Palati.* Soft palate.

*Venesection.* Bleeding from a vein by puncturing.

*Vertigo.* Giddiness ; dizziness.

*Vesicular.* Relating to, or like vesicles ; hollow ; full of small interstices.

*Vestibule of the Ear.* A cavity of an irregular shape, which forms part of the labyrinth or internal ear. The vestibule is situate on the inner side of the tympanum ; on the outer side of the meatus auditorius internus before the semicircular canals, and behind the cochlea.

*Viscera.* Internal organs of the body.

## Z.

*Zincichloridum.* The salt mostly used to destroy cancerous and other morbid growths.

*Zingiber.* Ginger.

## AURAL LITERATURE.



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IN order to impart still greater completeness to our work, and thereby to enhance its value for the professional reader, we have thought fit to append the following list of works, in various languages, on the subject of the ear and its diseases. The list commences at the time of the revival of anatomical studies in the 16th century, when the organ of hearing first became the object of closer investigation, and is brought down to the present day. We have endeavored to make it as complete as possible, and we feel sure that no work of any importance on the subject has been overlooked.

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† Republished 1859, by C. J. Price & Co., Philadelphia. Edited, with additions, by Laurence Turnbull, M. D.

‡ Republished 1860, by Blanchard & Lea, Philadelphia.

THE END.



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A WORK

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